

**RACE, PLACE, AND RESILIENCE:  
SOCIAL EQUITY IN NORTH CAROLINA'S POST-DISASTER BUYOUT PROGRAM**

Amanda W. Martin

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Approved by:

Phil Berke

James H. Johnson, Jr.

William T. Lester

Mai Thi Nguyen

Gavin Smith

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## **ABSTRACT**

Amanda W. Martin: Race, Place, and Resilience:  
Social Equity In North Carolina's Post-Disaster Buyout Program  
(Under the direction of Mai Thi Nguyen)

This three-paper dissertation analyzes the context and outcomes of post-disaster buyouts completed in North Carolina after hurricanes in 1996 and 1999, with attention to race and social equity issues. Buyouts are a mechanism for removing development from areas at risk for disaster. As climate change and urbanization worsen flooding in the United States, more communities are considering buyouts. However, research has not caught up with this expanding practice. In particular, an understanding of the long-term outcomes of buyouts is lacking.

The first paper examines the motivations for and outcomes of buyouts decisions in two high-poverty African American communities that made different decisions about buyouts. Case comparison reveals that differences in leadership, perceptions of climate risk, and competing priorities motivated the different decisions. Buyouts reduced future flood impacts, increased participants' home values, and provided the opportunity to move to a lower poverty neighborhood. However, they also broke up social networks, contributed to disinvestment near buyout land, and risked loss of history and memory in marginalized communities threatened by climate change.

The second paper examines the geography of buyouts with respect to race and segregation. Using regression analysis, the paper finds that buyouts are associated with neighborhoods with greater shares of African Americans and counties with high levels of

residential segregation. The association of race and buyouts is not a result of higher levels of poverty in African American neighborhoods or disproportionate exposure to flood risk.

The third paper analyzes the association between buyouts and 20-year neighborhood change. Using spatial regression, this paper finds that buyouts are negatively associated with growth in housing units. Buyouts are also associated with racial turnover in nearby neighborhoods. These results suggest that buyouts encouraged disinvestment in local housing stock, and that white flight occurred in areas where buyout participants were most likely to relocate.

The final chapter analyzes implications for research and practice. These implications include reducing negative neighborhood impacts and intangible losses associated with buyouts while supporting wealth-building opportunities for low-income participants. Both community planning and policy change are needed to support these outcomes. Better data are also critical to advance buyouts research and practice.

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## TABLE OF CONTENTS

<i>Chapter One. Introduction</i> .....	1
Dissertation Summary .....	6
References .....	10
<i>Chapter Two. Social Equity and Local Climate Adaptation: Learning from Buyouts in Marginalized Communities</i> .....	14
Learning from Hazard Mitigation for Climate Adaptation .....	17
Local Climate Adaptation: Governance and Outcomes .....	19
Case Studies .....	22
Kinston, North Carolina .....	26
Princeville, North Carolina .....	34
Understanding Motivations and Outcomes .....	38
Problems for Environmental Relocation in Marginalized Communities .....	42
References .....	49
<i>Chapter Three. Muddy Water: The Racial Landscape of Post-Disaster Buyouts</i> .....	58
Buyouts and Flood Risk Reduction .....	60
Three Concepts of Justice and Relevance to Buyouts .....	64
Methods .....	69
Results .....	77
Discussion .....	84
Conclusions .....	88
References .....	93
<i>Chapter Four. The Role of Post-Disaster Buyouts in Neighborhood Change: A 20-Year Analysis of North Carolina</i> .....	102
Introduction .....	102
Neighborhood Change Theory .....	104

Buyouts and North Carolina Disaster History .....	109
Methods and Data .....	112
Findings .....	117
Discussion.....	125
Implications .....	129
References.....	134
<i>Chapter Five. Conclusion .....</i>	<i>141</i>
Summary of Research Findings .....	141
Limitations of the Research .....	143
Implications for Policy and Planning.....	144
Future Research Needs.....	153
References.....	156
<i>Appendix 2.1. Lincoln City With Respect To Census Tracts.....</i>	<i>159</i>
<i>Appendix 3.1. Correlation Coefficients.....</i>	<i>160</i>
<i>Appendix 3.2. Alternative Specifications .....</i>	<i>161</i>
<i>Appendix 4.1. Results of Additional Models .....</i>	<i>164</i>

## LIST OF TABLES

Table 1. Summary of Research on the Process and Outcomes of Local Climate Adaptation .....	20
Table 2. Demographic and Housing Characteristics of Princeville, Lincoln City Before Buyout	26
Table 3. Home Value, Original and Post-buyout, 2001 .....	29
Table 4. Demographic and Housing Change in Princeville and Lincoln City, 1990-2016* .....	33
Table 5. Variables Used in Study .....	72
Table 6. Characteristics of Census Tracts in North Carolina .....	77
Table 7. Buyouts & Neighborhood Characteristics: Regression Results.....	79
Table 8. Regression Results for High Buyout Neighborhoods .....	81
Table 9. Variables and Data Sources on Buyouts and Neighborhood Change .....	114
Table 10. Regional Differences in Buyouts .....	116
Table 11. Selected Characteristics for (1) All Block Groups, (2) Block Groups with at Least One Buyout, and (3) High-Buyout Block Groups .....	118
Table 12. Regression Results: Buyouts and Change in Number of Housing Units, 1990-2010.	119
Table 13. Buyouts and Change in Racial Mix.....	122
Table 14. Regression Results: Buyouts and Change in Number of Vacant Housing Units, 1990- 2010.....	164
Table 15. Regression Results: Buyouts and Newly Constructed Housing Units .....	165
Table 16. Regression Results: Buyouts and Change in Racial Mix (Latinos and Native Americans) .....	166

**LIST OF FIGURES**

Figure 1. Road into buyout land in 2017 ..... 32

Figure 2. Lincoln City with respect to Census tracts..... 159



## CHAPTER ONE. INTRODUCTION

Coping with flooding is a monumental problem facing the United States in the twenty-first century. In 2016, Hurricane Matthew ravaged eastern North Carolina; in 2017, Hurricanes Harvey and Maria devastated greater Houston and the entire island of Puerto Rico; 2018 brought Hurricane Florence back to parts of North Carolina still struggling to recover from the 2016 disaster, and Hurricane Michael was the first Category 5 hurricane to make landfall in the United States in nearly 25 years. Combined, these hurricanes have caused more than \$300 billion in damages in the United States, part of a decades-long trend of increasing losses (Gratz et al., 2008; Hirsch & Archfield, 2015; Pielke & Downton, 2000; Slater & Villarini, 2016). In three of the last four years, severe inland flooding in the Midwest and the Deep South destroyed over a billion dollars of property, crops, and infrastructure (NOAA National Centers for Environmental Information, 2019).

Flooding has plagued civilization since the beginning of time, but new, modern forces are shaping and exacerbating the impact of flooding in our world. Anthropogenic climate change is bringing more intense storms and sea level rise, increasing the frequency of flood events (Hirsch & Archfield, 2015; Lall et al., 2018). At the same time, sustained growth and development in vulnerable areas is also driving flood losses (Klotzbach, Bowen, Pielke, & Bell, 2018; Pielke et al., 2008). Aging infrastructure often fails to adequately handle floodwater under increased development and greater flood hazards. Today, fifteen million people in the United States live in

a 100-year floodplain, and twice as many live in the 500-year floodplain, nearly one in ten U.S. residents (Furman Center, 2017).

Because of the increase in flooding frequency and impact, the wellbeing of people, property, and economies depends on our ability to reduce the impact of flooding. Communities try to prevent flooding disasters in many ways. Over the past 25 years, scholars and practitioners have recognized the value of land use strategies, like preventing development in floodprone areas (Beatley, 2009; Berke & Campanella, 2006; Burby et al., 1999; FEMA, 2013; Holway & Burby, 1993; Mileti, 1999; Stevens, 2010). There are many reasons to prefer land use strategies over engineered solutions. Land use strategies are less expensive to implement and require only enforcement rather than active maintenance and investment. They keep development out of harm's way and encourage green infrastructure that absorbs floodwater during a disaster. Engineered strategies offer a false sense of complete security from flooding, and their failure can have catastrophic impacts that can accelerate the power and destruction of floodwaters.

Land use strategies are just as important to implement in areas where development already exists as they are in places where development can be prevented. One instrument for changing land use patterns in developed communities is strategic property acquisitions, or "buyouts." A buyout program for the purpose of hazard mitigation changes land use by removing pre-existing development located in risky areas and turning the parcels into open space. The earliest documented hazard mitigation buyout in the United States occurred in Soldiers Grove, Wisconsin in 1978, when a locally led effort relocated an entire riverside business district to higher ground nearby (Beatley, 1998; David & Mayer, 1984). Buyouts became more visible among planners and emergency managers when several Midwestern towns implemented major relocation programs with federal support following the catastrophic 1993 Mississippi River

floods. The North Carolina buyout programs after Hurricanes Fran and Floyd, which are the focus of this dissertation, again demonstrated the scale of buyout possibilities when the state completed buyouts of nearly 5,000 residences. In the 2000s, small and large communities have used buyouts, especially after disasters like Hurricane Ike, Superstorm Sandy, and Hurricanes Matthew, Harvey, and Maria, for example.<sup>1</sup> With growing concerns about how climate change will increase future flooding, many scholars see buyouts as a primary tool to cope with climate-driven flooding through managed retreat, which reduces flood risk by “moving exposed people, assets and human activities” (Oppenheimer & Glavovic, 2019) out of high-risk areas (Hino, Field, & Mach, 2017; Siders, 2018).

Buyouts can occur through via multiple funding streams. Currently, the Federal Emergency Management Administration (FEMA) administers three programs that have bought out over 38,500 floodplain residences on a voluntary basis (Siders, 2017). The largest of these is the Hazard Mitigation Grant Program (HMGP), which specifically serves post-disaster areas (FEMA, 2015a). Authorized by the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988, HMGP awards up to 20 percent of the total FEMA award for disaster damages to advance mitigation during reconstruction (FEMA, 2015a). State governments, the typical direct recipients of HMGP funds,<sup>2</sup> may elect to use some or all of these funds for buyouts, subject to the requirement that the land remain open space in perpetuity. Other primary sources of funding for buyouts include the federal Department of Housing and Urban Development’s Community

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<sup>1</sup> In the 2000s, some states and cities used buyouts as a rebuilding tool, as opposed to hazard mitigation, by allowing the land to be redeveloped by a new owner, for example in Louisiana’s Road Home Program and New York City’s post-Sandy Built It Back program (Green & Olshansky, 2012; Greer & Brokopp Binder, 2017; Maly & Ishikawa, 2013; Maly et al., 2017). This dissertation focuses exclusively on buyouts for hazard mitigation, not for rebuilding.

<sup>2</sup> Eligible applicants to HMGP include states, territories, and federally recognized tribes (FEMA, 2015a)

Development Block Grants for Disaster Recovery (CDBG-DR), along with state and local funds. This dissertation focuses on HMGP buyouts in North Carolina, implemented after Hurricanes Fran and Floyd in the late 1990s and early 2000s.

Planners and researchers advocate for post-disaster buyout programs because they change land use to reduce overall flood exposure. The American Planning Association's Planning Advisory Service report, *Planning for the Next Generation*, expresses the typical case for post-disaster buyouts and summarizes the challenges to changing land use patterns during disaster recovery:

"Disasters can create opportunities for land-use change, particularly in precluding rebuilding in hazardous areas and relocating those uses elsewhere. Nonetheless, major land use changes rarely happen even after a disaster. The main reason is that disasters do not usually destroy all the buildings and infrastructure in a particular area. Therefore, some property value and ownership rights and patterns remain; pressures to rebuild what existed before are incentivized through many insurance schemes" (Boyd, Hokanson, Johnson, Schwab, & Topping, 2014).

Buyout programs attempt to take advantage of the "opportunities" provided by disasters while overcoming the challenges of property values, ownership rights, and neighborhood development patterns that survive the disaster. Buyouts accomplish this objective by offering residents the chance to move to a less risky area through a voluntary process which provides a payout based on property value. Through buyouts, the public sector reduces its overall exposure to costs that they typically cover during and after disaster, including National Flood Insurance payouts (Perry & Lindell, 1997; Tate, Strong, Kraus, & Xiong, 2015; White, 2011).

However, there is more to consider about the effects of buyout programs than the reduction in flood exposure. There are a number of potential drawbacks. Buyout programs dismantle both physical places and social networks, often during a post-disaster period laden

with survivors' trauma. There is evidence that buyout participants sometimes feel pressure to sell, perhaps because governments have an incentive to maximize participation in order to achieve benefits of scale, such as assembling enough open space to hold future floodwaters or reducing public maintenance responsibilities in buyout areas (de Vries & Fraser, 2012; J. C. Fraser, Elmore, Godschalk, & Rohe, 2003). Planners may advocate for post-disaster construction moratoria which ostensibly allow communities time to have a dialogue about redeveloping in a different and more resilient way (Boyd et al., 2014); however, moratoria have also been used to advance a pre-determined buyout objective because residents who cannot start committing their own resources toward rebuilding in place are more likely to take a buyout later (Brokopp Binder & Greer, 2016; de Vries & Fraser, 2012). One study of eight buyout programs finds that local decisions about where to acquire buyouts lack transparency and depend on political factors (Siders, 2018).

Buyouts may be especially likely to affect marginalized communities. Marginalized populations have greater vulnerability to disaster and lower home values, both factors that may cause concentrations of buyouts in areas where marginalized populations live (Boyd et al., 2014; de Vries & Fraser, 2012; Siders, 2018), leading to concerns that governments are trying to push out low-income people of color or dismantle their communities (Bullard & Wright, 2012; Freudenberg, Calvin, Tolkoff, & Brawley, 2016; Olshansky & Johnson, 2010; B. Phillips, Stukes, & Jenkins, 2012). On the other hand, marginalized populations are among those most in need of permanent flood risk reduction due to disproportionate physical and social vulnerability.

None of these complexities mean that buyouts are inherently unjust or unwise, but they warrant a closer investigation of the ways in which buyouts may reflect existing social inequalities or exacerbate them. Research on buyouts has only recently begun to unpack the

ways in which buyout programs engage longstanding sources of inequality, such as political representation and racial turnover in neighborhoods (Loughran & Elliott, 2019; Siders, 2018). Understanding the ways in which historic and economic marginalization interface with buyout implementation and outcomes is the primary motivation for my dissertation. By developing a better empirical understanding of the role of inequality in buyouts, researchers, policymakers, and affected communities can identify strategies that disentangle buyout programs from longstanding systems of disempowerment.

### **Dissertation Summary**

This dissertation includes three interrelated, standalone papers that deal with social equity in North Carolina's buyout program. This buyout program began after Hurricane Fran caused widespread devastation in North Carolina in 1996, and it was expanded after Hurricane Floyd caused even more damage in 1999 (North Carolina Emergency Management, 2000). With HMGP funding, the state and participating local governments completed buyouts of 4,800 properties funded by HMGP between both storms (North Carolina Emergency Management, 2017). These buyouts are the focus of this dissertation. The state is in the process of implementing another major buyout program after Hurricanes Matthew and Florence in 2016 and 2018, respectively, but these buyouts are not yet complete and so they are not included in this dissertation.

The design and administration of the post-Fran and post-Floyd buyout programs in North Carolina fall in a landscape of buyout programs which vary across states and years. One variable which sets apart these different programs is the balance of state and local roles in program administration and support. In some cases, states take complete administrative control of the program, working directly with individual property owners. And in other cases, the state may act

purely as a pass-through to local governments that wish to administer buyouts, without providing any additional capacity or funding. In the case of post-Fran and post-Floyd buyouts, North Carolina fell in between these two extremes. The state solicited application packages from local governments, which had to agree to implement the buyout program. However, the state remained highly engaged in the program, committing technical assistance to local governments and gap financing for individual property owners. This administrative design reflects a balance between state-centric and local-centric buyout program designs.

Scholars Alex Greer and Sherri Brokopp Binder identify two other characteristics which set buyout programs apart from one another: the degree of government involvement beyond the buyout real estate transaction and the level of financial incentive for individuals to participate (Greer & Brokopp Binder, 2017). The North Carolina buyouts that followed Hurricanes Fran and Floyd differed slightly with respect to level of financial incentive; in both cases, properties were purchased at pre-flood fair market value, but after Floyd, the state provided significant additional incentive funding, sometimes doubling the value of the buyout for the participant, as detailed in Chapter Two of the dissertation. As for post-government involvement, the state did not remain involved in the buyout program, and did not require local governments to do anything other than take ownership and prevent development on the land. However, some local governments elected to take proactive measures; a good example of the variety of these interventions is provided by the City of Kinston, again detailed in Chapter Two. Kinston enacted a construction moratorium in the buyout area to discourage rehabbing houses for future occupancy. The City also facilitated infill and greenfield development to provide housing for buyout participants. Program design decisions like these can influence the decisions of individual homeowners as well as the outcomes for participants and the community. The implications of these two program design

elements, degree of financial incentive and government involvement, are discussed throughout the dissertation papers and in the conclusion chapter.

The first paper of this dissertation uses qualitative methods to examine the motivations for and outcomes of buyouts in two high-poverty African-American communities in 1999. In one community, the town decided to buy out an entire neighborhood, while the other town decided against buyouts. Using a comparative case study approach based on interviews, the media record, administrative data, and other sources, the findings suggest that differences in leadership, perceptions of climate risk, and competing priorities shaped the different decisions. The community that implemented buyouts gained demonstrated flood risk reduction, but there were negative consequences as well, such as loss of social networks and disinvestment in areas around the buyout. The community that forwent buyouts gained greater national attention and retained their historic location, but the population suffered repeat catastrophic loss in 2016. The comparison of these two cases raises several issues related to social equity in buyouts to which researchers and practitioners should attend. These matters include the relative lack of disincentives for local governments to pursue buyouts in marginalized communities, challenges of designing a fair process for decision-making about buyouts, preserving history and memory in racial and ethnic minority communities, and the social consequences of buyouts that are especially acute in poor communities.

The second paper uses frameworks of justice to explore the geography of the buyouts with respect to race and segregation. The primary data sources are an administrative dataset of the buyouts and the Census. Using regression analysis, the paper finds that buyouts are associated with neighborhoods with greater shares of African Americans, and with counties with high levels of residential segregation. This paper also finds that the association of race and



buyouts is not a result of higher levels of poverty in African American neighborhoods or disproportionate exposure to flood risk. There are a few possible explanations for these results. One is that decisions about where buyouts occur may reflect implicit or explicit racial bias. Another is that the historic disinvestment in African American neighborhoods may lead officials to disproportionately select those areas for buyouts or may lead residents of those areas to disproportionately accept buyouts.

The third paper explores the association between buyouts and 20-year change in neighborhoods where buyouts occur and in neighborhoods adjacent to buyouts. Primary data sources are similar to those used in the previous paper: an administrative dataset of buyouts and Census data. Using spatial regression techniques, this analysis finds that buyouts have a negative association with growth in housing units. It also finds that buyouts are associated with racial turnover in the neighborhoods near buyouts, where the share of whites decreased and the share of African Americans increased. These results suggest that buyouts encouraged disinvestment in the local housing stock, and that white flight and racial steering occurred in areas where buyout participants were most likely to relocate.

The final chapter, the conclusions, ties these results together with an analysis of implications for research and for planning and policy. These implications include the role of planning, improved engagement and accountability in buyouts, and reducing unwanted and unintended consequences. The dissertation closes with an exploration of new approaches to buyouts and resilience more broadly. These approaches include learning from the deep history of relocation programs designed to address urban housing and development, whole community relocation, and a renewed emphasis on reducing social sources of vulnerability as opposed to focusing on physical exposure alone.

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## CHAPTER TWO. SOCIAL EQUITY AND LOCAL CLIMATE ADAPTATION: LEARNING FROM BUYOUTS IN MARGINALIZED COMMUNITIES

Marginalized populations experience the worst and most profound impacts of climate change globally and in the United States (Dodman & Satterthwaite, 2008; Martinich, Neumann, Ludwig, & Jantarasami, 2013; NAACP, 2015; Paavola & Adger, 2006; Roberts, 2009). These effects are expected to worsen in coming decades. A longstanding social equity concern is that climate adaptation efforts may not adequately address the needs of poor or marginalized people. Further, some adaptation interventions have the potential to worsen the vulnerability of marginalized populations; adaptation efforts that make climate impacts worse for other populations or places are termed *maladaptation* (Barnett & O'Neill, 2010; Juhola, Glaas, Linner, & Neset, 2016).

Understanding the nature and breadth of potential maladaptation effects among marginalized populations is challenging. Climate adaptation interventions are nascent compared with other relevant policy arenas like environmental planning, community development, and hazard mitigation. Many places are primarily in the adaptation planning phase, rather than implementation (Woodruff & Stults, 2016). The newness of climate adaptation practice makes it difficult to evaluate the long-term outcomes of adaptation measures. This may be especially true for analyzing maladaptive impacts in marginalized communities, as political pressure may lead officials to downplay or hide these outcomes. In addition, early adopters of climate adaptation

planning have tended to be wealthier communities (Hamin et al., 2014; Shi, Chu, & Debats, 2015), which may bias our understanding of impacts in poorer places.

For all these reasons, it is difficult to capture maladaptive impacts in marginalized communities. However, it is possible to draw lessons from closely aligned policy fields that have a longer history of implementation. In particular, the disaster management field has experience with many of the same weather hazards that are associated with climate change, and many strategies to mitigate the impacts of these hazards are relatively well known and well researched (Dovers, 2009; Preston, Mustelin, & Maloney, 2013). Research on social equity issues in hazard mitigation programs may provide insights applicable to climate adaptation.

In this paper, I use case studies of hazard mitigation to explore decision-making, outcomes, and the context of race and poverty in environmental relocation. “Environmental relocation” refers to a targeted, voluntary program, run by a governing organization, which moves residents and development out of the way of climatic hazards (Oppenheimer & Glavovic, 2019). These cases focus on buyouts, an oft-used environmental relocation program in the United States. In a typical buyout program, a government body offers to buy private property located in a risky area in order to demolish any land improvements and permanently ban further development.

The cases in this paper focus on the community scale of buyout decision-making and outcomes. Scholars have often described climate adaptation as an essentially local process, to the point where it has become a heuristic in the literature (Corfee-Morlot, Cochran, Hallegatte, & Teasdale, 2011; Preston et al., 2013; Satterthwaite, Huq, Reid, Pelling, & Romero Lankao, 2009). Recent research has more critically examined the advantages and drawbacks of local

climate adaptation, both from a process standpoint, including the motivations for and barriers to action, and from an outcomes perspective, identifying the potential for local adaptation along with concerns about equity and effectiveness.

To better understand community-scale buyout decisions and outcomes in marginalized communities, this paper asks three interrelated research questions: How did the local decision-making process lead to one community participating in the buyout program and the other not participating? What were the long-term consequences to participants and to the community of these different local decisions? How did the context of marginalization shape the buyout decision process and its outcomes?

The evidence to answer these questions is provided by two case studies of buyout decision-making and long-term recovery in Princeville, North Carolina and Lincoln City, a neighborhood of Kinston, North Carolina. These two communities are located in Eastern North Carolina on rivers which flooded after Hurricane Floyd in 1999. Both suffered widespread destruction of housing and infrastructure as a result. The City of Kinston implemented a nationally recognized buyout of hundreds of contiguous properties (NOAA, 2017). In contrast, the Town of Princeville, one of the oldest African American towns in the United States, decided against implementing buyouts and rebuilt in place. In 2016, Hurricane Matthew re-flooded both places. These comparative cases provide twenty years of perspective on the local decisions about pursuing buyout programs and the impacts of these decisions on the participants and communities. To bring forth evidence about how the context of marginalized communities shaped these decisions and outcomes, I focus on two interrelated sources of marginality: minority racial identity, in this case African American, and economic deprivation, defined as elevated levels of poverty and lower wealth relative to the general population.



This paper proceeds as follows: In the following section, I review the case for learning from hazard mitigation to better understand climate adaptation. Next, I summarize the current research on local climate adaptation and concerns about equity. I then review the methods, data, and findings from the two case studies. Using this evidence, I find that differences in leadership, understanding of climate risks, and competing priorities shaped the different directions of the decisions. As a result of buyouts, Kinston reduced its flood risk and participants gained home equity, but the buyout broke apart social networks and contributed to a cycle of disinvestment for residents left behind. Princeville, as a result of forgoing buyouts, retained its historic location and gained greater celebrity, but sadly suffered repeat devastation in 2016 as a result of Hurricane Matthew. Case comparison demonstrates several social equity problems to which environmental relocation programs like buyouts must attend: likelihood of concentrated relocations in marginalized communities, fairness and justice in the decision-making process, recognition of marginalized histories, and unintended consequences of relocation for poor people.

This research adds to scholarship on buyouts and climate change adaptation in three ways. First, it explores the long-term outcomes of buyouts, a major gap in the body of research on buyouts. It also examines the community scale as a level of analysis relevant to buyout decision-making, which is more typically researched at the household level. This research also offers lessons for inclusive climate adaptation. The conclusions about the positive and negative impacts of buyouts in marginalized communities will help climate adaptation specialists anticipate similar potential impacts in other environmental relocation programs. Third, this paper provides an explicit foundation to learn from a hazard mitigation practice for the purposes of climate adaptation.

### **Learning from Hazard Mitigation for Climate Adaptation**

Despite major overlap in threats and policy responses, climate adaptation and hazard mitigation research and practice have developed in parallel tracks (Glavovic & Smith, 2014). Climate adaptation is a relatively new field of practice, but many climate weather hazards and their mitigation techniques are well known and well researched by the disaster management field (Dovers, 2009; Preston et al., 2013). Especially in the case of flooding, the strategies to reduce impacts have been familiar to fields like floodplain management, urban planning, engineering, coastal management and emergency management for decades. Therefore, the flood hazard mitigation strategies of recent decades can provide useful insights for climate adaptation research and practice.

This study focuses on buyouts, a hazard mitigation intervention increasingly in use in the United States. Buyouts are an environmental relocation intervention, and as such, they provide an opportunity to better understand “strategic retreat” climate change adaptation strategies which move “people, assets, and human activities” out of high-risk areas (Oppenheimer & Glavovic, 2019). In fact, two recent papers characterize post-disaster buyouts as managed retreat for climate change (Hino et al., 2017; Siders, 2018). Buyouts use private property transactions to reduce the exposure of the built environment to floodwaters, ideally to the benefit both of residents and of government, which decreases its need to expend funds for flood control infrastructure and disaster response (Greer & Brokopp Binder, 2017). Buyouts are particularly relevant to communities that face sea level rise or increased risk of flooding as a result of climate change. They also pertain to any community that considers an organized, voluntary relocation in response to climate risks. The cases presented in this paper provide an opportunity to draw lessons about local climate adaptation especially in areas at risk for flooding but also for all

communities that will consider relocation to cope with serious climate impacts to property, livelihoods, and lives.

### **Local Climate Adaptation: Governance and Outcomes**

In response to climate threats, local governments worldwide have begun to consider that climate change adaptation will be, at least in part, their responsibility. In fact, cities and other local governments have emerged as leaders in climate adaptation in advance of other, larger scales of government (Hughes, 2015; Measham et al., 2011; Nordgren, Stults, & Meerow, 2016). These adaptations span land use, engineering, social education and empowerment, and institutional approaches like market-based tools and policy changes (Noble et al., 2014).

Much of the research literature has assumed that adaptation is a natural fit for local government action, to the point where this assumption has been called a heuristic (Measham et al., 2011; Preston et al., 2013). There are many advantages to the local scale for adaptation, summarized in the bottom left quadrant of Table 1-1. Local government often controls planning, land use, and development, which are major drivers of vulnerability. Local government can reduce exposure to climate hazards through wise decisions about development approval and future land use (Measham et al., 2011). Other land use tools that local governments typically wield, such as zoning, building standards, and protected areas, are among the most effective, permanent strategies to reduce climate vulnerability (Noble et al., 2014). Finally, proponents argue that the highly localized impacts of climate change merit solutions crafted by local leaders who best understand the environmental and social terrain of their communities (Tompkins & Adger, 2004).

Table 1. Summary of Research on the Process and Outcomes of Local Climate Adaptation		
<i>Process of Taking Local Action</i>	<i>Motivations for Action</i>	<i>Barriers to Action</i>
	Leadership/ policy entrepreneurship	Limited funding
	Strong understanding of climate change impacts	Limited staff capacity
		Election cycle disincentivizes long-term thinking
		Poor horizontal or vertical intergovernmental integration
		Competing priorities
<i>Outcomes of Local Action</i>	<i>Advantages</i>	<i>Concerns</i>
	Local government often controls land use, so can deter greater vulnerability through development and future land use decisions	Risk of worse outcomes for marginalized populations
	Local governments often can enact or enhance zoning, building codes, and protected areas, which are longlasting and effective tools to reduce climate vulnerability	Local might not be the right scale for action
	Local governments can address localized climate impacts	

Given these advantages of local action on climate adaptation, researchers have used case studies and multi-city evaluations to understand why some places pursue adaptation and others do not, summarized in the top row of Table 1. Without a regulatory reason to act, cities that do take action often have strong internal leadership who champion climate adaptation (Carmin, Anguelovski, & Roberts, 2012; Hamin et al., 2014; Shi et al., 2015; Tanner, Zaman, Acharya, & Gogoi, 2019). In cities that are taking action, staff also demonstrate elevated understanding of the risks that they face (T. Lee & Hughes, 2017; Shi et al., 2015; Tang, Brody, Quinn, & Chang, 2010). Early adoption of climate change adaptation is also associated with higher municipal spending per capita and stronger vertical and horizontal relationships in (Aylett, 2015; Shi et al., 2015; Valdivieso, Andersson, & Villena-roldán, 2017; Westerhoff, Keskitalo, & Juhola, 2011). Places which lack these characteristics associated with early adoption are less likely to take climate action.

There are other barriers to local action on climate adaptation as well. Finite resources like funding and staff capacity are unsurprisingly found to limit local climate action (Aylett, 2014; Moser, Ekstrom, Kim, & Heitsch, 2019; Nordgren et al., 2016; Shi et al., 2015). The election cycle limits the incentive for elected leaders to take action for long-term benefit to the community, especially when it may be costly or unpopular in the short term (Michel-Kerjan, 2010). Other obstacles to engaging in a process of local adaptation planning or action include poor horizontal or vertical integration of adaptation in government and competing priorities for decision-makers (Carmin et al., 2012; Ekstrom & Moser, 2014; Hlahla, Nel, & Hill, 2019; Lawrence, Sullivan, Lash, Ide, & Cameron, 2015; Measham et al., 2011; Mukheibir, Kuruppu, Gero, & Herriman, 2013).

Some of the local economic and development priorities that compete with climate change adaptation are disincentives to act. Local governments often are incentivized allow development in risky places, like scenic coastlines, because it supports the local tax base and the local economy, a phenomenon deeply studied in the hazards field but also recognized by climate adaptation researchers (Burby, 2006; Cutter, Emrich, Gall, & Reeves, 2017; Kenworthy, 1997; Michel-Kerjan, 2010; Shi, 2019; UCS, 2018; D. Young & Essex, 2019). Compounding this problem, in the United States, the federal government builds large scale flood protection infrastructure, funds emergency response, and subsidizes flood insurance. Local governments do not bear the full cost of response and recovery that may result from development in risky areas, so they are not incentivized to make land use decisions that consider these full costs.

Finally, scholars have raised concerns about outcomes of local climate adaptation, particularly equitability and effectiveness, summarized in the bottom right quadrant of Table 1. With respect to equitability, local land use planning for climate adaptation can make social

inequality worse by protecting populations with wealth and social privilege and harming marginalized populations (Anguelovski et al., 2016; Graham, Barnett, Mortreux, Hurlimann, & Fincher, 2018; Hughes, 2015; McManus, Shrestha, & Yoo, 2014; Shi et al., 2016; Vargo et al., 2016). Researchers raise concerns about the effectiveness of local action. The local scale may limit the scope of climate adaptation compared with approaches that also incorporate regional, national, and international action (Bulkeley, 2010; Bulkeley & Betsill, 2013; Nalau, Preston, & Maloney, 2015). Other scales of government may be better equipped to overcome the institutional, political, administrative, and fiscal barriers to local adaptation efforts (Bauer & Steurer, 2014; Shi, 2019). Although increasing numbers of local governments are planning for climate change adaptation, implementation remains limited (Woodruff & Stults, 2016). For this reason, scholarship on the effectiveness or equitability of local climate adaptation action also remains limited. This paper aims to fill this gap through analyzing not just decision-making about buyouts, but also the outcomes of those buyouts in marginalized communities.

## **Case Studies**

Two cases of communities in North Carolina shed light on buyout decision-making and the consequences of taking a buyout, or not, for racially and economically marginalized participants and communities. On September 16, 1999, Hurricane Floyd made landfall in North Carolina, drenching Eastern North Carolina. Flooding worsened for days in the eastern third of the state, as upstream watersheds in the state capitol metro area and elsewhere drained into the coastal plain, spilling over into countless towns where it exceeded estimates of the 500-year flood.

After Hurricane Floyd, the State of North Carolina committed to reducing flood risk in impacted areas. Per the Federal Stafford Disaster Relief and Emergency Assistance Act, the state

was awarded federal Hazard Mitigation Grant Program (HMGP) dollars to spend on hazard mitigation during disaster recovery. HMGP is a flexible program which allows states to invest in hazard mitigation actions of their choice. The program typically funds 75 percent of eligible projects, leaving a 25 percent match requirement from other sources. Of all the HMGP funds that the State of North Carolina dedicated for residential mitigation, all were programmed for buyouts, as opposed to elevations or retrofits which are also eligible under HMGP. To generate as many buyouts as possible, North Carolina partnered with local governments to solicit homeowner applications and administer HMGP locally. The state government provided the 25 percent match funds for the projects. In Kinston, officials eagerly took on a large buyout effort, while in Princeville, officials decided against administering a buyout. The purpose of the case studies is to examine the motivations for these different decisions, explore how the decisions influenced long-term outcomes for participants and communities, and analyze how the context of marginalization, both as African American communities and as poor communities, shaped decision-making and outcomes.

#### *Case study data and methods*

Disaster research often employs the case study methodology because it engages the temporal, political, and geographic “contextual complexity” (Rufat, Tate, Burton, & Maroof, 2015, p. 470) of the social phenomena of disaster (B. Flyvbjerg, 2006; Leavy & Phillips, 2014; B. D. Phillips, 2014; Yin, 2014). Case study methods are particularly important to these cases because research has shown that these contextual factors affect the outcome of hazard-related relocation decisions (Iuchi, 2014; Sipe & Vella, 2014).

Data for the comparative case analysis come from a variety of data sources. These sources include original interviews; administrative buyout records; official documents such as

plans, meeting minutes, and declarations; American Community Survey and Census data; the news media record; field notes from site visits; and participation-observation as a volunteer planner for a community design charrette in Princeville in August 2017 following Hurricane Matthew. Semi-structured interviews were conducted with 19 key informants during field visits between June 2016 and October 2017. A purposive sample of key informants captured perspectives from current and prior local government officials, non-government community leaders, and outside professionals who contributed to the recovery and/or buyout program in both places after Hurricane Floyd. A snowball selection process was used to identify and interview (former) residents who did and did not participate in the buyout in Kinston and residents who experienced rebuilding in Princeville without a buyout. In addition to interview transcripts and notes, a contact summary form for each interview summarized interim findings and questions in key thematic areas following each interview (Miles, Huberman, & Saldana, 2013).

Interview transcriptions and notes were analyzed following McCracken's five-stage analysis (McCracken, 1988; Piercy, 1998). In this method, interview data are analyzed in a process that moves from the specific to the thematic and general. Transcripts and writeups are reviewed for information potentially relevant to the research questions; individual pieces of information are analyzed in relation to extant literature and then in relation to other pieces of information from the transcript. Notes and analyses are then compared across transcripts, themes are developed, and analysis by thematic area yields conclusions, whose evidence can be traced back to any of the previous levels of analysis.

In addition, the Kinston case benefitted from administrative data on the buyouts. The City of Kinston provided access to buyout property transactions from the year 2001. The records include names, purchase prices, old and new addresses, and other details, which were digitized,



geolocated, and analyzed. City officials cannot locate buyout records from other years. The 2001 buyouts records represent 42 percent of all Hurricane Floyd buyouts in Kinston and are not a random sample of all buyouts. Therefore, findings are interpreted with caution and analysis is limited to descriptive statistics. Newspaper articles were found using a LexisNexis search with keywords “Princeville,” “Kinston,” “Lincoln City,” “Floyd,” and “buyout”. The case study analysis triangulates original findings with academic research on Kinston or Princeville. In addition to using multiple sources of data to answer research questions, research included engaging with the cases for over four years, debriefing with other scholars of North Carolina disasters, and negative case analysis to strengthen the findings (Phillips, 2014).

#### *Case selection*

The case selection was motivated by the opportunity to study two communities which made different decisions about running a hazard mitigation buyout program. The two communities selected in this study – one town, Princeville, and one neighborhood within a small city, Lincoln City within Kinston – were selected on the basis of demographic and geographic similarities, as well as similar levels of catastrophic flooding damage from Hurricane Floyd. Princeville turned down the offer of a buyout program, while Kinston pursued the buyout program enthusiastically. These instrumental cases (Baxter & Jack, 2008; Braun & Clarke, 2009) are used to draw out generalizations about local action on climate adaptation in marginalized communities.

#### *Princeville and Lincoln City*

Table 2 illustrates that residents of Lincoln City and Princeville were almost exclusively African-American, and both places had slightly more senior citizens than the state average. Both places were poor compared with the state average, although Lincoln City had a lower median

income and higher family poverty rate than Princeville. Single family homes were most common in both places, but in Princeville, almost half of the households owned their homes, while in Lincoln City, only about a quarter did.

Table 2. Demographic and Housing Characteristics of Princeville, Lincoln City Before Buyout

	Lincoln City*	Princeville	North Carolina
Population	3,666	1,652	6,628,367
Percent African American	99.4%	96.9%	22.0%
Percent 65+	12.6%	13.6%	12.1%
HS diploma or higher	42.8%	42.7%	70.0%
College or higher	1.8%	2.7%	12.0%
Median income (1989 \$)	6,803	10,568	26,647
Families below poverty	56.6%	35.3%	9.9%
Occupied housing units	1,423	621	2,517,026
Owner occupied	25.6%	48.5%	68.0%
Single family homes	41.3%	51.7%	67.9%
Mobile homes	12.8%	14.5%	15.0%

Source: Census 1990. Note: Lincoln City data refers to Lenoir County Census Tract 103, which includes most of Lincoln City as well as some other areas of Kinston. See Appendix 2.1 for map.

Princeville and Lincoln City have some qualitative differences. Princeville has a special history as the first town chartered by African Americans in the United States. Founded in 1865, the town prides itself on a legacy of self-determination. Lincoln City, on the other hand, is not an independent administrative unit. Both communities had experienced repeated flooding from nearby rivers before Floyd, but Kinston had flooded in 1996 while Princeville had not flooded since the 1950s.

## **Kinston, North Carolina**

### *Motivations for buyout decision*

In Kinston, the decision to pursue a buyout program was championed through its planning department, which expressed strong commitment to the objective of hazard mitigation. The experience of Hurricane Fran, just three years before Hurricane Floyd, supported the

urgency of this objective, and planning staff recommended that the city council adopt a goal to remove all residences from the floodplain (FEMA, 2013). The Planning Department had even pre-prepared the materials for an HMGP application for buyouts after its success with a smaller buyout program after Hurricane Fran (Greer, 2015; G. Smith, 2011). To encourage the uptake of buyouts, the City of Kinston enacted a temporary construction moratorium in the areas targeted for buyouts to discourage rebuilding before buyout offers were made (de Vries & Fraser, 2012; McCann, 2006). Kinston's hazard mitigation objective accommodated other development goals, such as vibrancy of the downtown district. Concerned about impacts of out-migration on the town's businesses, Kinston recruited infill redevelopment in other areas and offered an extra \$10,000 to homeowners to relocate within the municipality (FEMA, 2013; J. C. Fraser et al., 2003).

The decision for Kinston to participate in the state's buyout program opened up a decision for individual property owners, who had to apply for a buyout. Property owners' objectives tended to differ from those of local and state officials. In interviews, participants regarded buyouts as a chance to move to a less distressed neighborhood and avoid the monumental task of rebuilding. A former resident and community leader explained that the "good" of the buyout was that it "helped people get out of a place they wanted to get out of for years but didn't have the money to get out." Underscoring the perceived distress of the neighborhood, a city official described Lincoln City homes as "pitiful," and called the buyout "the offer of a lifetime." Some families lacked feasible alternatives. A former resident who was a child when the buyout occurred described her parents' initial attempt to rebuild. "Well, we wanted to [return to our home]...I remember they tried to redo everything and then it was just too costly, eventually...they just took the buyout." The financial costs of rebuilding along with

the opportunity for residential mobility were the primary incentives for individual property owners, in contrast to the hazard mitigation goals of state and local officials.

In fact, low home values along with state and local policies made not taking a buyout substantially more expensive for most homeowners. The older homes in Lincoln City required elevation to meet the local building code if it was determined that the storm caused “substantial damage,” or damage that required renovations costing more than 50 percent of a property’s value. An interviewee explained the situation:

“If the houses had actually had some value, they probably could have stayed or it wouldn’t have been a substantial damage situation. So, you got a house worth twenty thousand dollars and you have to fully replace the electrical in it, you got at least ten thousand dollars of work and in almost every case it was substantial damage case and they couldn’t rebuild.”

Without the option of HMGP funding to elevate, which had been available after Fran but not after Floyd, homeowners would have had to pay out of pocket to elevate their homes. Few homeowners even held flood insurance that would cover losses to their existing structure. In the end, 97 percent of eligible property owners in Lincoln City accepted the buyout, leading to a large tract of contiguous buyout properties (FEMA, 2011, 2013; McCann, 2006). The combination of state and local policies toward hazard mitigation shaped homeowners’ financial incentives to encourage buyouts and discourage rebuilding.

### *Outcomes*

Administrative data suggests that Lincoln City buyout participants increased their home equity, moved to neighborhoods with lower levels of poverty, and reduced their flood vulnerability. The state realized that the low value of buyout participants’ homes (average of \$26,067 in Lincoln City) would preclude purchasing a new house on the private market, so the state offered up to \$75,000 to help participants purchase an equivalent home and relocate. The

average value of the new homes was twice as high as the original homes (see Table 3), providing additional home equity to participants. In addition, according to interviewees, many participants' replacement homes were younger than their previous residences and had less deferred maintenance. These higher value homes did result in some foreclosures, however, among residents who could not afford the higher utilities or property taxes that came with their new properties, according to interview data. The town also facilitated infill redevelopment and attempted, only partially successfully, to spur new development that would serve buyout participants.

Table 3. Home Value, Original and Post-buyout, 2001					
		n	Stan. Dev.	Min.	Max.
Value of Original Property	\$26,021	198	\$17,024	\$59	\$94,235
Value of Post-Buyout Home	\$62,046	95	\$27,750	\$5,404	\$128,730

In addition to increasing their home values, participants moved into less distressed neighborhoods with lower poverty, as interviewees described was a primary objective for household participation. According to administrative records, only five percent of participants relocated within the same Census tract as Lincoln City, where the poverty rate was 57 percent before Hurricane Floyd. On average, buyout participants moved to a Census tract with a 15 percent poverty rate.

Critically, the City of Kinston achieved its goal of reducing the number of residences in the floodplain. With HMGP funding from Hurricanes Fran and Floyd, the City of Kinston removed over 850 housing units from the floodplain in Kinston (North Carolina Emergency Management, 2016). Of all the buyout participants captured in the city's administrative records, none moved to homes within the 100-year floodplain. In 2016, Hurricane Matthew devastated

Eastern North Carolina, setting rainfall records in 17 counties, and flooding riverine communities once again, including Kinston and Princeville (State of North Carolina, 2017). In Kinston, floodwater filled many low-lying areas including the land where Lincoln City homes once stood. The 850 homes that likely would have flooded had been removed from this vulnerable area, reducing destruction and suffering.

While the benefits to buyout participants included higher home values, lower poverty neighborhoods, and lower flood risk, there were also negative impacts to participants and their former neighbors. Previous to Hurricane Floyd, tight social networks in Lincoln City had provided important day-to-day benefits like carpooling and childcare. For example, one interviewee's father owned a car, and before Hurricane Floyd, he had driven his neighbors to their shared workplace, a factory. When the household took the buyout, those former neighbors had to leave their jobs because they lacked their own transportation. Geographic proximity in Lincoln City had grounded social networks that provided services of economic value, and as the buyout generated geographic dispersion, these networks and services diminished. In an interview fifteen years after the buyouts but before Hurricane Matthew, one town official expressed a sense of possible regret about breaking apart the African American community in Lincoln City for a flood that might not come again in their lifetimes. However, since Hurricane Matthew caused repeat devastation and flooding in Kinston, no one has suggested that the social price of the buyouts was too high.

For residents near the buyout land, the area became a disamenity. After the buyouts were complete, houses were demolished and utility infrastructure removed. The pavement remained, and over the years since the buyouts, trees and shrubs crowded the street network and some roads are now impassible. Twenty years later, it evokes an abandoned neighborhood (see Figure

1). Opportunists have used the area for dumping appliances and mattresses, and for a while, neighbors called the police frequently on account of suspicious behavior. A local government official concedes that there is no political will to implement park plans that have been proposed for the land over the years, explaining that “there is so much need across the entire area of Kinston, it would be foolish, really, to spend the money in that area when it may or may not get used at all.”<sup>3</sup> As this quote suggests, the buyout land is part a cycle of disinvestment in the Lincoln City area.

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<sup>3</sup> Park plans have included a green infrastructure plan written by University of North Carolina graduate students in 2002; Retrofitting Green, a plan developed by the Kinston Open Space Project Committee in 2005, which calls for building a greenway, arboretum, and educational and recreational features, and restoring a creek, and establishing demonstration forestry plots; a 2015 proposal developed by a University of North Carolina graduate student, using community engagement in Kinston, to monetize ecosystem services in the buyout area; and over a decade of ongoing interest in developing a skeet shooting range on the land.



Figure 1. Road into buyout land in 2017

Not only did the landscape of abandonment develop next to remaining residents, these residents also lost their Lincoln City neighbors. As homeowners took the opportunity to move, the area was drained of its homeownership households, who had provided greater social and economic stability, according to former residents who were interviewed. At the same time, significant stock of naturally occurring affordable housing was lost in the buyout. Poorer renters were left with a diminished supply of low-cost rental options, and many turned to public housing on the east side of Kinston, further concentrating African-American poverty, according to former residents and local officials. Table 4 summarizes the changes in Lincoln City and Princeville from before the buyout decision to recent years. Median income has dropped and the poverty rate is 54.5 percent; less than one in five households own their homes, and a quarter of the housing is



vacant. Today, the census tract that includes the buyout land is the most economically distressed rural Census tract in North Carolina (High & Owen, 2014).

In summary, the buyout program had significant impacts for households and the community in which it was implemented. Many participants gained home value, moved to areas of lower poverty, and reduced their future flood risk, but they also lost social ties. Neighbors to the buyout land and former Lincoln City renters did not gain these benefits, and instead the buyout land, the loss of homeownership households, and the loss of naturally occurring affordable housing support generated further economic deprivation in the adjacent neighborhoods. While the buyout generated individual opportunity and reduced flood risk, it also tore the neighborhood's social fabric and further distressed its economic condition.

Table 4. Demographic and Housing Change in Princeville and Lincoln City, 1990-2016*						
(U.S. Census Bureau, Decennial Census 1990 and American Community Survey, 2012-2016)						
	<u>Lincoln City</u>			<u>Princeville</u>		
	<u>1990</u>	<u>2012-2016</u>	<u>Change</u>	<u>1990</u>	<u>2012-2016</u>	<u>Change</u>
Population	3,666	1,654	<b>-55%</b>	1,652	2,300	<b>+39%</b>
Median income (2016 \$)	\$13,167	\$11,250	<b>-15%</b>	\$20,454	\$27,902	<b>+36%</b>
Families below poverty	56.6%	54.5%	<b>-4%</b>	35.3%	27.3%	<b>-23%</b>
Housing units	1,560	925	<b>-41%</b>	654	968	<b>+48%</b>
Occupied housing units	1,423	668	<b>-53%</b>	621	845	<b>+36%</b>
% Owner occupied	25.6%	18.4%	<b>-28%</b>	48.5%	58.1%	<b>+20%</b>
% Mobile homes	12.8%	7.8%	<b>-39%</b>	14.5%	34.0%	<b>+134%</b>
* Lincoln City data refers to Lenoir County Census Tract 103, which includes most of Lincoln City as well as some other areas of Kinston. See Appendix 2.1.						

## **Princeville, North Carolina**

### *Motivations for buyout decision*

Princeville's decision to reject a buyout program followed a different trajectory of local decision-making and state and federal policy context. After Hurricane Floyd, North Carolina Emergency Management approached town officials about a complete buyout. Unlike the local champion in Kinston, an external agency suggested reducing vulnerability through a large-scale buyout in Princeville. The Town had a very small staff that did not include a planner, and from the start, town officials were defensive and reluctant even to allow a discussion about buyouts (Associated Press, 1999a).

Unlike the City of Kinston or most homeowners in Lincoln City, the Princeville town government had a seemingly attractive alternative to buyouts. The U.S. Army Corps of Engineers offered to rebuild the levee that had failed during Floyd. Federal officials determined that the rebuilt levee would keep the town out of the 100-year floodplain, which would make its residents ineligible for buyouts – thus casting the decision about buyouts as a choice between rebuilding the levee or taking buyouts, which provided further reason to decline a buyout program. However, fifteen years later, federal officials would determine that the levee did not, in fact, provide such a high level of protection, which is discussed later (USACE, 2016).

There was significant public debate in Princeville about whether to pursue buyouts. The town polled residents and held public meetings to discuss possible buyouts (Thompson, 1999c). For many, moving the location of the historic town or selling their land to the government constituted abandonment of the work of their ancestors and the town's legacy of African American self-determination (Mizelle, 2016; B. Phillips et al., 2012; Yellen, 1999). As one leader commented in an interview, "We got too much history to turn our backs." National press

cast the possible buyouts in dramatic terms, writing that “residents had to decide whether to return to the now uninhabited land and rebuild, or abandon forever the place where their ancestors first experienced full U.S. citizenship” (Associated Press, 1999b). One interviewee who assisted the Town with its Floyd recovery suggested that the Town also feared that buyouts would spell the end of Princeville through population loss, although no Town leaders shared this concern in interviews.

Some residents, at least 75 to 100 households according to different accounts, wanted to be able to take a buyout (Thompson, 1999b; Yellen, 1999). Some wanted a buyout so they would never have to deal with flooding again (Yellen, 1999) and others wanted a buyout so they would have the funds to rebuild (Thompson, 1999a). As one resident explained, “I would rather take the buyout and get cash money in my hands and decide where to go from there,” (Thompson, 1999a).

Ultimately, the framing of buyouts as abandonment of history prevailed. After “turmoil and deliberation,” on November 22, 1999, the town commission split the vote (2-2) over whether to participate in the buyout program. Mayor Perkins cast the deciding vote against participating in the buyout program, citing history by saying, “Rebuilding is staying with your heritage,” (Burritt, 1999).

### *Outcomes*

As Princeville redeveloped in place, the rebuilt levee provided a sense of security that turned out to be unfounded. Before Hurricane Matthew, in a 2015 interview, a town leader explained that residents no longer feared flooding. “I think when people came back—and you see they came back—they weren’t worried about it. Not even worried about it anymore.”

However, that same year, a USACE report revealed that the levee in Princeville did not protect the town from the 100-year storm (USACE, 2015, 2016), even though the National Flood Insurance Program asserts the opposite. The following year, Hurricane Matthew devastated eastern North Carolina, and floodwater poured around Princeville's levee into the town (State of North Carolina, 2017). If Princeville's risk had been assessed correctly, the town could have rebuilt its levee *and* administered a buyout because the buyout program was predicated on being in the 100-year floodplain. However, it is impossible to know if the town would have done so. More certain is that anyone rebuilding with a federally backed mortgage would have been required to hold flood insurance, which would have significantly reduced the financial losses during Hurricane Matthew.

Despite reinforcing their vulnerability to flood loss, the decision to forgo buyouts provided some tangible benefits for households. After Princeville decided against participating in the buyout program, the town and its households accessed federal, state, and charitable disaster recovery funding to support redevelopment to its previous population size, as illustrated in Table 3. As a result, the profile of the housing stock changed. Before Floyd, many Princeville residents had lived in small, hand-built homes. On one hand, these homes were an invaluable historic asset, but on the other hand, some homes did not meet basic modern standards such as indoor bathrooms. Other pre-Floyd homes had been constructed cheaply with public money in the 1970s, and according to interview data, these homes had aged poorly and were in serious need of maintenance. The media record and interview data indicate that after Floyd, with generous recovery aid, many homeowners in Princeville "went a bit bigger" with their replacement home, for example, from three bedrooms to four bedrooms in a manufactured home (AP, 2000). However, as old stick-built homes were replaced with housing that was less expensive to

develop, the stock of mobile homes, which are more vulnerable to natural disasters than other housing types (Bolin & Stanford, 1991), tripled to comprise a third of the town's occupied housing (see Table 2).

The town also found some benefits to preserving its location, even as it lost the opportunity to rebuild in a safe location. USACE fortified the levee and the town's population level has surpassed pre-flood levels in the past decade (Table 2). Not only did the decision against participating in the buyout program preserve Princeville's historic location, it actually brought greater national attention to its unique history (Tilove, 2005). Rebuilding in place, rather than relocating, fit into a narrative of overcoming adversity in Princeville that caught the attention of politicians and celebrities. President Clinton made a visit to Princeville in 1999, and issued an Executive Order that created a federal council that would "do more to help this city that occupies such a significant place in history" (Clinton, 2000). This federal council amounted to a few tangible outcomes, other than a lengthy recovery plan which was never implemented. However, interview data suggest that the experience with Hurricane Floyd put Princeville on the map for outsiders, who knew little about the town's history before the fateful decision to rebuild and forgo a buyout.

After the complete devastation from Hurricane Matthew, Princeville is again in the position to seriously consider buyouts. Many interviewees external to Princeville saw the 1999 decision against buyouts as a missed opportunity, especially in light of the flooding damage from Matthew. But both before and after Hurricane Matthew, no one within the town described any regret—only frustration that their levee had not protected them. The process for decision-making about buyouts is lengthier this time, and nearly as fraught among residents and leaders who hold

different opinions. Elevations are on the table this time, as is a potential relocation project to a nearby tract of land, but few final decisions have been made at the time of this writing.

## **Understanding Motivations and Outcomes**

### *Motivations for local decision-making*

The case comparison demonstrates that the decision about whether to administer buyouts was shaped by internal leadership, the degree of understanding of climate risks, including experiential knowledge, and competing local priorities, all reasons that are in keeping with the local climate adaptation literature. Both cases affirm the importance of leadership and policy entrepreneurship from within the local government. In Kinston, the town planner served as the local champion, and he proactively ushered his town through the buyout process by starting to plan for it in advance of disaster, trusting that another hurricane would come. In contrast, there was no strong champion for buyouts in Princeville, even though two of the Commissioners voted in support of the buyouts. Both towns had support from the state and federal government in the form of financial resources and offers of staff capacity, but only the town with local, internal commitment to buyouts enacted a buyouts program.

In addition, the different levels of understanding and prioritization of future climate risks also motivated the two communities in different directions. In Kinston, the town planning director focused on the risk of repeat flooding, to the point where he conducted advanced planning for a buyout program before Hurricane Floyd ever struck. This understanding of Lincoln City's risk was made more tangible by Hurricane Fran, which had struck just three years prior, and helped garner buy-in from elected officials, which previously had not been interested in hazard mitigation according to interview data. In contrast, interview data suggest that the risk of flooding did not factor into the town's decision about buyouts. There were two limitations to

Princeville's understanding of its flood risk. First, the town had not flooded recently. References to previous flooding were largely stated as proof of past generations' ability to overcome adversity, unlike in Kinston, where suffering flood losses was a recent experience. Second, the town was given incorrect information about its flood risk—namely, that the town would be protected from the 100-year flood if its levee was rebuilt, which was the option that the town selected. Hurricane Matthew, whose flooding did not extend as far as Floyd, still inundated the town. The contrast between Kinston and Princeville demonstrates that accurate information, and the lived experience of multiple environmental hazards, supports local action on adaptation. The finding that experiential knowledge of climate risk motivates buyout decisionmaking is supported by post-Matthew consideration of buyouts Princeville. Given the recent memory of Hurricane Floyd, Princeville residents are worried that future floods will endanger their town in its current location if recovery does not add new layers of protection. This knowledge, which is closely linked to a sense of exhaustion with rebuilding yet again, has helped put buyouts on the table in Princeville after Hurricane Matthew.

Intergovernmental relationships also emerge as a key theme in the cases, enabling local action. In North Carolina, after Floyd, HMGP was administered by local governments. However, the HMGP buyout program is a federal program, and its widespread adoption in North Carolina was championed by the state government. The state contributed significant resources by assisting with grant applications, providing match funding that often local governments must provide, and offering financial assistance to individual participants for relocation. Kinston's local leadership to implement the buyouts was substantially supported by state and federal priorities, which made it feasible and effective at the local level. (On the other hand, Princeville's decision against buyouts was also supported by a federal agency, the Army Corps of Engineers, which offered to

rebuild the local dyke.) These linkages among scales of government interest adaptation scholars, who often, but not always, focus on dysfunction in the linkages as a barrier to taking action (Bauer & Steurer, 2014; Corfee-Morlot et al., 2011; Hlahla et al., 2019; Lawrence et al., 2015; Mukheibir et al., 2013; Nalau et al., 2015; Shi, 2019; Westerhoff et al., 2011). Examples from hazard mitigation programming might provide a template for interscalar climate adaptation programs.

Also in keeping with the literature on local climate adaptation, the Princeville case demonstrates the challenge of competing local priorities when deciding to take action on environmental relocation. Princeville sought to sustain its history legacy through retaining its original location, which was at odds with the buyout. However, this competing priority differs from the local development agenda which is more typically described as a competing local priority in research on hazard mitigation and adaptation (Burby, 2006; D. Young & Essex, 2019). Princeville is located in an undesirable area precisely because it is an African American community; this was an essential survival strategy for African American land owners in the Ku Klux Klan and Jim Crow eras (Waggoner, 2000). Similarly, Lincoln City's population by poor African American households resembles much of the South, where African American communities are segregated in lowlying areas (Ueland & Warf, 2006). A great deal of scholarly literature has dedicated itself to the worthy topic of conflict between local development incentives and flood risk reduction (Burby, 2006; Burby & French, 1981; Cutter et al., 2017; Kunreuther, 2009; Platt, 1985). Greater attention might be paid to other competing priorities which may derive from historic injustices.



*Outcomes of local action: Flood risk reduction*

These cases demonstrate provide strong evidence that local action on environmental relocation can result in permanent risk reduction through land use measures. The Kinston case provides clear evidence which demonstrates that by removing development, the town reduces impacts of flooding, from personal losses to government expenditures. By comparison, Princeville's rebuilt levee did almost nothing to protect the town from a storm the size of Hurricane Matthew.

The buyout program in Kinston provided highly localized flood risk reduction benefit, another of the theorized advantages to local adaptation action over other scales of governance. The buyout program was highly tailored to the local context, not just because it concentrated buyouts in localized areas of high flood impact, but because the local government also considered the future housing needs of potential participants through facilitating redevelopment and new development. The buyout program also responded to the financial needs of participants, but this contextualizing actually happened at the state level through the establishment of SARF. Contextualization at the local and state scale made the program effective and reduced some potential negative impacts to participating households.

The case studies add evidence to both sides of the scholarly debate about whether local is the appropriate scale for climate adaptation action. As a local program, buyouts were successful in addressing the very localized impacts of flooding in the town – so in this sense, local action did generate effective results, with the caveat that it was made possible by state and federal government programs as well. On a larger scale, upstream development patterns in the piedmont region of North Carolina very likely contributed to the degree of flooding downstream, and in fact, many scientists argue that the greatest driver of increased flood losses in recent decades is

increased development, not climate change (Klotzbach et al., 2018; Pielke et al., 2008). In this larger context, a greater impact strategy would be to limit the runoff from upstream development and increase absorption and water storage in other parts of the watershed. Small, rural municipalities like Kinston and Princeville are hardly positioned to incentivize these actions in other places; a state or federal initiative would likely be needed.

### **Problems for Environmental Relocation in Marginalized Communities**

These cases demonstrate some additional serious challenges tied to the context of buyouts in marginalized communities. These issues require additional research among scholars of buyouts and climate adaptation, and they suggest the need for policy and planning innovation.

#### *Concentration of environmental relocation in marginalized communities*

These cases suggest reasons that environmental relocation programs may be concentrated in minority and marginalized communities. In particular, there may be fewer fiscal and political disincentives for local governments to pursue environmental relocation in marginalized communities. Contrary to the concern that local governments will lose tax revenue from buyouts or other development restrictions, interview data indicates that Kinston did not suffer any major loss of tax revenue because the value of the homes bought out were so low. In addition, there may be fewer political disincentives to environmental relocation in segregated communities. According to climate adaptation research, local leaders may choose not to pursue adaptation projects which could be unpopular in the short term, despite being beneficial in the long term (Adger et al., 2009). Segregation is associated with poor political representation, so elected officials may not worry as much about unpopular action in segregated, marginalized communities.

A potential disproportionate concentration of environmental relocation in marginalized communities speaks to a paradox in the equitability of adaptation interventions. On one hand, marginalized populations live in floodprone areas for unjust reasons, and to the extent that buyouts have ill effects on communities, they deepen this injustice. On the other hand, as Siders (2018) explains, “not acting—leaving low-income and minority populations in areas known to be hazardous or using federal funding to rebuild in those areas—also perpetuates inequality.” Additional empirical data on the outcomes of buyouts for participants and communities may help build a case for one framing or the other. Critical analysis which takes into account the equitability of the provision of other flood mitigation strategies, including less failsafe ones like grey infrastructure which nonetheless get rebuilt after failing, is also needed (Martinich et al., 2013).

#### *Fairness and democracy in decision making*

The two cases illustrate social equity problems for the process of decision-making for local adaptation action, especially in regard to environmental relocation. Scholarship has identified the ability to influence climate adaptation decisions which affect one’s wellbeing as a social equity priority (Graham et al., 2018; McManus et al., 2014). In Kinston, as noted previously, local leadership in the Planning Department played a major role in implementing the buyout, in keeping with literature on local adaptation. However, there is no evidence that the overall decision to pursue a major buyout was discussed in public with the affected neighborhood before that decision was made. In contrast, Princeville’s elected officials eventually invited residents to weigh in on the decision during multiple public meetings, despite initial resistance to allow discussion of the buyout. Ultimately, the decision was made by elected officials in a public vote. Historically, citizens have not demonstrated interest in participating in

hazard mitigation planning (Godschalk, Brody, & Burby, 2003), but the transformative nature of removing swathes of development is likely to garner more interest due the personal and emotional connections that people have with places (Manzo & Perkins, 2006), as it did in Princeville.

The differences in decision-makers and community representation across these two decision-making processes may be particularly relevant to other environmental relocation decisions because of the importance of policy entrepreneurship to local climate adaptation action (Aylett, 2014; Carmin et al., 2012; Tanner et al., 2019). In Kinston, the champion for buyouts was a planner, an unelected position, and the affected Lincoln City community was not formally represented in the decision. In Princeville, where there was no internal champion for buyouts, the decision was made by elected officials who represented the whole of the affected community. Policy entrepreneurs may not be elected officials, and elected officials may not be policy champions for adaptation. These cases suggest that internal champions for climate adaptation are not positioned to represent the interests of marginalized populations, such as poor communities of ethnic minorities, any more than any other local government official.

Local government decisions about buyouts are made more complex by the dual nature of environmental relocation as both a household-level and a community scale intervention. HMGP structures buyouts as a voluntary program that individual property owners elect, but at scale, buyouts transform neighborhoods and towns. In reality, homeowners in both towns were limited in their choices by decisions made by local and state government. Some Princeville citizens felt that the town had unduly interfered in the individual household's choice to take a buyout (AP, 1999; Thompson, 1999a). In Kinston, where homeowners technically had a choice about the buyout, many participants had no other financially reasonable alternatives. Both of these

scenarios raise difficult questions about who ought to make decisions about voluntary relocation programs. While critiques of buyout decision-making practices are mounting, research and practice have not yet dealt with good alternatives, *i.e.* how best to structure a functional and participatory process to make both joint and individual decisions about environmental relocation.

*Memory, history, and marginality in disappearing places*

The case studies also raise the importance of history and memory from the perspective of the affected community in environmental relocation programs. Buyouts risk the loss of history and memory attached to a place, a concern also found in community views of relocation due to toxic hazards (Shriver & Kennedy, 2005). This is evidenced most strongly in Princeville, where buyouts were framed as an abandonment of the town's historic legacy as the first town chartered by African Americans in the United States. Even in Lincoln City, which does not have as singular a history as Princeville, former residents still want to preserve its memory. Hundreds of former residents gather each spring for a weekend reunion in which hundreds of people attend. Community leaders wish for a memorial – “something permanent,” as one interviewee described it – to their former neighborhood on the land.

The risk of loss and memory is particularly concerning among racial, ethnic, or cultural minorities. Cultural and ethnic minority histories and identities are often already marginalized or poorly recognized (I. M. Young, 1990). Typical buyout practice in the United States, along with managed retreat and other environmental relocation programs, are not structured to engage the collective nature of deep, cultural ties to place among ethnic minorities (Hardy, Milligan, & Heynen, 2017; Marino, 2018). Further, when a community's ties to place are not well understood by external decision-makers, conflict and distrust can result (Burley, Jenkins, Laska, & Davis, 2007). Trust between officials and the affected community is essential to a relocation that is

effective and acceptable from the perspective of the administrators and the affected community (Baker, Binder, Greer, Weir, & Gates, 2018; Brokopp Binder & Greer, 2016; J. C. Fraser, Doyle, & Young, 2006; Perry & Lindell, 1997). Therefore, attending to the retention of history, memory, and group identity in environmental relocation will make risk reduction more just *and* more effective.

#### *Unintended social impacts for poor populations*

Finally, the comparison among cases reveals ways that decisions about buyouts affected participants and communities in both positive and negative ways outside of hazard mitigation. Many of these effects are directly related to the lack of wealth and prevalence of poverty in both communities. For participants in Kinston, the buyout provided an opportunity to increase their home equity through the buyout and gap financing. This outcome, outside the scope of hazard mitigation, has transformative potential. Homeownership is a significant source of stability and wealth generation in the United States, and it remains a significant area of racial stratification (Dietz & Haurin, 2003; Krivo & Kaufman, 2004). Further, most participants moved to an area of lower poverty than Lincoln City. Neighborhood conditions, such as relative wealth or poverty, shape life outcomes from health to educational outcomes (Chetty, Hendren, Kline, & Saez, 2014; Flippin, 2004; Massey & Denton, 1993; Squires & Kubrin, 2006; Yen & Kaplan, 1999).

Buyouts unfortunately also generated some negative community effects, tied to the economic conditions of the neighborhood. Buyouts caused the loss of social networks, which are particularly important in the day-to-day lives of poor households (M. Fullilove, 2004; Nguyen, Webb, Rohe, & Noria, 2016; Stack, 1975; Vale, 2002). The land itself became a disamenity for the residents at the margins of the neighborhood, where dilapidated and unsafe housing became concentrated. The lack of political will to generate an amenity in a poor, African American

neighborhood is echoed in interview data. In addition, the buyout resulted in the loss of “naturally affordable” housing units, or homes on the private market that are affordable to low- and moderate-income households. Kinston was exceptional in that the town worked with developers to generate new housing options that would be affordable to buyout participants. But even with this effort, the town lost 207 housing units between 2000 and 2010, the period in which many of the buyouts occurred (U.S. Census Bureau, 2000, 2010). Effects on the affordable housing stock in a particular place are most acute for those who cannot afford typical market-rate housing.

Each of these unintended consequences demonstrate how the buyouts generated impacts of particular concern for poor populations. Yet, many of these consequences have potential remedies, such as collective relocation (Marino, 2018; Perry & Lindell, 1997), housing counseling and wraparound services that are used in community development programs (Varady & Kleinhans, 2013), and adaptation or relocation programs which build new, resilient housing in less risky places. The positive elements of the Kinston buyouts, such as increasing home equity, demonstrate that adaptation interventions could intentionally integrate homeownership programs or any number of programs that build material wealth or even social and political empowerment. It has been noted that adaptation action is more likely to occur when it coincides with development priorities (Aylett, 2014). However, community and economic development priorities may need to actively be incorporated into adaptation strategies to address inequities in adaptation processes and outcomes.

This paper has demonstrated that two marginalized communities made different decisions about environmental relocation based on differences in leadership, perception of climate risks, and competing priorities. As a result of these different decisions, it is possible to explore some

long-term impacts of buyouts on participants and communities by case comparison. Buyouts permanently reduced flood risk in Kinston, and bolstered home equity for participants. However, the buyout program also had negative consequences for the area around the buyout land because the buyout generated an environmental disamenity and supported a cycle of disinvestment. By comparison, *not* taking a buyout garnered publicity and greater recognition that benefitted Princeville. However, the decision resulted in devastating flood losses just 17 years later. These cases demonstrate that there are difficult problems to solve in designing a fair decision-making process, including giving the community a voice in a buyout program that has a collective impact, but which occurs through individual homeowner decision. They also demonstrate that buyout programs may not anticipate the degree of unintended social risks of environmental relocation, including loss of marginalized histories and loss of social networks. The analysis of these issues can guide the research and innovation agenda on equitable climate adaptation toward workable solutions to these enduring problems.



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### CHAPTER THREE. MUDDY WATER: THE RACIAL LANDSCAPE OF POST-DISASTER BUYOUTS

Climate change is bringing more intense precipitation events to the United States (Lall et al., 2018). This precipitation, along with sea level rise and more intense coastal storms, increases flood events that impact human settlements (Fleming et al., 2018; Hirsch & Archfield, 2015; Slater & Villarini, 2016). At the same time, increased development in risky areas is driving up the frequency and severity of damaging floods (Klotzbach et al., 2018; Mileti, 1999).

Flooding has a disparate effect on socially vulnerable populations, including ethnic and racial groups that experience discrimination and marginalization. Marginalized populations may be more likely to live in floodprone areas (Ueland & Warf, 2006) and lack resources that others use to cope with flooding and rebound quickly (Finch, Emrich, & Cutter, 2010; Peacock, Morrow, & Gladwin, 1997). Further, strategies to manage flood risk and adapt to changes in flooding patterns can have disparate burdens (Anguelovski et al., 2016). For example, efforts to reform the National Flood Insurance Program to better reflect flood risk may exacerbate affordability problems for the poor (Kousky & Kunreuther, 2013).

This article examines how one land use strategy to manage flood risk may reflect or even exacerbate racial inequality. This study analyzes the distribution of post-disaster buyouts with respect to race and segregation in North Carolina. Post-disaster buyouts are a land use strategy that removes vulnerable properties from risky areas by buying them from willing homeowners. The properties are demolished and the land on which the houses sit must remain open space in

perpetuity. However, buyout proposals have been critiqued by scholars and community members for their potential racially disparate impacts. Specifically, critics have argued that buyouts dismantle African American communities (Bullard & Wright, 2012; B. Phillips et al., 2012), intentionally or unintentionally. For this reason, it is important to understand whether buyouts disproportionately occur in communities of color, and the implications of their distribution for racial inequality.

North Carolina is an important place to study the intersection of flood resilience and racial justice because of its leadership in both areas. In the 1990s and 2000s, the State of North Carolina ran one of the nation's most aggressive hazard mitigation programs, including buyouts, which later became a model for other states (Berke, Lyles, & Smith, 2014). In addition, after Hurricane Floyd in 1999, the State developed the nation's most advanced floodplain mapping program. North Carolina is also a leader in racial justice movements. The state was the birthplace of the civil rights sit-in movement in the 1960s and the environmental justice movement in the 1970s and 1980s, both of which spread across the nation. North Carolina is a microcosm of environmental topographies common to other states that experience major flooding, especially Southeastern states where watersheds include extensive coastal wetlands, agricultural plains, historic rural towns, and growing urbanized areas.

To understand the racial distribution of post-disaster buyouts in North Carolina, this study asks: Is the incidence of buyouts associated with the share of racial minorities in a neighborhood? If an association is found, could it be explained by (1) coincident higher levels of poverty or (2) concentrations of racial minorities in the floodplain? Using administrative and Census data, this study finds that the share of African Americans in a neighborhood is statistically significantly associated with more buyouts. This association holds even after

controlling for poverty and for flood vulnerability. In addition, segregation is associated with high-buyout neighborhoods. Two explanations are offered for the preponderance of buyouts in segregated, African-American neighborhoods. A procedural justice explanation suggests that local leaders target African American areas for buyouts out of explicit or implicit prejudice. A distributive justice explanation suggests that historic disinvestment in African American neighborhoods may make residents more interested in moving to another area through a buyout.

The paper proceeds as follows: In the following section, I review buyouts in the context of flood risk management and climate adaptation. Next, theories of distributive justice, procedural justice, and recognition are discussed, along with their application to buyouts and managed retreat. Methods, data, and empirical results are presented and then discussed. Finally, I offer recommendations for buyouts practice and buyouts research.

This paper fills a gap in the literature by offering empirical analysis of buyouts with respect to race. Scholarly critique of race in buyouts and managed retreat has employed case study research (Bullard & Wright, 2012; Hardy et al., 2017; Marino, 2018; B. Phillips et al., 2012). This is the first study to examine the racial geography of buyouts across an entire state. It also demonstrates how race-neutral strategies for flood risk reduction can reflect and potentially worsen racial inequality. Ultimately, because inequality drives social vulnerability, addressing the ways in which buyouts exacerbate racial injustice will advance resilience.

### **Buyouts and Flood Risk Reduction**

Over the course of the twentieth century, the federal approach to reducing physical vulnerability to flooding evolved from a minor role to a sprawling set of infrastructure programs and insurance subsidies (Mileti, 1999). In recent decades, scholars and advocates have suggested

that land use-based strategies are more effective than infrastructure and insurance to cope with flooding impacts (Beatley, 2009; Berke & Campanella, 2006; Brody & Highfield, 2013; Burby et al., 1999; FEMA, 2013; Holway & Burby, 1993; Mileti, 1999; Stevens, 2010; White, 2011).<sup>4</sup> Anticipatory land use strategies reduce development intensity in floodprone areas. Responsive land use strategies remove existing development located in vulnerable areas, which is the objective of post-disaster buyouts. The climate adaptation field recognizes buyouts as one of the only extant models for implementing “managed retreat” from areas at risk for increased climate risks in the United States (Hino et al., 2017; Siders, 2018). The lessons drawn from the experiences of implementing buyouts will inform interventions that advance hazard mitigation and climate resilience.

The first federal post-flood buyout occurred in the late 1970s in Soldiers Grove, Wisconsin, where local leaders convinced federal officials that it would be less expensive and more effective to move the town’s downtown district away from the river than to build a levee (David & Mayer, 1984; Tobin & Peacock, 1982). The practice expanded when several Midwestern towns implemented buyouts after the Mississippi River floods of 1993 (Freudenberg et al., 2016; Interagency Floodplain Management Review Committee, 1994; Knobloch, 2005; Maly, Kondo, & Banba, 2017). Since then, buyouts have been used across the nation, often after a flooding disaster but sometimes under blue skies as well. Typical funders include the Community Development Block Grant for Disaster Recovery run by the Department of Housing and Urban Development (HUD) and multiple programs under FEMA, including the Pre-Disaster

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<sup>4</sup> Home elevations are effective in many cases compared with homes on grade, but buyouts are still more effective than elevations. Elevated homes may still flood depending on building standards and changes in the floodplain due to upstream development or climate change (Hurley, 2019)

Assistance Grant Program, the Flood Mitigation Assistance Grant Program, and the Hazard Mitigation Grant Program (HMGP).

HMGP is the nation's largest source of buyout funding that requires that buyout properties remain as open space in perpetuity.<sup>5</sup> This program is authorized by the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1989, and it can fund any number of hazard mitigation activities, from residential retrofits to utility upgrades. In buyouts funded by HMGP, state, tribal, or local authorities receive federal funds to purchase properties located in vulnerable areas. Typically, the funds go through state government, which determines whether buyouts will be among the activities for which local governments, homeowners, or others will receive funding. For residential HMGP activities, states may solicit subapplications from local governments, which in turn solicit interest from homeowners. Participating property owners receive the market value of their house, which then is demolished and must remain open space in perpetuity. FEMA has funded an estimated 40,000 buyouts in the United States (NPR, 2019).

Although FEMA buyouts are lauded as a wise federal investment in permanent risk reduction, there are concerns and critiques of buyouts—and other programs that remove development—from a social justice perspective. For example, environmental justice scholar Beverly Wright describes New Orleans' early recovery plan sketches, which identified areas where previously developed land might be converted to open space, writing, "What became perfectly clear after a first glimpse of the new map, or, as it was called, the smaller footprint, was that the footprints of African Americans in New Orleans were to be erased," (2012). Siders

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<sup>5</sup> HUD does not require that buyouts be maintained as open space in perpetuity, although lower levels of government that administer the funds can require it.

(2018) argues that the process of implementing buyouts may exacerbate social inequalities through lack of transparency and a program's vulnerability to political influences.

Concerns about equity issues related to buyouts are compounded by a relative paucity of data and research on this topic. A critical first question is whether buyouts are a social benefit or a burden, and to whom. Because of heterogeneity in buyout program design, implementation, and context, and limited research on long-term outcomes (Brokopp Binder & Greer, 2016; Greer & Brokopp Binder, 2017), it is difficult to draw universal conclusions about who benefits and who is harmed by buyouts.

However, it is possible to outline groups of stakeholders and possible benefits and burdens that accrue to these groups. Individual buyout participants reduce their future flood risk if they move to an area of lower risk. Participants also may benefit socially or economically from moving into a different neighborhood, though a recent analysis of buyouts on Staten Island, New York, finds that most recipients moved to areas with greater social vulnerability than before (McGhee, 2017). Psychological stress, loss of place attachment, and loss of social networks can also ensue from relocation (Agyeman, Devine-Wright, & Prange, 2009; Perry & Lindell, 1997).

Buyouts also affect stakeholders apart from buyout participants. Neighbors to buyout properties may benefit if the property becomes more of an amenity than the residence was to the neighborhood (Zavar, 2015b). Homeowners might benefit if conversion to parks and recreational space improves property values, although recent research on "green gentrification" also warns of potential displacement effects for renters when neighborhoods add environmental amenities (Curran & Hamilton, 2013; Sze & Yeampierre, 2018; Wolch, Byrne, & Newell, 2014). On the other hand, buyout land may not be maintained and could also become a vacant lot or other

disamenity for neighbors. Residents of the local community have particular place-based identities, histories and cultures that could be dismantled by buyouts, if buyouts change the built, natural, or social environment dramatically; this concern is particularly high among ethnic and cultural minorities (Agyeman et al., 2009; B. Phillips et al., 2012).<sup>6</sup> Buyouts also diminish housing supply, which could spur or exacerbate housing problems due to limited housing stock. As this analysis suggests, the context of buyouts – where they occur, who takes buyouts, what happens with the land, and how it impacts housing – shapes the distribution of benefits and burdens. Through the lens of multiple frameworks of justice, it is possible to understand how buyouts could both reflect and contribute to racial inequality, and why questions of racial justice matter for buyouts and managed retreat.

### **Three Concepts of Justice and Relevance to Buyouts**

Multiple conceptualizations of justice have been adapted to environmental and climate policy issues in ways that support the analysis of racial and social equity in buyouts (Bulkeley, Carmin, Castán Broto, Edwards, & Fuller, 2013; Ikeme, 2003; Paavola & Adger, 2006; Schlosberg, 2012). Three such theories include *distributional justice*, *procedural justice* and *recognition*. Distributional justice, or an equal distribution of benefits and burdens among all people, builds from Rawls' "justice as fairness" theory (Rawls, 1971). Rawls argues that all people should have equal access to basic goods, and where inequality in the distribution is unavoidable, the greatest benefit should go to the least well-off. Critical geographers extend this

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<sup>6</sup> Taxpayers and government also are affected, albeit less personally. Local government may lose tax revenue from removing homes from the tax roll, but could also save expenses if infrastructure is removed or municipal services are reduced (BenDor et al., 2018). On the other hand, if the buyout land becomes an amenity, neighbors' property values could increase and tax revenue would go up. Federal government and taxpayers benefit if the avoided losses generated by the buyout exceed the cost of the buyout (Godschalk et al., 2009; Tate et al., 2015).



view and argue that the unequal distribution of benefits and burdens is generated and maintained through spatial proximity and segmentation (Harvey, 2009; Lefebvre, 1974; Soja, 2010).

Through spatial, social, economic, and political avenues, disaster and climate change burdens are distributed unequally, and the burden falls more heavily on marginalized communities (Gutierrez & LePrevost, 2016; Klinsky & Dowlatabadi, 2009; Lal, Alavalapati, & Mercer, 2011; Levy & Patz, 2015; Morello-Frosch, Pastor, Sadd, & Shonkoff, 2012). Marginalized populations have disproportionate exposure to physical vulnerabilities and simultaneously, they have fewer resources to adapt. Scholars also find that interventions that intend to increase climate resilience can exacerbate inequalities, for example, through infrastructure investments or land protections that prioritize privileged populations or burden or displace historically marginalized populations (Anguelovski et al., 2016; Barnett & O'Neill, 2010).

This displacement is the primary concern of scholars who critique buyouts and other interventions for the retreat of development (Bullard & Wright, 2012; B. Phillips et al., 2012). There are other ways that buyouts may reflect and contribute to distributional racial injustice, too. Buyouts may reflect racial inequality because buyouts are designed as an option of last resort in places that are not protected from flooding by infrastructure or land use regulation (Bukvic & Owen, 2017; Freudenberg et al., 2016). Socially vulnerable populations, including racial and ethnic minorities, are more likely to live in areas that lack these protections (Martinich et al., 2013). One reason for a concentration of racial minorities in the floodplain is that, prior to the 1960s, housing discrimination and racial violence limited non-White families to less desirable areas, such as swampy and floodprone neighborhoods (Ueland & Warf, 2006). Another reason for concentration of people of color in floodplains pertains to wealth. On average, African

American families have lower wealth than white families (Oliver & Shapiro, 2006), and properties in floodprone areas not protected by infrastructure cost less, and therefore are more affordable to households of lower wealth (D. Lee & Jung, 2014). Areas with lower property values face a disadvantage in justifying flood protection investments by the U.S. Army Corps of Engineers, which must exceed benefit-cost ratio of 1.0, where “benefit” is measured by the market value of structures protected. Communities of color may also have less political power to steer local, state, and federal decisions about infrastructure.

For all these reasons, it is not surprising that the first communities that must relocate explicitly because of climate change in the United States are comprised of people of color—Native American communities in Louisiana and Alaska (Davenport & Robertson, 2016; Herrmann, 2016). Therefore, it is important to understand the context of buyouts with respect to historically marginalized populations, which is the present research objective.

Some scholars critique the distributional equity model because its emphasis on a static distribution of goods does not explain the process that creates and reinforces social inequity. One group of these critics argue that unequal political and economic power creates distributional inequalities through controlling information and decision-making processes (Bent Flyvbjerg, 1991; Forester, 1989; Habermas, 1985; Healey, 2006). Advocates for greater *procedural justice* argue for decision-making processes that engage all stakeholders and for building the capacity of those stakeholders to take part in decisions (Innes & Booher, 2010). The procedural justice framework provides theoretical reasons that buyouts could disproportionately occur in communities of color, or why their implementation could burden racial minorities more than whites. Without a process designed for adequate representation, decision-making, including flood risk reduction decisions, may intentionally or unintentionally generate a distribution of

benefits that favors historically privileged groups (Douglas et al., 2011), a point which has been made specifically about buyouts (Siders, 2018). Racial segregation can diminish political representation (Massey & Denton, 1993), one critical element of procedural justice, which is one reason that racial segregation is included in this research study as a key independent variable of interest. The procedural understanding of justice provides additional avenues for exploring ways in which buyouts could reflect racial and social injustice.

A final scholarly paradigm for justice relevant to buyouts is recognition. Scholars developed the concept of recognition to incorporate the identities and subjective, contingent experiences of different groups, such as racial and ethnic minorities, in an understanding of justice (C. N. Fraser, 1999; Honneth, 1992; Taylor, 1997; I. M. Young, 1990). Advocates argue that decision-making must recognize and integrate group identity in order to achieve justice, including in the context of climate adaptation (Martin et al., 2016; Schlosberg, 2012). Further, many marginalized perspectives argue that recognition itself is the ultimate goal of struggles for justice that enable cultural survival (Schlosberg, 2004).

The justice framework of recognition pertains to buyouts because buyouts can risk the loss of unique histories and memories, especially those of the subaltern. People develop place-specific bonds with one another and the environment where they live, called “place attachment” (Altman & Low, 1992). Some research shows that place attachment is higher among racial and ethnic minorities (Brown, Perkins, & Brown, 2003). Because of place attachment, disruption or loss of one’s home or neighborhood, such as could result from buyouts, leads to trauma and alienation (M. T. Fullilove, 1996). In addition to psychological aspects of place attachment, subjective understandings of “place” contributes to the development of identity (Burley et al., 2007; Dixon & Durrheim, 2000; Scannell & Gifford, 2010). Place-based identity is an example

of the group identities at the center of literature on recognition, especially where it intersects with other group identities such as cultural or racial identities. Through transforming landscapes, major land use changes negatively affect place identity (Wester-Herber, 2004). The potential for buyouts to cause this loss is particularly concerning for group identities that have survived long-term subjugation and external devaluation, such as racial minorities (B. Phillips et al., 2012). Market pressures and climate change are already threatening cultural erasure for marginalized racial and ethnic groups located in risky areas (Adger, Barnett, Marshall, Brown, & O'Brien, 2012; Durkalec, Furgal, Skinner, & Sheldon, 2015; Hardy et al., 2017). The concept of recognition provides a theoretical scaffolding for analyzing how buyouts could contribute to inequality by jeopardizing minority identities, histories, and cultural survival.

#### *A Note on Colorblindness*

These three concepts of justice – distributional justice, procedural justice, and recognition – demonstrate that multiple justice frameworks contribute to our understanding of the causes and effects of unequal distribution of buyouts by race. All three theories of justice suggest avenues to achieve justice through different public policy approaches. However, addressing racial justice in public policy issues like buyouts and climate adaptation is made more difficult by the modern ideology of “colorblindness.” Colorblindness refers to an erroneous belief that society has entered a race-neutral existence, in which dismantling racism is no longer an appropriate objective of the government (Bonilla-Silva, 2003). This belief drives changes in public policy that dismantle affirmative action, school integration, and other programs designed to advance racial equality (Saito, 2015). Under the paradigm of colorblindness, racial disparities can only be understood as relics of historic discrimination that continue to exist today for nonracial reasons (Hardy et al., 2017; Saito, 2015). Colorblindness belies the structural nature of racism, in which

racial inequality is perpetuated by the strength of social, economic, and political institutions, which must be changed in order to bring about racial justice (Feagin, 2006). Hampered in its ability to acknowledge or intervene in structural racism, colorblind public policy faces major limitations to advancing racial justice. This study aims to counter colorblind approaches to flood risk reduction and climate adaptation by documenting the racialized geography of buyouts and discussing two socio-spatial constructions that might play a role in generating racial concentrations of buyouts: poverty and floodplain exposure.

## **Methods**

### *Research questions and hypotheses*

To understand the racial distribution of post-disaster buyouts in North Carolina, this study asks, is the incidence of buyouts associated with the share of racial minorities in a neighborhood or the degree of segregation? If an association is found, could it be explained by (1) coincident higher levels of poverty or (2) concentrations of racial minorities in the floodplain? The following hypotheses are proposed:

*Hypothesis 1: Neighborhood racial composition is associated with buyouts.*

H 1-1: The share of African Americans in a neighborhood is associated with more buyouts

H 1-2: The level of local segregation is associated with more buyouts

If evidence supports Hypothesis 1, Hypothesis 2 proposes that two nonracial variables could play a role.

*Hypothesis 2: After controlling for poverty and/or flood vulnerability, the association between neighborhood racial composition and buyouts is no longer statistically significant.*

H 2-1: After controlling for poverty, the association between neighborhood racial composition and buyouts is no longer statistically significant.

H 2-2: After controlling for flood vulnerability, the association between neighborhood racial composition and buyouts is no longer statistically significant.

### *Data*

Data used in this study come from state and federal sources, summarized in Table 5. Administrative data come from the North Carolina Emergency Management Division (NCEM). NCEM provided data on all projects funded by HMGP in North Carolina, including, but not limited to, buyouts. These projects occurred with funding made available after disasters that occurred between 1996 and 2010. During this time period, 5,532 HMGP projects were completed in the state, of which 4,715 were buyouts.<sup>7</sup> The geocoding was done with ESRI ArcMap and it was cross-referenced with Google Maps and county tax parcel data. Buyouts were agglomerated by Census tract, which was the geography used to represent neighborhoods.

The study also uses data on flood vulnerability. Floodplain data come from the National Flood Hazard Layer, which supports the National Flood Insurance Program. These floodplain data were overlaid with spatial data on the location of all buildings in the state of North Carolina, which come from the North Carolina Flood Risk Information System (FRIS).<sup>8</sup> Using this overlay, it was possible to calculate the share of buildings in each tract exposed to differently defined floodplains in each Census tract. Floodplains considered in the analysis include the 100-year or 1% chance floodplain, the 500-year or 0.2% chance floodplain, and the coastal V-zone,

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<sup>7</sup> Multi-unit buyouts – for example, of a small mobile home park – are represented as the number of units that were bought out.

<sup>8</sup> North Carolina Floodplain Mapping Program provides the Flood Risk Information System as a means for the public to access the most accurate available information about flood risk in the State of North Carolina.

which is a 100-year floodplain with special risk due to risk of high wave heights. Flood vulnerability metrics also included a binary variable that indicated whether the tract was in a county declared a disaster after Hurricanes Fran and Floyd. These two hurricanes occurred in 1996 and 1999, respectively, and account for the funding for 94.4% of the buyouts.

Finally, these tract-level data on buyouts and flood vulnerability were joined with demographic and economic data on neighborhood characteristics. These characteristics are captured by the U.S. Census. Census data from 1990 were used because these data pre-date the hurricanes of the 1990s and their subsequent buyout programs. Most of the buyouts (4,463 or 97.2%) were funded in association with disasters that occurred prior to 2000. The key racial characteristic pulled from the Census was share of population that is African American. Racial justice critiques of buyouts, especially those in North Carolina, have mostly been based in places that are home to African Americans (Bullard & Wright, 2012; Nelson, Ehrenfeucht, & Laska, 2007; B. Phillips et al., 2012). These data were interpolated from the 1990 Census to 2010 Census geography by the Longitudinal Tract Database (Logan, Xu, & Stults, 2014).

In addition to the racial composition of neighborhoods, the data also include a measure of segregation, the Dissimilarity Index. The Dissimilarity Index is a measure of evenness that indicates the share of people in a particular county that would need to move among its composite Census tracts in order for the share of each Census tract to match that of the county. More segregated counties have higher levels, and vice versa. The Dissimilarity Index requires the specification of two groups for comparison; whites and African Americans are used in this study. The final key independent variable in the dataset is the share of people living in households under the poverty line is taken from the Census. Additional control variables include share of senior citizens, share of housing units that are mobile homes, share of housing valued at under

\$100,000 (1989 dollars), share of housing built before 1950, share of housing built after 1980, percent rural as defined by the Census, county population, county population growth rate, and census tract population. These additional control variables come from the Census.

Table 5. Variables Used in Study

Variable Name	Definition	Measurement	Source(s)
Buyouts (Dependent variable)	Number of buyouts in the tract	Count	NCEM
African Americans	Proportion of African Americans in tract	Proportion	Census 1990
Dissimilarity Index	Share of people within county who would need to move so that every tract's share of white and nonwhite residents was equal	Proportion	Census 1990, calculated by author
Poverty	Share of people in households under the poverty line	Proportion	Census 1990
Vulnerability: 100-year floodplain	Share of buildings in the tract located in 100-year floodplain	Proportion	FRIS
Vulnerability: 500-year floodplain	Share of buildings in the tract located in the 500-year floodplain	Proportion	FRIS
Vulnerability: V-zone	Share of buildings in the tract located in the coastal V-zone	Proportion	FRIS
Vulnerability: Hurricane Fran	Tract located in county declared for major disaster and FEMA Individual Assistance after Hurricane Fran (1996)	Binary (0 1)	FEMA
Vulnerability: Hurricane Floyd	Tract located in county declared for major disaster and FEMA Individual Assistance after Hurricane Floyd (1999)	Binary (0 1)	FEMA
HMGP participation	Tract located in jurisdiction that administered HMGP	Binary (0 1)	NCEM
Control Variables			
Senior citizens	Share of population 65 years old or older	Proportion	Census 1990
Mobile Homes	Share of housing units that are mobile homes	Proportion	Census 1990
Housing under \$100K	Share of housing valued under \$100,000 in 1989 dollars	Proportion	Census 1990
Older homes	Share of housing units that were built before 1950	Proportion	Census 1990
Recent development	Share of housing units that were built after 1980	Proportion	Census 1990
Rural	Share of housing units???? In rural areas	Proportion	Census 1990
County population	Population count	Count	Census 1990
County population growth rate	Growth rate in county, 1970-1990	Proportion	Census 1990
Census tract population	Population of Census tract	Count	Census 1990

### *Distribution of the dependent variable and effect on models*

The association between buyouts (dependent variable) and neighborhood characteristics (independent variables) in populated census tracts (n=2,171) was assessed with multivariate regression. Two characteristics of the distribution of the dependent variable influenced the research design: an excess of zeroes and an excess of extreme positive outliers. In the dataset, 88 percent of the census tracts (n = 1,936) contain zero buyouts. Data with an excess of zeroes are termed *zero-inflated*. Zero-inflated data create or reflect two different problems (Lambert D, 1992; Tu & Liu, 2006). First, they can violate the distributional assumptions of a model, leading



to biased results. Second, zero-inflated data can occur when two distinct conditions or processes are governing a model: one which generates zeroes, and another which generates variation in non-zero values (Lambert D, 1992; Mullahy, 1986; Washington, Karlaftis, & Mannering, 2004). In either situation, a zero-inflated count model can be used. A zero-inflated model is comprised of two steps. The first step is a model that examines the influence of independent variables on the zero-generating process by modeling the dependent variable as a binary outcome: zero for all zero values, and one for all nonzero values. Then, in the second step, a separate count model examines the variation in the nonzero dependent variable observations. This is specified as a Poisson or negative binomial model, and includes only the non-zero values of the dependent variable. The Poisson distribution assumes equidispersion, or the condition in which mean equals the variance of the dependent variable, while the negative binomial model relaxes this assumption. The buyout data are overdispersed, as determined by a Pearson's chi-square test ( $p < .0000$ ), so a zero-inflated negative binomial model (ZINB) was selected.

This analysis adapts the zero-inflated model to capture two distinct conditions in zero-buyout tracts. Most tracts ( $n = 1,577$ ) with zero buyouts were located in a jurisdiction that ran an HMGP program, but there were no buyouts in that tract. Households in that tract may have taken a different type of HMGP project, such as home elevations. Other tracts have zero buyouts because they are located in jurisdictions that did not administer a Hazard Mitigation Grant Program during the study period ( $n = 582$ ), despite the fact that all North Carolina local governments were eligible to participate. Because these tracts had no possibility of having any buyouts, these observations are “structural zeroes.”

The process governing local governments' decisions to administer HMGP is assumed to be a different process from that which governs the decisions of individual households to take

buyouts in an area where the local government is participating. Therefore, the zero-inflated model distinguishes between structural zeroes and all other observations, including non-structural zeroes. In the first step, **Model 1**, the dependent variable is a binary indicator of whether the tract was in an area that administered HMGP, or in other words, whether or not the tract is a structural zero. Model 1 ( $n=2,171$ ) uses a logit model to test the association of this dependent variable with race and segregation, poverty, flood vulnerability and all control variables. The second step, **Model 2** only includes tracts in jurisdictions that administered HMGP ( $n=1,592$ ). Model 2 uses a negative binomial model to examine the association between the dependent variable, the count of buyouts, and the same set of independent variables. Because three independent variables are measured at the county level (segregation, county population, and county growth rate), the standard errors for these models and all others are clustered at the county level.

In addition to excess zeroes, the data also have extreme positive outliers, indicated by a kurtosis measure of 581, where a kurtosis measure greater than 3 is considered high (Wooldridge, 2013). Among tracts with at least one buyout, the average number of buyouts was 18, but there was a large variation in that number, up to 565 in one tract, as illustrated in Table 6. These extreme outliers matter from a policy perspective. We may not expect one buyout to have a major effect at the neighborhood scale, but that possibility becomes more tangible at 10 buyouts, and even more likely at 100 buyouts. Therefore, the neighborhoods with the largest numbers of buyouts – those extreme outliers – are of special interest. Without data on threshold effects of buyouts, there is no singular logical way to segment the outliers from other observations. A typical definition of an outlier is any value outside 1.5 times the value of the interquartile range. However, in this dataset, the interquartile range is 0, even if only including

tracts in places that administered HMGP. Therefore, three different methods are used and the results are compared in Models 3 through 5. Models 3 and 4 use a binary dependent variable to differentiate extreme outliers from other observations, excluding structural zeroes (n=1,592). In **Model 3**, the outliers are defined as any tract above one standard deviation from the mean (>18 buyouts). In **Model 4**, the outliers are defined as any tract above two standard deviations from the mean (>36 buyouts). **Model 5** uses a negative binomial model and the full count data, but includes only those observations with at least one buyout (n=258).

#### *Considering vulnerability and poverty as confounders*

Pre-buyout flood vulnerability creates a problem for studying the relationship between race and buyouts, and this problem has both statistical and real-world significance. From a statistical perspective, flood vulnerability could separately influence both race and buyouts, and this joint influence could confound the results if race and buyouts are not independently related. There are reasons to anticipate the joint influence of flood vulnerability. Tracts with greater flood vulnerability may have greater numbers of buyouts because flood vulnerability likely motivates household participation in HMGP. Racial minorities might be more likely to live in the floodplain due to historic discrimination and higher poverty rates (U.S. Census Bureau, 1990, 2017). Together, these problems suggest a relationship between race and buyouts could be explained, fully or in part, by vulnerability or poverty.

Understanding flood vulnerability and poverty as potential confounders also serves policy recommendations and brings to light the relevance to different conceptual frameworks of justice. If a disparate racial geography of buyouts is explained by flood vulnerability or poverty, it would suggest a distributive justice intervention focused on fairer access to wealth building or housing outside the floodplain. If these potential confounders are not found to explain the relationship

between race and buyouts, procedural aspects like power and representation in decision-making might play more of a role. In either case, it is important to identify the intermediary drivers of racial disparities so that they can be addressed through policy and other types of interventions. Therefore, instead of simply controlling for flood vulnerability and poverty, they are added to the model one by one to illustrate the degree to which each accounts for the statistical relationship between race and buyouts. The models within each step-wise regression are indicated by a letter after the number of the model (i.e. Model 2a excludes poverty and flood vulnerability, Model 2b adds poverty only, Model 2c adds poverty and flood vulnerability).

A final methodological concern is the potential for multicollinearity between race and poverty in the dataset. A high degree of multicollinearity among key independent variables makes coefficient estimates unreliable because it is difficult statistically to distinguish their effects on the dependent variables. The correlation coefficient between percentage African American and percent in poverty is 0.65, which indicates that the two variables are correlated, but they do not exceed the recommended maximum correlation coefficient for multivariate regression, 0.8 (Menard, 2011). Variance inflation factors (VIF) were also used to test for multicollinearity. A VIF above 10 is generally considered the threshold for unacceptable levels of correlation (Wooldridge, 2013). None of the VIFs exceed 3.1. By both of these metrics, the results are not compromised by multicollinearity. For reference, a table of correlation coefficients is included as Appendix 3.1. To further ensure that results were not compromised by multicollinearity, three alternative specifications add and drop certain variables to test for sensitivity to changes that would indicate that multicollinearity is a problem. The findings are discussed in the results section below. Together, they do not support the theory that

multicollinearity between share of African Americans and poverty level is generating unreliable estimates in the main models.

## Results

### *Buyouts are more frequent in African American neighborhoods*

There are 2,171 populated Census tracts in the state, of which 12% had at least one buyout in the study period (Table 6). On average, tracts with at least one buyout had a greater share of African Americans (32.1%) than tracts without buyouts (18.5%), and higher rates of poverty (17.7% versus 11.6% in neighborhoods without buyouts). Segregation was lower in tracts with buyouts than in tracts without buyouts. Finally, tracts with buyouts have a greater share of buildings the 100-year and 500-year floodplains, but fewer buildings in the coastal V-zone, on average.

Table 6. Characteristics of Census Tracts in North Carolina

	Mean	Mean, No buyouts	Mean, at least one buyout	Min	Max
<b>Buyouts</b>					
Has at least one buyout (%)	0.119 (0.324)	0 (0)	1 (0)	0	1
Number of buyouts	2.172 (17.20)	0 (0)	18.28 (46.94)	0	565
HMGP participation (%)	0.732 (0.443)	0.696 (0.460)	1 (0)	0	1
<b>Race and Segregation</b>					
African American	0.202 (0.218)	0.185 (0.207)	0.321 (0.256)	0	0.995
Dissimilarity Index (Segregation)	0.435 (0.142)	0.442 (0.140)	0.384 (0.151)	0	0.671
<b>Poverty</b>					
Poverty	0.123 (0.0906)	0.116 (0.0865)	0.177 (0.102)	0.003	0.668

<b>Flood Vulnerability</b>					
Impacted by Hurricane Floyd (1999)	0.653 (0.476)	0.631 (0.483)	0.818 (0.387)	0	1
Impacted by Hurricane Fran (1996)	0.590 (0.492)	0.558 (0.497)	0.822 (0.384)	0	1
100-yr Floodplain	0.0361 (0.0974)	0.0285 (0.0859)	0.0923 (0.147)	0	1
Coastal V-zone	0.00367 (0.0364)	0.00378 (0.0372)	0.00286 (0.0302)	0	0.816
500-yr Floodplain	0.0141 (0.0483)	0.0114 (0.0446)	0.0344 (0.0665)	0	0.719
<b>Other Controls</b>					
Seniors	0.120 (0.0552)	0.119 (0.0562)	0.132 (0.0454)	8.91E-05	0.472
Rural	0.519 (0.425)	0.517 (0.424)	0.536 (0.434)	0	1
Mobile Homes	0.155 (0.134)	0.152 (0.133)	0.178 (0.138)	0	0.791
Homes with value < \$100K	0.777 (0.223)	0.767 (0.225)	0.856 (0.189)	0	1
Older Housing	0.166 (0.134)	0.162 (0.135)	0.194 (0.124)	0	0.841
New Development	0.312 (0.173)	0.3206 (0.176)	0.246 (0.125)	0	0.972
County population (10k)	18.64 (16.40)	19.47 (16.50)	12.46 (14.25)	0.541	51.143
County growth (20 year)	0.374 (0.262)	0.385 (0.264)	0.292 (0.229)	-0.134	2.252
Total Population	3,025.7 (1,483.0)	2,923.1 (1,470.4)	3,786.3 (1,350.8)	1	10,340
<b>Observations</b>	2171	1913	258		

The regression findings in Table 7 measure the association between buyouts (the dependent variable) and race, segregation, poverty, flood vulnerability and other neighborhood characteristics. Model 1 is the first step in the ZINB model, and the dependent variable is a dummy indicator in which indicates being in a jurisdiction that participated in HMGP. Model 1

estimates the association between this dummy and the full set of independent variables. The results show no association between HMGP participation and African Americans or segregation.

Table 7. Buyouts & Neighborhood Characteristics: Regression Results				
	Model 1	Model 2(a)	Model 2(b)	Model 2(c)
<b>Race and Segregation</b>				
African American	-0.41 (0.85)	2.80*** (0.55)	2.41*** (0.71)	2.44* (0.99)
Segregation	-0.06 (2.50)	0.81 (1.79)	0.78 (1.78)	0.18 (1.87)
<b>Poverty &amp; Flood Vulnerability</b>				
Poverty	4.67 (2.82)		1.63 (1.99)	-1.65 (2.22)
Hurr. Floyd	-0.41 (1.00)			-1.11 (1.97)
Hurr. Fran	2.12* (0.94)			1.51 (1.83)
100-yr FP	24.94 (13.72)			11.63* (5.17)
500-yr FP	9.62 (9.87)			1.41 (3.00)
V-zone	-2.07 (2.93)			-13.36* (6.07)
<b>Other Controls</b>				
Seniors	-7.77* (3.39)	7.14 (4.06)	7.28 (3.97)	4.55 (3.89)
Rural	-0.56 (0.56)	-0.94 (0.58)	-0.93 (0.59)	-0.23 (0.63)
Mobile Home	2.92 (1.57)	4.67** (1.76)	4.78** (1.78)	2.09 (1.83)
Home Value < \$100K	-1.28 (0.76)	-0.41 (0.51)	-0.54 (0.53)	-0.13 (0.47)
Older Homes	1.31 (1.05)	-0.55 (1.23)	-0.77 (1.36)	0.11 (1.50)
New Homes	1.85** (0.66)	-3.79** (1.39)	-3.77** (1.32)	-3.28** (1.19)
County Pop.	0.08** (0.03)	-0.04** (0.02)	-0.04* (0.02)	-0.02 (0.02)
County Growth	-0.23 (1.31)	-0.05 (1.12)	-0.19 (1.08)	-0.86 (1.22)
Total Population	0.00 (0.00)	0.00*** (0.00)	0.00*** (0.00)	0.00*** (0.00)
Constant	-0.84 (1.79)	-1.28 (1.64)	-1.33 (1.61)	-2.01 (1.74)

lnalpha		2.67*** (0.16)	2.67*** (0.16)	2.55*** (0.16)
Observations	2171	1592	1592	1590
Pseudo R-squared	0.340	0.066	0.066	0.081
Standard errors in parentheses				
="* p<0.05                      ** p<0.01              *** p<0.001"				

The results from the second step of the ZINB, Models 2(a), 2(b) and 2(c), find that there is a statistically significant, positive association between the count of buyouts and the share of African Americans in a tract ( $p<0.05$ ). This association is not eliminated by controlling for potential confounders poverty and flood vulnerability. Segregation is not associated with the count of buyouts in this model. Among the flood vulnerability variables, the share of buildings in the 100-year floodplain was positively associated with the count of buyouts but the share of buildings in the coastal V-zone was negatively associated with the count of buyouts ( $p<0.05$  for both). All models control for size of county, population growth, rural/urban characteristics, share of senior citizens, value and age of housing, share of recent housing development, and mobile homes.

When using maximum likelihood estimation, a typical indicator of the fit of the model is McFadden's pseudo R-squared. Pseudo R-squared values are lower than R-squared values; pseudo R-squared values of 0.2 to 0.4 are considered an "excellent fit" (McFadden, 1977). By this rubric, the model for the first stage of the ZINB has an excellent fit (0.34) but the models for the second stage do not (0.07-0.08).

#### *High-buyout areas have more African Americans and higher segregation*

Models 3, 4, and 5 find that there are greater shares of African Americans and higher rates of segregation in high-buyout tracts, measured in three different ways. These results are illustrated in Table 8. Models 3 and 4 use a binary indicator that captures outlier tracts that are



greater than one and two standard deviations from the mean, or >19 and > 36 buyouts, respectively. Model 3(a) shows a positive association between African Americans and high-buyout tracts, but this association goes away when controlling for poverty and flood vulnerability in Model 3(c). However, all variations of Model 4 find a strong association between African Americans and high-buyout tracts, even after controlling for poverty in Model 4(b) and both poverty and flood vulnerability in Model 4(c) ( $p < 0.01$ ).

Table 8. Regression Results for High Buyout Neighborhoods

	Model 3(a)	Model 3(b)	Model 3(c)	Model 4(a)	Model 4(b)	Model 4(c)	Model 5(a)	Model 5(b)	Model 5(c)
<b>Race and Segregation</b>									
African American	2.57*** (0.66)	2.22* (0.96)	1.39 (1.14)	3.19*** (0.68)	3.52*** (0.70)	3.08*** (0.85)	0.79* (0.39)	0.78 (0.49)	0.28 (0.50)
Segregation	2.32 (1.46)	2.27 (1.48)	3.94** (1.44)	3.21 (1.84)	3.25 (1.83)	4.68** (1.74)	2.91** (0.91)	2.90** (0.89)	3.08*** (0.77)
<b>Poverty and Vulnerability</b>									
Poverty		1.33 (2.51)	-0.55 (2.81)		-1.27 (2.22)	-4.30 (2.29)		0.04 (1.43)	-1.34 (1.35)
Hurr. Floyd			0.07 (0.70)			0.32 (0.89)			0.69 (1.25)
Hurr. Fran			2.23* (0.99)			1.64 (1.03)			-0.14 (1.25)
100-yr FP			3.74*** (0.99)			2.44 (1.87)			1.30 (0.83)
500-yr FP			6.00*** (1.71)			8.93*** (2.50)			4.82** (1.59)
V-zone			0.00 (.)			0.00 (.)			-7.67*** (1.34)
<b>Other Control Variables</b>									
Seniors	2.59 (3.61)	2.61 (3.60)	2.94 (4.27)	8.69* (3.82)	8.80* (3.86)	11.06** (4.24)	1.95 (3.36)	1.97 (3.42)	2.20 (3.11)
Rural	-1.98** (0.67)	-1.95** (0.67)	-1.27 (0.84)	-1.51 (0.82)	-1.54 (0.85)	-0.47 (1.20)	-1.12** (0.40)	-1.12** (0.41)	-0.64 (0.49)
Mobile Home	5.98** (2.00)	5.94** (1.98)	4.12 (2.66)	6.60** (2.42)	6.73** (2.40)	3.74 (3.40)	3.78** (1.18)	3.78** (1.19)	1.95 (1.35)
Home Value < \$100K	-1.28 (1.59)	-1.38 (1.54)	-0.57 (1.89)	-1.63 (2.22)	-1.50 (2.40)	-0.40 (3.21)	-0.28 (0.59)	-0.28 (0.60)	0.20 (0.50)
Older Homes	-0.93 (1.19)	-1.11 (1.22)	-1.17 (1.42)	-4.12* (2.09)	-3.92 (2.15)	-4.66 (2.87)	-0.38 (1.01)	-0.39 (1.09)	-0.47 (1.01)
New Homes	-2.66 (1.64)	-2.62 (1.63)	-2.52 (1.73)	-5.41* (2.62)	-5.41* (2.63)	-4.93* (2.42)	-2.57* (1.29)	-2.57* (1.26)	-1.84 (1.10)
Total Population	0.00* (0.00)	0.00* (0.00)	0.00** (0.00)	0.00 (0.00)	0.00 (0.00)	0.00* (0.00)	0.00 (0.00)	0.00 (0.00)	0.00* (0.00)

County Pop.	-0.12** (0.04)	-0.12** (0.04)	-0.13* (0.06)	-0.11** (0.04)	-0.11* (0.05)	-0.11 (0.06)	-0.04*** (0.01)	-0.04*** (0.01)	-0.02 (0.01)
County Growth	-1.65 (1.34)	-1.72 (1.27)	-1.74 (1.46)	-1.62 (1.35)	-1.56 (1.36)	-1.66 (1.48)	0.04 (0.57)	0.03 (0.58)	-0.43 (0.50)
Constant	-2.35 (1.33)	-2.38 (1.35)	-5.83* (2.35)	-3.42* (1.41)	-3.43* (1.45)	-7.11* (2.80)	1.78 (0.94)	1.78 (0.95)	0.60 (0.94)
lnalpha							0.30*** (0.08)	0.30*** (0.08)	0.19* (0.08)
Observations	1592	1592	1519	1592	1592	1519	258	258	258
Pseudo R-squared	0.244	0.245	0.334	0.264	0.264	0.352	0.052	0.052	0.068

Standard errors in parentheses  
 ="\* p<0.05      \*\* p<0.01      \*\*\* p<0.001"

The fully controlled Model 3(c) and Model 4(c) and all variations of Model 5 find that segregation is statistically significantly associated with high buyout tracts ( $p<0.05$ ). Model 5 uses a negative binomial model to examine the association between independent variables and the count of buyouts in a tract, comparing only those tracts that had at least one buyout. The positive association between segregation and greater numbers of buyouts is particularly strong in all variations this model ( $p<0.001$ ). Model 5 does not find a statistically significant relationship between share of African Americans and greater numbers of buyouts. None of the models of high-buyout areas find a statistically significant association with poverty. Among flood vulnerability variables, the share of tracts in the 500-year floodplain was the only statistically significant predictor of high-buyout areas across all models that included flood vulnerability, Models 3(c), 4(c), and 5(c) ( $p<0.01$ ). In Model 5(c), the coastal V-zone is strongly and negatively associated with higher counts of buyouts ( $p<0.001$ ).

#### *Alternative specifications*

Three alternative specifications examine whether multicollinearity between share of African Americans and poverty could result in unreliable estimates. Alternative Specification A drops two other variables that have moderate levels of correlation with poverty and share of

African Americans: share of homes built before 1950 and share of homes valued under \$100,000. It is possible that these variables contribute to overspecification of the model, which would reduce the explanatory power of the poverty and share of African Americans variables. The results from Alternative Specification A for Models 1-5 (fully specified versions only, i.e. Models 2c, 3c, 4c, and 5c) are detailed in Appendix 3.2. After dropping variables with mild collinearity, poverty still is not statistically significant, except in Model 4, where the coefficient estimate on poverty is negative. Dropping these variables does not change the statistical significance of the variable for share of African Americans in any of the models.

Next, Alternative Specifications B and C add a variable for the share of African-American poverty. If African-American poverty was a statistically significant variable, or if adding this variable changed the significance of African-Americans population share, it would suggest that the relationship between buyouts and African American neighborhoods was specific to poor African American neighborhoods. It would suggest that poverty and race were simultaneously playing a role. Alternative Specification B added African-American poverty, and Alternative Specification C added African-American poverty and took out overall poverty. As illustrated in Appendix 3.2, adding a variable for African-Americans poverty in Alternative Specifications B and C did not change the statistical significance and direction of the main model results, nor was the new variable statistically significant, with the exception of Model 1, where the dependent variable is participation in HMGP. As a whole, the fifteen models run under these Alternative Specifications A, B, and C do not suggest that multicollinearity is a problem for the primary findings of the main models about the statistical association between the share of African-Americans and number of buyouts.

## Discussion

### *Race and segregation in buyouts*

The results demonstrate that buyouts have a racial neighborhood geography with respect to African Americans and segregation. Most evidence supports *Hypothesis 1-1: The share of African Americans in a neighborhood is associated with more buyouts*, and *Hypothesis 1-2: The level of local segregation is associated with more buyouts*. However, this racial geography likely is not explained by disparate neighborhood exposure to floodprone areas. Adding controls for flood vulnerability changed only the results of Model 3. Therefore, the evidence does not support *Hypothesis 2-1: After controlling for flood vulnerability, the association between neighborhood racial composition and buyouts is no longer statistically significant*.

The racial geography of buyouts also likely is not explained by an association of race and poverty. Before controlling for poverty, the share of African Americans is statistically significantly associated with buyouts in Model 2(a), and the high-buyout tracts in Models 3(a), 4(a) and 5(a). After adding poverty to these models, the share of African Americans loses its statistical significance in Model 5 only. Poverty alone is not a statistically significant predictor of buyouts in any of the Models 1 through 5. Therefore, moderately strong evidence points against *Hypothesis 2-2: After controlling for poverty, the association between neighborhood racial composition and buyouts is no longer statistically significant*.

Finally, the model results show that the racial geography is specific to buyouts and not to overall HMGP participation. Race and segregation were not statistically significant predictors in Model 1, which examined their association with participation in the HMGP program. The share of African Americans and segregation were only associated with buyouts in Models 2 through 5.

This finding suggests that the linkage between race, segregation, and buyouts derives from buyouts specifically, rather than the overall HMGP program implementation.

*Buyouts in a racialized landscape*

The results suggest that buyouts, despite being a race-neutral intervention, have a racialized outcome which is likely not explained by higher flood vulnerability and higher poverty rates. The models find that a concentration of African Americans in the floodplain does not explain the statistical association between buyout rates and African Americans in a neighborhood, and it is likely not explained by higher poverty rates, either. However, there are at least two other explanations, one procedural and one distributive, that may shed light on causal mechanisms.

First, buyouts are the end product of a subjective process to design and implement a buyout program, which makes room for implicit or explicit racial bias. At the outset, buyouts appear to have an objective goal: reduce vulnerability of residents by removing their residences. However, across the nation 30 million people live in a floodplain and thousands of homes lie in the floodplain in North Carolina alone (Furman Center, 2017). Many of those homes might be justified for buyouts under FEMA's cost effectiveness test, a point which buyouts scholar Siders describes in a 2018 review of eight buyout programs, writing that "decisions often involve political motivations and rely on cost-benefit logic that may promote disproportionate retreat in low-income or minority communities." Further, Greer and Brokopp Binder write, "As it stands, there is no cohesive set of best practices to guide the design and implementation of home buyout programs and to help ensure that they consistently facilitate the best possible outcomes for participating households and communities" (Greer & Brokopp Binder, 2017). The federal government does not provide any guidance about how a large number of homes should be

prioritized for hazard mitigation interventions, other than to encourage states to use a prioritization of some kind (FEMA, 1998, 2015a). Often the decision is ultimately up to local government, and it is possible that local officials who select neighborhoods or homeowners to prioritize for buyout applications employed implicit or explicit racial bias.

The lack of prioritization criteria is compounded by the nondemocratic nature of buyout decision-making. There is no requirement that a local package of buyout applications go through public review (apart from public comment during environmental review once the package of buyouts has been submitted to FEMA) despite major community impacts of a large buyout. A review of nine buyout programs finds that “the federal policies that guide the development of the programs are lenient, nearly to the point of being a blank check...This also leaves the affected communities in a vulnerable position, as there are few checks and balances in place to ensure that programs are designed to reflect community needs and interests,” (Greer & Brokopp Binder, 2017). A study of the post-Sandy New York and New Jersey buyout programs finds that “specific target areas were selected not only based on risk analysis but due to political, economic, and social factors. The selection of buyout areas and qualification of eligibility occur through political decisions at multiple government levels,” (Maly et al., 2017). This top-down process particularly raises concerns for segregated communities of color because segregation is associated with reduced political capital and poor political representation. The overabundance of segregation in areas with buyouts suggests that populations most impacted by buyouts may have the least voice in a process with major localized community development impacts. This explanation is also supported by previous research, which has found that residents of neighborhoods highly impacted by buyouts were not represented in key decisions about the buyout (Baker et al., 2018; J. C. Fraser et al., 2003).

In addition to the politicized and subjective nature of state and local decision-making about buyouts, buyouts also operate in a larger landscape shaped by investments that have political and racial origins. Capital markets have historically and continually discriminated against African American neighborhoods (Apgar & Calder, 2005; Hanson, Hawley, Martin, & Liu, 2016; Munnell, Tootell, Browne, & Eneaney, 1996; Rugh, Albright, & Massey, 2015). The lack of investment undermines economic security and leads to social problems. Therefore, residents of African American neighborhoods may have more reason to want a buyout as an opportunity to move to a different neighborhood.

If more buyouts occur in neighborhoods with more African Americans because of the social and economic benefits of relocation, buyouts may worsen inequality by solidifying conditions of disinvestment. During a buyout, equity that was held in real estate in the neighborhood is removed and placed elsewhere. Further, buyouts may disproportionately remove homeowners from a neighborhood. Homeowners in owner-occupied homes may be more interested in a buyout than landlords who want to continue profiting from their rental homes (J. C. Fraser et al., 2003). Homeownership provides greater economic and social stability to neighborhoods (Haurin, Dietz, & Weinberg, 2003; Rohe & Stewart, 1996) which could be lost through a major buyout program.

Buyouts that are concentrated in areas with more African Americans may also worsen inequality through threatening cultural recognition and continuity. Neighborhoods with greater numbers of buyouts are subject to greater disruptions of the social and natural environment, and the consequential psychological effects and diminishment of place-based group identity. These issues have come to light particularly in the case of Princeville, North Carolina, which has a unique place-based identity of independence and survival through flooding and racism. Residents

and leaders felt that accepting buyout would cause the loss of their history and legacy (B. Phillips et al., 2012). African Americans and other marginalized populations are more likely to experience permanent dislocation than groups with more power and resources (Morrow-Jones & Morrow-Jones, 1991). The concentration of buyouts in African-American communities could lead to disproportionate diminishment or loss of African-American histories, memories, and place-based identities.

## **Conclusions**

### *Recommendations for buyouts practice*

The analysis presented in this paper suggests several recommendations with respect to buyouts practice. The first recommendation is for better community representation and participation in the design and implementation of buyout programs. This recommendation is not unique to this paper or to issues of racial justice; research has documented that poor community engagement is associated with lower satisfaction with buyout programs (Baker et al., 2018). Community participation should move beyond traditional public decision-making forums, which have been shown to favor more privileged groups in society (Bent Flyvbjerg, 1991). Community empowerment requires a process in which qualified representatives of communities' stakeholders have actual decision-making power (Arnstein, 1969; Davidoff, 1965). Capacity building and leadership training can generate such representatives from the community itself. These approaches require time and funding to succeed. FEMA is in a position to fund decision-making and planning processes, or at least could recommend such approaches through their HMGP guidance (FEMA, 2015b, 2015a). States similarly could incentivize engaged decision-making processes for buyouts through obligation of state funds or through a requirement for the implementation of HMGP or other federally funded programs.



A second recommendation is to re-examine options within buyout programs to reduce negative consequences, which would reduce disproportionate distribution of burdens even if buyouts continue to be concentrated in segregated, African-American neighborhoods. One option that Native communities in Louisiana and Alaska are considering is whole community relocation. Whole community relocation may reduce some of the community-wide effects of buyouts, such as worsening disinvestment among those “left behind” by the buyout, loss of social networks, and loss of place attachment and identity. Group identity can be symbolized through the creation of a new or different built environment, but only if it is fully recognized and ingrained in the design of that place (Low, Taplin, Scheld, & Fisher, 2002). Over 20 years ago, emergency management scholars Perry and Lindell outlined insightful recommendations for relocating whole communities, with major emphasis on building community capacity, effective communication, social and personal needs of relocating households, preservation of social networks, and attention to cultural and organizational differences among minority groups (Perry & Lindell, 1997). These principles for relocation, if implemented, would permit the reduction of flood risk while minimizing community-wide losses that may be especially acute in communities of color.

Outside of whole community relocation, there are other strategies that can reduce the unintended negative consequences of buyouts, especially those likely to disproportionately affect African American communities. For example, buyout land can become a community amenity like a park or natural recreation and education area. It can also house a historic marker or other reflection of the site’s history. Homeownership programs and other wealth development activities can target areas within and around buyout sites, to reduce the likelihood that the buyout will spur further disinvestment. Buyout programs could also address economic stability and

homeownership through incorporating these objectives into program design. Achieving these outcomes requires planning and financial and political commitments which are not currently incentivized by HMGP. Despite this, federal and state officials are in a position to incentivize, fund, and/or require additional planning and investment in concert with buyouts.

Pre-disaster planning and programming is one way in which community engagement can be improved, alternative or complimentary solutions can be explored that might reduce disproportionate burden of buyouts in African American or other marginalized communities. Pre-disaster planning can help state and local governments achieve hazard mitigation goals through buyouts while taking into account holistic community development goals (Boyd et al., 2014; G. Smith, 2014c). Without the time pressure of the disaster recovery, more creative options may be explored, which ultimately positions communities to advocate for those solutions should a disaster occur. Capacity building programs that build the ability of marginalized populations to take part in decision-making, and equally important, that build the ability of the government to incorporate participation from diverse stakeholders, have more time to succeed if implemented before disaster.

A final recommendation is for the development of education and outreach materials that more adequately represent unintended consequences, racial justice issues, and strategies to overcome both. There is a growing grey literature that champions buyouts as a resilience strategy aimed at local decisionmakers and the lay public, e.g. (Freudenberg et al., 2016; e.g. NOAA, 2017). This literature should more fully engage social justice issues and lay out recommendations for reducing unintended consequences of buyouts. This grey literature has been authored by organizations with land and natural resources missions; those organizations might consider authoring future publications on buyouts and managed retreat in partnership with

organizations that have racial justice missions like the NAACP or organizations with community engagement expertise. In addition, a robust education and outreach program aimed at community members can generate more community-level awareness about potential benefits and burdens of buyouts, which will help them advocate for strategic investments in their community that reduce negative consequences.

### *Research recommendations*

There is a need for more research on race, social justice, and buyouts or other managed retreat strategies. North Carolina bears topographical, demographic, and development patterns similar to other southeastern states, which lends external validity to this study. Repeating this study in a region of the nation with significantly different social and environmental landscapes may yield different results. To achieve this research goal, improved data are needed. FEMA or another institution should collect standardized data on buyouts for use in research. Even basic data about where buyout participants move is largely lacking (McGhee, 2017). Longitudinal research will better capture the effects of buyouts for people and for places. In addition, a greater understanding of the relationship between buyouts and community context, such as racial and socioeconomic characteristics, will help buyouts researchers and practitioners interpret the racial geography of buyouts. For example, buyouts may generate different types of benefits for surrounding neighbors in high-wealth areas than in low-wealth areas. Comparative case research could provide greater insight on how the socioeconomic, cultural, and environmental features of a place affect the outcomes of buyouts.

Finally, climate adaptation in the United States has focused primarily on reducing physical vulnerability, but the field has not as thoroughly addressed reduction in social vulnerability. This gap is particularly concerning from a social justice perspective because

inequality is a major social vulnerability driver. By focusing just on the reduction of physical vulnerability, the resilience field misses the opportunity to address inequalities that increase social vulnerability and likely affect the distribution of physical vulnerability as well. Buyouts are a critical tool for reducing flood risk in vulnerable areas, but without attending to their consequences for racial justice, they risk worsening inequality.

This paper has demonstrated that buyouts in North Carolina have a particular racial geography. They are concentrated in African American neighborhoods in counties with high levels of segregation. The statistical association between race, segregation, and buyouts is not explained by the correlation between race and poverty, nor by a concentration of African Americans in locations vulnerable to flood. This racial geography may result from subjective buyout processes that make room for implicit or explicit racial bias through politicized decision-making. Or, historic disinvestments may make residents of African American neighborhoods more interested moving out, and therefore interested in taking buyouts. It is critical to improve engagement and transparency in buyout decision-making, and to take action to mitigate unintended consequences or disproportionate burden experienced by African American communities where buyouts take place.

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## CHAPTER FOUR. THE ROLE OF POST-DISASTER BUYOUTS IN NEIGHBORHOOD CHANGE: A 20-YEAR ANALYSIS OF NORTH CAROLINA

### **Introduction**

Local and state governments use residential buyouts to mitigate flood risk. In a typical home buyout, the government purchases a property from a private homeowner located in an area at high risk of flooding. The government takes ownership of the property, demolishes the built structure, and ensures that the parcel remains open space in perpetuity. As a result, the buyout permanently eliminates the exposure of the improved property to floodwaters. The increasing popularity of buyouts as a flood mitigation tool coincides with an increase in flooding due to development pressures and climate change (Fleming et al., 2018; Hirsch & Archfield, 2015; Klotzbach et al., 2018; Mileti, 1999; Slater & Villarini, 2016). The process of moving development out of high-risk areas, especially those at facing greater risk due to climate change, is termed “managed retreat” (Agyeman et al., 2009; Hino et al., 2017; Siders, n.d.).

Buyouts are intended to mitigate hazards for an individual property, but they can have larger collective effects as well. For one, they reduce the exposure of the public sector to the expenses of flood response and recovery and can provide a last-resort option for communities with many households that are struggling to recover from flooding (Aronoff, 2017; BenDor, Salvesen, Kamrath, & Ganser, 2018; Freudenberg et al., 2016; Godschalk, Rose, Mittler, Porter, & West, 2009; Tate et al., 2015). Buyouts may also affect neighbors and towns in the long term in other ways. Town officials are often worried about loss of their tax base from out-migration or loss of valuable real estate (Freudenberg et al., 2016; Lewis, 2012; Maly & Ishikawa, 2013;

McCann, 2006). An additional concern is whether buyouts generate a disinvestment effect in the places where they occur (Freudenberg et al., 2016). By demolishing housing, buyouts remove capital investments from a particular place, strategically disinvesting in built assets (G. Smith, 2014b). Historically, in the neighborhood development context, disinvestment of built capital from a neighborhood has been associated with racially concentrated poverty, crime, and decline in housing quality, neighborhood amenities, and municipal services (Raleigh & Galster, 2015; N. Smith, Caris, & Wyly, 2001; Wyly & Hammel, 1999). For this reason, it is important to track whether buyouts, a critical tool for flood hazard mitigation, might have unintended long-term effects at the neighborhood scale. Despite the growing popularity of buyouts, researchers have only begun to understand long-term effects (Zavar, 2015b; Zavar & Hagelman, 2016). For this reason, decision-makers are implementing buyouts without a holistic understanding of their potential long-term impact on local communities.

The present research study aims to address this gap in the research by looking at the effect of buyouts on neighborhood change. I examine neighborhood change in places with buyouts, and because buyouts necessitate migration, I also look at neighborhood change in places *near* buyouts, where spillover effects might occur. Specifically, I ask whether buyouts are associated with change in neighborhood housing stock and the racial mix of neighborhood's residents, two conditions that affect the impact of neighborhoods on residents' lives (Chetty et al., 2014; Flippen, 2004; Massey & Denton, 1993; Squires & Kubrin, 2006; Yen & Kaplan, 1999). Using data from the State of North Carolina, where 4,800 buyouts were implemented after hurricanes in 1996 and 1999, the findings suggest that buyouts are associated with a process of disinvestment and white flight. For each house that received a buyout, there was an average loss of 1.5 housing units in the neighborhood, after controlling for owner-occupancy rates, racial

composition, and region of the state among other factors. Racial effects were most pronounced in spillover neighborhoods near buyouts. Adjacency to a high-buyout neighborhood was associated with growth in the share of Black residents and decline in the share of White residents. These findings are consistent with the theory that buyouts are associated with disinvestment, out-migration, and white flight.

The paper proceeds as follows: In the following section, I review major theories of neighborhood change and explain why they might apply to the buyouts context. Next, I introduce more thoroughly buyout policy and North Carolina's recent disaster history. In the following sections, I explain my methods and data sources. In the findings section, I review descriptive statistics about neighborhood change in areas with buyouts, and present the modeling results. The modeling results are broken into two sections: first, the results that pertain to change in the neighborhoods where buyouts occur; these are termed "direct effects." The second section of the results pertains to changes in neighborhoods surrounding buyouts; these are termed "spillover effects." After discussing the results, I provide several implications for buyouts practice and research.

### **Neighborhood Change Theory**

Neighborhoods are spatially bounded places, smaller than cities, which share social ties (Schwirian, 1983). The characteristics of neighborhoods are not limited to urban areas; neighborhoods can also refer to suburban and rural nodes of population (National Geographic, 2019). *Neighborhood change* refers to transition in the socioeconomic characteristics and physical conditions of the neighborhood (Schulze Bäing, 2014; Temkin & Rohe, 1996). Patterns of neighborhood change matter because neighborhoods affect residents' health (Katz, Kling, & Liebman, 2001; Sampson, Morenoff, & Gannon-Rowley, 2002), education (Ainsworth, 2002;



Garner & Raudenbush, 1991; Harding, 2003), employment status (Anil et al., 2010; Massey & Denton, 1993; Wilson, 1996), and intergenerational economic mobility (Chetty et al., 2014). The way in which neighborhoods change – both in terms of their conditions and their residents – affect the distribution of opportunities and life conditions in the general population.

Sociologists at the University of Chicago in the 1920s and 1930s developed the earliest theories of neighborhood change. Ernest Burgess' 1925 model of the city featured concentric zones, ranging from “socially excluded” near the central business district to “stable low-income” to “wealthy.” As new immigrants arrived, ethnic groups moved through the concentric zones of status through a pattern that Burgess compared to ecological invasion and succession (Burgess, 1925). Burgess' work influenced a large body of neighborhood change models which became known as “ecological models.” Ecological models explained neighborhood change as the product of external economic forces that act on people and places. Through the twentieth century, ecological approaches provided influential, if controversial, explanations of many neighborhood change phenomena (Downs, 1981; Duncan & Duncan, 1957; Hoover & Vernon, 1959; Lowry, 1960; Muth, 1985).

Two particularly impactful theories that grew from ecological theories are “filtering” and “tipping.” Filtering is an early theory of the Chicago School, which holds that as long as cities grew, upwardly mobile households would move into newer housing, leaving older housing to become affordable to other populations – often residents of color – as it deteriorated in value (Fisher & Winnick, 1951; Hoyt, 1933). This theory of neighborhood “succession” provides a supply-side explanation for the provision of affordable housing as well as neighborhood decline and its racial connotations (Temkin & Rohe, 1996). In 1971, Thomas Shelling introduced a related, demand-side explanation known as “tipping,” in which he explained that household

migration decisions depend on their socio-demographic preferences for neighbors. When racial minorities move into a neighborhood, the White residents tolerate their presence to a particular “tipping point,” at which white residents leave *en masse*, also known as white flight (Card et al., 2007; Schelling, 1971). Small demographic changes, such as in-migration of a small number of minorities, can create major demographic change in a neighborhood. Real estate agents may steer minority residents into racially mixed areas at the edge of white neighborhoods to prompt the tipping effect (Galster, 1990).

Almost immediately after the emergence of ecological theories, scholars took issue with the assumption that neighborhood change could be explained entirely by larger social and economic forces. These researchers, who came to be known as subculturalists, argued that specific cultures within a city, called “subcultures,” drive neighborhood development (Firey, 1945; Fischer, 1975). Today, researchers find that internal, neighborhood-level drivers like culture, leadership, and local institutions affect neighborhood change (Saldivar-Tanaka & Krasny, 2004; Stoecker, 1994). This research challenges the assumption that whiter neighborhoods or wealthier neighborhoods are necessarily more desirable by demonstrating that poor neighborhoods and neighborhoods of ethnic minorities offer unique amenities like social networks, which are particularly important to poor residents (Gans, 1962; Logan, Zhang, & Alba, 1975). Related work has demonstrated how residents’ attachment to their neighborhoods affects their decisions about where to live, including the context of disaster and climate change (Agyeman et al., 2009; Curley, 2010; Lewicka, 2010; Manzo, 2003; Manzo, Kleit, & Couch, 2008).

Another field of neighborhood change literature based in political economy emerged in the second half of the twentieth century. The political economy perspective argued that the

investment of capital in cities did not simply rely on the rules of economics but was driven by the allied interests of a small number of land-holding elites (Castells, 1977; Lefebvre, 1974; Logan & Molotch, 1987). These scholars also critiqued ecological models for their on the assumption that neighborhood change is determined by the social status of in- and out-migrants. They argued that patterns of investment and disinvestment in the capital stock of neighborhoods drove neighborhood socioeconomic conditions (N. Smith et al., 2001; Stone, 1993).

Political economists and subculturalists have particularly critiqued ecological models' treatment of race. Scholars of race in the United States have long recognized that segregation limits the life opportunities of Black and other minority residents (Jargowsky, 1996; Massey & Denton, 1993; Wilson, 1987). The social, health, and economic benefits of living in a neighborhood of higher wealth or status are collectively termed "locational attainment" (Logan, Alba, McNulty, & Fisher, 1996), which captures the linkage between socioeconomic status and neighborhood, and the benefits denied by systemic barriers to minority in-migration. Ecological theorists argued that as the economic status of racial and ethnic minorities improved, they would assimilate into whiter and wealthier neighborhoods (Park, Burgess, & McKenzie, 1925). This theory is known as "spatial assimilation," and there is some modern research that suggests that spatial assimilation occurs, particularly in non-Black immigrant populations (Scopilliti & Iceland, 2008). However, most evidence suggests that systems of racial segmentation, from redlining to real estate steering, limits the movement of minorities, especially Black households, into White neighborhoods (Charles, 2003; Massey, 1985). This phenomenon is termed "place segmentation," to set it apart from the theory of spatial assimilation (Charles, 2003). For example, while "tipping" may describe the individual behaviors of White residents, it does not

consider other systemic drivers of segregation and white flight captured by place segmentation, such as redlining and discriminatory real estate practices.

In recent decades, many scholars such as Grigsby et al. (1987) and Temkin and Rohe (1996) have acknowledged the evidence that economic, cultural, *and* political drivers shape neighborhoods. Given this synthetic understanding, the hypothesis in this paper, that buyouts affect neighborhood change, builds on multiple theories of neighborhood change. A common theme among multiple theories of neighborhood change is the motivations and outcomes of households' locational decision-making. This locational decision-making is a core component of the buyout process: As part of a buyout, households must affirmatively decide to move. Therefore, the idea that a large group of households are making decisions about where to live suggests that buyouts may trigger neighborhood change – both in the place where buyouts occur but also in the place to which participants move. In addition, buyouts may affect neighborhood change through strategic disinvestment that affects a neighborhood's capital stock, a key element of political economists' understanding of neighborhood change. Finally, the concept of “place attachment” is a recurrent theme in research on post-disaster buyouts, which has demonstrated that degree of place attachment affects buyout uptake by individual homeowners.

The hypothesis that buyouts affect neighborhood development conditions is also supported by field work conducted for Chapter Two. This field work found that buyouts advanced disinvestment in the Kinston neighborhood of Lincoln City, removing homeownership households and leaving behind a dumping ground around which homes became dilapidated. In addition, in the interview data, one person suggested that buyouts contributed to white flight in Kinston. According to this person, buyout participants, mostly black, had moved out of one heavily bought-out neighborhood into other neighborhoods in the city. White residents

responded by moving out of the city entirely. Both the results from the case study and multiple theories of neighborhood change support the hypothesis that buyouts could trigger neighborhood change.

### **Buyouts and North Carolina Disaster History**

Buyouts have served a prominent role in the hazard mitigation portfolio pursued by the State of North Carolina in recent decades. The goal of buyouts is to reduce exposure to disaster through permanently removing development. Hazard mitigation interventions that rely on land use, like buyouts, which are more fail-safe and flexible than large-scale infrastructure protection, and may be less expensive (Burby et al., 1999; Godschalk, 2003). The first federally funded buyouts occurred in the late 1970s in Soldier's Grove, Wisconsin, where local leaders wanted to move its downtown a few blocks away from the river instead of building a large-scale flood control project which had been proposed (David & Mayer, 1984; Tobin & Peacock, 1982). The Stafford Act of 1988, which guides FEMA's involvement in all phases of disaster, codified funding sources for buyouts through establishing multiple programs that aim to reduce natural hazard risk. Of these FEMA programs, the largest is the Hazard Mitigation Grant Program (HMGP). HMGP funded the approximately 4,800 buyouts in North Carolina which provide the basis for the study.

The goal of HMGP is to allow disaster-stricken areas to mitigate future disasters while they build back (FEMA, 2015a). HMGP is triggered by a Presidential disaster declaration. HMGP funding levels are determined through a formula that roughly correlates to the severity of the disaster, which means that larger disasters usually get more HMGP funding. HMGP does not provide direct funding to private property owners; instead, it funds mitigation programs that are administered by state, local, or tribal governments or nonprofits. These entities must spend the

dollars on projects that reduce disaster risk, but may choose from an array of eligible activities. Home elevations, other structural retrofits, generators, planning, as well as buyouts are all examples of activities eligible for funding under HMGP.

FEMA stipulates certain requirements for buyout programs that HMGP funds. The government or nonprofit which makes the buyout acquisition must offer market value for the home, although it can be either pre-flood market value or post-flood market value (FEMA, 2015b). After the home is acquired, it must be demolished and the property, now owned by the government or nonprofit administrator, must be maintained as open space in perpetuity (FEMA, 2015a, 2015b). Through this stipulation, FEMA ensures that buyouts are a permanent reduction in the flood vulnerability of parcel.

Despite the growing popularity of buyouts, there is not a lot of research on their long-term effects on places where they are implemented. The most common land use on buyout parcels is vacant lot, followed by recreational uses like park land (Zavar & Hagelman, 2016). One study of Lexington, Kentucky, found that where buyout land was used for recreational uses, a majority of neighbors perceived the land as a neighborhood amenity (Zavar, 2015a). In a survey of buyout participants from four cities, including two in North Carolina, respondents reported that their new neighborhoods had lower crime but were further from friends and family, employment, transportation, and shopping (J. C. Fraser et al., 2003). There is also anecdotal evidence that North Carolina's buyouts reduced the stock of unsubsidized housing affordable to lower income households (J. C. Fraser et al., 2003; G. Smith, 2014a). These studies collectively support the theory that buyouts affect the community and the participants in ways that extend beyond flood risk mitigation, through the change in land use from residential to open space as well as through relocation. The present study aims to add greater breadth to these findings by

using an entire state dataset of HMGP buyouts and by specifically looking at neighborhood change in and around places with buyouts.

North Carolina was an early adopter of large-scale buyouts using HMGP funding, which makes it an ideal location to examine the role of buyouts in long-term neighborhood change. North Carolina experienced two major hurricanes in the second half of the 1990s. After Hurricane Fran struck in 1996, the state used HMGP funding to mitigate future damages on 1,765 homes, including elevating 512 homes and buying out 1,253 others (North Carolina Emergency Management, 2016). Just three years later, Hurricane Floyd devastated eastern North Carolina, and the state funded the buyout of another 3,057 homes with HMGP funding. After both hurricanes, North Carolina incentivized uptake of buyouts through innovative programmatic decisions. Homes were purchased for pre-flood market value, as opposed to post-flood value, to increase the amount that households would receive. This is typical in HMGP but it is not required by all buyout programs run by FEMA (FEMA, 2015b). In addition, the Floyd-specific North Carolina State Acquisition and Relocation Fund (SARF) offered additional funding so that buyout households could afford equivalent housing elsewhere (McCann, 2006). This funding source was critical because the value of homes of buyout participants was relatively low. For example, in Kinston, North Carolina, where 800 buyouts occurred, the average pre-flood market value of a buyout home was \$26,000 (\$41,000 in 2019 dollars) (City of Kinston, 2001). This practice is not always used but it is becoming more common, and it is often used to incentivize local relocation (Baker et al., 2018; Greer & Brokopp Binder, 2017). Finally, the State of North Carolina chose to put all of its post-Floyd HMGP funding for residences toward buyouts, not elevations (North Carolina Emergency Management, 2016). Each of these practices likely increased the rate of participation in buyouts.

Since Floyd, North Carolina has endured several flooding events, notably Hurricane Matthew in 2016 and Hurricane Florence in 2018, which flooded land that had been bought out nearly twenty years prior in several towns. While the state is currently administering buyouts with funds from the Matthew and Florence recoveries, these buyouts are too recent to be included in this study on long-term neighborhood change.

## **Methods and Data**

### *Integrating spatial effects in multivariate regression*

To examine the effect of buyouts on neighborhood change, I use a spatial autoregressive model based on ordinary least squares (OLS) regression. Spatial regression starts with the assumption that what happens in one place may affect nearby places. Capturing the effect of this “spatial dependence” is the objective of spatial regression. In this case, I am interested how neighborhood change, the dependent variable, is different when buyouts occur in the neighborhood or in adjacent neighborhood. The effect of buyouts on neighborhood change in the neighborhood where they occur is called the “direct effect,” while the effect of buyouts in nearby neighborhoods on neighborhood change is called the “spillover effect” or the “indirect effect” (LeSage & Pace, 2009). Including spatial proximity, or a spatial lag, as part of the independent variable, generates a spatial cross-regressive model (Anselin, 2002). The general model includes a spatially-lagged and a non-spatially lagged term for the buyouts to capture both direct effects and indirect effects. It is specified in general form as follows:

$$y_i = X_i\beta_1 + WX_j\beta_2 + Z_i\beta_3 + \varepsilon,$$

Where:

$y_i$  is the dependent variable of interest representing neighborhood change in neighborhood  $i$



- $X_i$  is the first key independent variable, frequency of buyouts in neighborhood  $i$
- $X_j$  is the second key independent variable, frequency of buyouts in other neighborhoods  $j$
- $W$  is the spatial lag, which indicates the spatial relationship between neighborhood  $i$  and each neighborhood  $j$ , such that the terms  $WX_i$  together generate an average of  $X$  in neighborhoods contiguous to neighborhood  $i$
- $Z$  is a vector of control variables in neighborhood  $i$

The coefficient of interest is represented by  $\beta_1$ , the coefficient on the buyout frequency in neighborhood  $i$ , and  $\beta_2$ , the coefficient on the buyout frequency in the neighborhoods contiguous to neighborhood  $i$ . The null hypothesis is that there is no effect of buyouts on neighborhoods; the alternative hypothesis is that there is an effect:

$$H_0: \beta = 0$$

$$H_A: \beta \neq 0$$

#### *Data*

To analyze the effect of buyouts on neighborhood change, I use administrative and publicly available data. These data are aggregated to the block group level (n=6,095). The 2010 Census block group geography is used. Data sources by variable type are summarized in Table 9. Data on buyouts come from North Carolina Emergency Management, which maintains a database of all projects funded by the Hazard Mitigation Grant Program from 1996 to present. This dataset includes all buyouts that occurred with HMGP funding due to disaster declarations 1996 to 2006. Ninety-three percent of these buyouts occurred with funding from Hurricanes Fran and Floyd in 1996 and 1999, respectively. These data were geocoded using ESRI software and cross-referenced with Google Maps and county tax records.

Table 9. Variables and Data Sources on Buyouts and Neighborhood Change	
Variable	Source
<b>KEY INDEPENDENT VARIABLES: BUYOUTS</b>	
Number of Buyouts (continuous)	State of North Carolina
High Buyout Block Group (binary)	State of North Carolina
<b>DEPENDENT VARIABLES</b>	
Neighborhood Change - Housing	
Change in Housing Units, 1990-2010	Census 1990, 2010
Housing Units Built After 2005	Census 2010
Change in Vacant Housing Units, 1990-2010	Census 1990, 2010
Neighborhood Change - Racial Mix	
Change in Percent White, 1990-2010	Census 1990, 2010
Change in Percent Black, 1990-2010	Census 1990, 2010
Change in Percent Native American, 1990-2010	Census 1990, 2010
Change in Percent Hispanic/Latino, 1990-2010	Census 1990, 2010
<b>CONTROL VARIABLES</b>	
Region of North Carolina	University of North Carolina Libraries
Percent White, 1990	Census 1990
Percent Black, 1990	Census 1990
Percent Native American, 1990	Census 1990
Percent Hispanic/Latino, 1990	Census 1990
Percent Owner-Occupied, 1990	Census 1990
Percent Housing Units Occupied, 1990	Census 1990
Percent Housing Units in Urbanized Area, 1990	Census 1990
Percent Residents Age 65 and Older, 1990	Census 1990
Block Group Population, 1990	Census 1990
Houses Built in 1980s	Census 2010
Houses Built in 1950s	Census 2010
Houses Built before 1939	Census 2010
Land area (100,000 sq. meters)	Census 2010

Two measures of buyouts are used as independent variables. The first is a count of buyouts in each tract. Using a count of the buyouts allows for analysis of the average marginal effect of each additional buyout, which is helpful for assessing the magnitude of the impact especially on other counts, such as housing units. The second measure of buyouts is a binary indicator of a high-buyout neighborhood, in which the number of buyouts is greater than 17, which is the mean number of buyouts in all block groups plus two standard deviations. By capturing neighborhoods that meet this threshold, this binary indicator allows for the exploration of patterns or effects that could be more sensitive to concentrated areas of buyouts.

Neighborhood change, the dependent variable, can be measured in a variety of ways. Common metrics used to track neighborhood change in the research literature include

characteristics of the physical housing stock, racial diversity, and economic status. For this paper, I select two of these general characteristics, housing and racial mix. It is important to include housing stock variables because buyouts eliminate housing units, but it is not known how the housing stock, such as vacancies and new construction, might change in response to buyouts. To examine housing change, I use four variables: change in number of total housing units, change in vacant housing units, and number of new housing units built after Floyd and Fran, using both 2000-2010 and 2005-2010 as measures. Racial mix is also a logical measure of neighborhood change when discussing buyouts because Chapter Three found that buyouts in North Carolina were more common in Black neighborhoods, even when controlling for floodplain exposure and poverty. For change in racial mix, I use percent African American, percent White, percent Latino of any race, and percent Native American.<sup>9</sup> All of the dependent variable data come from the Census. These data were interpolated from previous Census to 2010 Census geography by the Longitudinal Tract Database at Brown University (Logan et al., 2014).

The period of neighborhood change is defined as the twenty-year period between 1990 and 2010. The years 1990 and 2010 represent the closest decennial censuses to track change from a pre-buyout period to a post-buyout period. Even though the later hurricane, Floyd, occurred in 1999, the process of administering buyouts can take several years. Therefore, the year 2000 is not a clear pre-buyout or a post-buyout period. Block group data are not available for much of North Carolina prior to 1990, which was the first year in which the entire county had

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<sup>9</sup> Major Census racial categories excluded from this analysis include Asian and Native Hawaiian and Other Pacific Islander. Asians are a growing segment of North Carolina's population, but they represented a very small fraction in 1990 and the Asian population is concentrated in the central and more urban areas of the state, which is not where most buyouts occurred. Only one-tenth of one percent of North Carolina's population is Native Hawaiian and Other Pacific Islander (U.S. Census Bureau, 2018).

tracts and block groups. This is especially true in rural areas, where many of the buyouts are located. Control variables are used to minimize impact of self-selection, where buyouts occur in places pre-disposed to neighborhood change. These control variables include percent urbanized, land area of block group (land area gives a general but not perfect reflection of development density), age of the housing stock, region of the state, percent senior citizens, and percent of different racial groups.

#### *Regional concentration of buyouts*

Buyouts are found across the entire state of North Carolina but they are concentrated in Eastern North Carolina. Seventy-seven percent of the block groups with buyouts are located in Eastern North Carolina, and 60 out of 65 high-buyout block groups in the state are located in this region (see Table 10). Therefore, regional development patterns specific to Eastern North Carolina could confound the association between buyouts and neighborhood change. To address this problem, I use region as a variable in two different ways, both designed to eliminate potential confounding. First, I use region as a control variable. Second, I run the same model specification but including only the block groups located in the Eastern region of North Carolina. Regions were defined as the Eastern Plains, Central Piedmont, and Western Mountains according to a reference map published by the North Carolina Maps Collection by the University of North Carolina (UNC Libraries, 2019).

Table 10. Regional Differences in Buyouts				
Region	Total Block Groups		Block Groups w/ Buyouts	
	Number	Percent of Total	Number	Percent of Total
Western	988	16%	39	10%
Central	3,344	54%	52	13%
Eastern	1,823	30%	298	77%
Total	6,155	100%	389	100%

## **Findings**

### *Descriptive Statistics*

This analysis includes 6,095 block groups, which excludes block groups with zero population. Table 11 provides descriptive statistics, including differences across three groups of observations: (1) the entire dataset, (2) block groups with at least one buyout, and (3) high-buyout block groups. The mean number of buyouts per block group is less than one, but the range is 0 to 337, which reflects spatial clustering of buyouts in certain neighborhoods. Only 65 block groups, one percent of the statewide total, are “high buyout block groups” (defined as >17 buyouts). These high buyout block groups have an average of 53 buyouts.

Areas with buyouts have distinct patterns of development and racial mix. For example, places with buyouts have higher shares of Black residents and lower shares of White residents, a pattern which is consistent and pronounced in the high-buyout neighborhoods. High-buyout block groups are 58 percent White and 41 percent Black on average, compared with 78 percent and 20 percent, respectively, statewide. Two characteristics, land area and percent urbanized, set high-buyout block groups apart from all block groups with at least one buyout. High-buyout block groups are smaller and more urban than all block groups with any buyouts, despite having similar population counts. This suggests that high-buyout block groups are in more urban neighborhoods while other block groups with buyouts tend to be in more rural areas. High-buyout block groups had much lower growth in housing between 1990 and 2010, 65 units versus 172 units for all block groups with buyouts and 248 average statewide. While one might attribute that lower growth to the removal of housing in buyouts, high-buyout block groups also saw the least new construction of housing units between 2000 and 2010 and especially between 2005 and

2010. Some characteristics are more balanced among the three groups of observations, including the average rate of occupied housing, the proportion of seniors, and the proportion of Latinos and Native Americans.

Table 11. Selected Characteristics for (1) All Block Groups, (2) Block Groups with at Least One Buyout, and (3) High-Buyout Block Groups

	(1) All Block Groups *	Mean (2) Block Groups with >0 Buyouts	(3) High Buyout Block Groups	Min All Block Groups	Max All Block Groups
Number of buyouts in BG	0.77	12	53	0	337
High-Buyout Block Group	0.01	0.17	1.00	0	1
Population **	1082	1283	1338	1	9719
Land Area (100,000 sq. meters)	204	394	269	1	7837
Housing Units	462	546	555	1	2874
Vacant Housing Units	49	56	45	0	2264
Proportion White	0.78	0.66	0.58	0	1
Proportion Black	0.20	0.32	0.41	0	1
Proportion Latino	0.01	0.01	0.01	0	0.25
Proportion Native American	0.01	0.01	0.01	0	0.97
Proportion Seniors	0.13	0.13	0.13	0	0.87
Proportion Owner-Occupied HU	0.70	0.67	0.64	0	1
Proportion HUs Occupied	0.90	0.90	0.92	0.07	1
Proportion HUs in Urban Area	0.64	0.53	0.68	0	1
County Growth '80-'90	0.35	0.27	0.22	-0.13	2.25
Region = Western	0.16	0.10	0.05	0	1
Region = Central	0.55	0.13	0.03	0	1
Region = Eastern	0.29	0.77	0.92	0	1
Change in Housing Units 1990-2010	248	172	65	-887	3442
Change in Vacant Housing Units 1990-2010	46	39	29	-225	1558
Housing Built 2000-2010	110	94	74	0	2436
Housing Built 2005-2010	38	30	16	0	824
Change in Proportion White, 1990-2010	-0.09	-0.08	-0.11	-1	0.91
Change in Proportion Black, 1990-2010	0.02	0.02	0.06	-0.92	1
Change in Proportion Latino, 1990-2010	0.07	0.06	0.06	-0.15	0.81
Change in Proportion Native American, 1990-2010	0.00	0.00	0.00	-0.29	0.12
<i>n</i>	6,095	389	65		

\* Block groups with zero population are excluded from the analysis

\*\* All data are from 1990 unless otherwise specified

### *Direct Effects*

The results find that buyouts are negatively associated with housing unit change. Table 12 presents the results from spatial autoregressive models which examine the association between buyouts, the independent variable, and 20-year change in housing units, the dependent variable. Across the entire state, the average marginal effect associated with each additional buyout is a loss of 1.5 housing units in the same block group (the direct effect). This average loss increases to 1.7 units when including just block groups in the Eastern region of the state. These

findings are statistically significant ( $p < 0.01$ ). These average marginal effects for the state and the Eastern region are larger than 1:1 ratio of buyouts-to-housing loss that would be expected if housing removal was caused only by households that participated in the buyout. These effects hold after controlling for other predictors of housing change, such as the degree of urbanization in the neighborhood, the age of housing units, the share of seniors in the neighborhood, and the share of homeowners. These and all other control variables are also shown in Table 12.

Table 12. Regression Results: Buyouts and Change in Number of Housing Units, 1990-2010				
	Entire State	Eastern Plains	Entire State	Eastern Plains
DIRECT EFFECT				
Number of Buyouts	-1.505*** (0.487)	-1.653*** (0.486)		
High-Buyout Block Group			-85.52** (36.90)	-92.25** (38.32)
SPILLOVER EFFECT				
Number of Buyouts	-0.0388 (0.990)	-0.0297 (0.987)		
High-Buyout Block Group			-33.64 (74.79)	-38.33 (76.70)
CONTROL VARIABLES				
Proportion White	1,291*** (249.4)	1,378* (820.3)	1,289*** (249.5)	1,312 (821.3)
Proportion Black	1,226*** (248.1)	1,255 (818.8)	1,223*** (248.2)	1,186 (819.8)
Proportion Latino	1,208*** (343.2)	343.7 (772.6)	1,201*** (343.8)	287.2 (774.3)
Proportion Native American	1,290*** (253.8)	1,252 (818.2)	1,287*** (253.9)	1,185 (819.2)
Proportion Seniors	-498.9*** (58.66)	-896.8*** (123.0)	-499.8*** (58.68)	-899.6*** (123.2)
Proportion Owner-Occupied HU	297.3*** (21.37)	263.9*** (43.54)	297.5*** (21.38)	265.1*** (43.67)
Proportion HUs Occupied	-233.4*** (35.07)	-123.9*** (47.79)	-231.5*** (35.14)	-119.7** (47.95)
Proportion HUs in Urban Area	119.5*** (10.59)	78.23*** (18.37)	119.6*** (10.60)	78.09*** (18.41)
Block Group Population	-0.142*** (0.00839)	-0.0878*** (0.0129)	-0.142*** (0.00839)	-0.0894*** (0.0129)
Land Area (100,000 sq meters)	0.0667*** (0.0107)	0.0262* (0.0135)	0.0671*** (0.0107)	0.0268** (0.0135)
Housing Units Built in 1980s (2010)	0.815*** (0.0443)	1.081*** (0.0848)	0.815*** (0.0443)	1.077*** (0.0849)
Housing Units Built in 1950s (2010)	-0.508*** (0.0788)	-0.554*** (0.154)	-0.508*** (0.0788)	-0.555*** (0.154)
Housing Units Built Before 1939 (2010)	-0.236*** (0.0802)	-0.210 (0.166)	-0.232*** (0.0802)	-0.203 (0.166)
Region (Western = reference)				
Central	34.83*** (10.54)		34.78*** (10.54)	
Eastern	23.03** (11.70)		23.70** (11.79)	
Constant	-973.9*** (250.0)	-1,079 (823.5)	-972.9*** (250.1)	-1,014 (824.5)
Observations	6,096	1,780	6,096	1,780
Pseudo R-square	0.246	0.290	0.246	0.287

Standard errors in parentheses  
\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

For neighborhoods with concentrations of buyouts, the results were similar. High-buyout block groups are associated with a statistically significant loss in housing units ( $p < 0.05$ ). The average differential effect associated with being a high-buyout neighborhood, in comparison to all other neighborhoods, is 86 fewer housing units in the 20-year change. This number rises to 92 fewer units when including just the Eastern region. Statewide, high-buyout block groups had an average of 53 buyouts (Table 11), so again, the estimated magnitude of the effect on housing units is greater than could be explained by buyout demolitions alone.

For the most part, buyouts are not associated with other statistically significant changes in the composition of the housing stock, including change in the number of vacant units and new constructions in the years 2000-2010 or 2005-2010. The one exception is high-buyout neighborhoods in Eastern North Carolina, which are negatively associated with new constructions between 2005 and 2010, but this is only weakly statistically significant ( $p < 0.10$ ). This holds across both the continuous count of buyouts and the binary indicator of a high-buyout neighborhood. These results are summarized in Appendix 4.1, Tables 14-15.

There is mixed evidence that, within a given neighborhood, buyouts are associated with an increase in the share of Blacks and a decrease in the share of Whites. Table 13 explores the association of buyouts with change in racial mix. High buyout neighborhoods were associated with an increase of 3.0 percentage points in the share of Blacks across the entire state ( $p < 0.05$ ). In the Eastern Plains, a similar magnitude of association was found between high buyout block groups and increase in the share of Blacks, but the statistical significance is only at the  $p < 0.1$  level. High buyout neighborhoods in Eastern North Carolina were associated with a decrease of



3.1 percentage points in the share of whites ( $p < 0.05$ ). None of the models show a statistically significant change associated with the continuous buyout variable, which suggests that effects are more prominent in areas of concentrated buyouts. Buyouts do not have a statistically significant association with change in the share of Latinos or Native Americans (see modeling results in Appendix 4.1, Tables A4-A5)

Table 13. Buyouts and Change in Racial Mix

VARIABLES	Change in Proportion Black				Change in Proportion White			
	Entire State	Eastern Plains	Entire State	Eastern Plains	Entire State	Eastern Plains	Entire State	Eastern Plains
<b>DIRECT EFFECTS</b>								
Number of Buyouts	0.000184 (0.000197)	0.000156 (0.000190)			-0.000228 (0.000225)	-0.000245 (0.000196)		
High-Buyout Block Group			0.0298** (0.0149)	0.0291* (0.0149)			-0.0278 (0.0170)	-0.0305** (0.0154)
<b>SPILLOVER EFFECTS</b>								
Number of Buyouts	0.00183*** (0.000401)	0.00162*** (0.000386)			-0.00147*** (0.000457)	-0.00141*** (0.000398)		
High-Buyout Block Group			0.153*** (0.0303)	0.133*** (0.0299)			-0.135*** (0.0345)	-0.129*** (0.0308)
<b>CONTROL VARIABLES</b>								
Proportion White	-0.157 (0.101)	-1.459*** (0.321)	-0.158 (0.101)	-1.460*** (0.320)	-0.165 (0.115)	0.536 (0.331)	-0.164 (0.115)	0.537 (0.330)
Proportion Black	-0.409*** (0.101)	-1.651*** (0.320)	-0.410*** (0.100)	-1.653*** (0.319)	0.0759 (0.115)	0.732** (0.330)	0.0769 (0.114)	0.734** (0.329)
Proportion Latino	-0.634*** (0.139)	-1.649*** (0.302)	-0.610*** (0.139)	-1.613*** (0.302)	0.0157 (0.158)	0.607* (0.311)	-0.00740 (0.159)	0.568* (0.311)
Proportion Native American	-0.142 (0.103)	-1.431*** (0.320)	-0.140 (0.103)	-1.429*** (0.319)	-0.120 (0.117)	0.606* (0.330)	-0.122 (0.117)	0.604* (0.329)
Proportion Seniors	-0.0134 (0.0238)	0.0885* (0.0481)	-0.0144 (0.0237)	0.0861* (0.0480)	0.117*** (0.0271)	0.00302 (0.0496)	0.118*** (0.0271)	0.00495 (0.0494)
Proportion Owner-Occupied HU	-0.0816*** (0.00869)	-0.0887*** (0.0170)	-0.0813*** (0.00869)	-0.0882*** (0.0170)	0.160*** (0.00990)	0.0993*** (0.0176)	0.160*** (0.00990)	0.0982*** (0.0175)
Proportion HUs Occupied	0.115*** (0.0142)	0.170*** (0.0187)	0.112*** (0.0142)	0.167*** (0.0187)	-0.145*** (0.0162)	-0.222*** (0.0193)	-0.143*** (0.0162)	-0.219*** (0.0192)
Proportion HUs in Urban Area	0.0628*** (0.00433)	0.0559*** (0.00719)	0.0627*** (0.00433)	0.0555*** (0.00717)	-0.0817*** (0.00494)	-0.0442*** (0.00741)	-0.0816*** (0.00493)	-0.0438*** (0.00739)
Block Group Population	-1.42e-05*** (3.40e-06)	-1.68e-05*** (5.05e-06)	-1.44e-05*** (3.40e-06)	-1.74e-05*** (5.04e-06)	2.73e-05*** (3.88e-06)	2.23e-05*** (5.21e-06)	2.75e-05*** (3.87e-06)	2.28e-05*** (5.19e-06)
Area (100,000 sq. meters)	4.15e-07 (4.59e-06)	-9.41e-06* (5.28e-06)	2.04e-07 (4.59e-06)	-9.64e-06* (5.27e-06)	-5.84e-06 (5.23e-06)	1.28e-05** (5.44e-06)	-5.63e-06 (5.23e-06)	1.31e-05** (5.43e-06)

VARIABLES	Change in Proportion Black				Change in Proportion White			
	Entire State	Eastern Plains	Entire State	Eastern Plains	Entire State	Eastern Plains	Entire State	Eastern Plains
Housing Units Built in 1980s (2010)	5.33e-05*** (1.80e-05)	4.82e-05 (3.32e-05)	5.43e-05*** (1.79e-05)	5.12e-05 (3.31e-05)	-7.45e-05*** (2.05e-05)	-9.26e-05*** (3.42e-05)	-7.55e-05*** (2.04e-05)	-9.57e-05*** (3.41e-05)
Housing Units Built in 1950s (2010)	0.000218*** (3.19e-05)	0.000296*** (6.01e-05)	0.000219*** (3.19e-05)	0.000296*** (5.99e-05)	-0.000280*** (3.64e-05)	-0.000355*** (6.19e-05)	-0.000281*** (3.64e-05)	-0.000354*** (6.17e-05)
Housing Units Built Before 1939 (2010)	-0.000219*** (3.25e-05)	-0.000150** (6.50e-05)	-0.000219*** (3.25e-05)	-0.000146** (6.48e-05)	0.000293*** (3.70e-05)	0.000113* (6.70e-05)	0.000293*** (3.70e-05)	0.000110 (6.68e-05)
Region = Central	0.0350*** (0.00427)		0.0352*** (0.00427)		-0.0541*** (0.00487)		-0.0543*** (0.00486)	
Region = Eastern	0.0564*** (0.00474)		0.0546*** (0.00477)		-0.0501*** (0.00541)		-0.0483*** (0.00544)	
Constant	0.120 (0.101)	1.409*** (0.322)	0.123 (0.101)	1.411*** (0.321)	0.103 (0.115)	-0.522 (0.332)	0.100 (0.115)	-0.525 (0.331)
Observations	6,095	1,780	6,095	1,780	6,095	1,780	6,095	1,780
Pseudo R-square	0.286	0.292	0.287	0.296	0.278	0.299	0.279	0.302
Standard errors in parentheses								
*** p<0.01, ** p<0.05, * p<0.1								

### *Spillover effects*

Being located *near* a neighborhood with buyouts is associated with a distinct pattern of neighborhood change, including an increase in the share of Blacks and a decrease in the share of Whites. Each additional buyout, averaged across contiguous neighborhoods, was associated with an increase of 0.18 percentage points in the change in the share of Blacks across the state (0.16 percentage points in Eastern North Carolina). Being surrounded by high-buyout neighborhoods is associated with a change in the share of Blacks 15.3 percentage points higher than in a neighborhood with no contiguous high-buyout neighborhoods (13.3 percentage points higher in Eastern North Carolina).

The associated change in the share of whites is of similar magnitude, but in the opposite direction. An increase of one buyout in the average number of buyouts in contiguous neighborhoods was associated with a decline of 0.15 percentage points in Whites in the state as a whole and 0.14 percentage points in Eastern North Carolina. A neighborhood surrounded by high-buyout neighborhoods has an expected change in share of whites 13.5 percentage points lower than a neighborhood without any contiguous high-buyout neighborhoods across the state, 12.9 percentage points in Eastern North Carolina. All results for spillover effects on the share of blacks and whites are statistically significant at  $p > 0.01$ . As with direct effects, being located next to block groups with buyouts was not associated with any statistically significant difference in change in the share of Latinos or Native Americans (see Appendix 4.1, Table 16).

Unlike racial mix, there were no statistically significant spillover effects on change in housing characteristics in neighborhoods near buyouts. This finding holds across changes in the number of housing units, changes in the number of vacant units, as well as newly constructed

homes. These findings are detailed in Table 12 for change in overall housing units, and in Appendix 4.1, Tables 14-16 for the other variables.

## **Discussion**

Findings from this study suggest that buyouts are part of a process of disinvestment and white flight. Buyouts dampened 20-year growth in housing, and this phenomenon could be explained in a few different ways. In general, the count of housing units primarily changes through two components: the construction of new units and the demolition or destruction of old units. The inventory of housing in buyout neighborhoods still grew on average (Table 11), even though buyouts have a negative effect on that change. One possibility is that fewer new units are being built in buyout neighborhoods. The estimated associations between buyouts and new construction are negative (Table 15, Appendix 4.1), but they are not statistically significant, with the exception of high-buyout neighborhoods in Eastern North Carolina, which is only weakly statistically significant ( $p < 0.10$ ). According to the components of housing unit change, the other primary possibility is that neighborhoods with buyouts had elevated levels of housing loss outside of the buyouts – losses due to unremediated flood damage or neglect. Both these explanations – fewer new construction units and losses due to complete deterioration – have a common theme of disinvestment.

At the same time as buyouts had negative effects on change in housing units, concentrations of buyouts were not statistically significantly associated with changes in vacant housing. Given the negative effect on housing inventory, if buyout participants were moving to other units within their original neighborhood and all else remained equal, one would expect to see the count of vacant units go down. There are two possible explanations for the lack of statistically significant effect on vacant housing units. One of the explanations is that households

participating in the buyouts are moving to a destination outside of their original neighborhood, which is reflected in case study administrative data from Kinston discussed in Paper 1. The other is that buyout households move within their neighborhood but other households move out just as fast. These two explanations are not mutually exclusive, but they may reflect different motivations and implications.

It is likely that the findings reflect at least a degree of out-migration of buyout participants to other neighborhoods. There are a few potential explanations for this diaspora. First, this out-migration of buyout participants could reflect locational attainment, or moving to areas of higher socioeconomic status. The motivations described in interview data from the Kinston case study (Paper 1) suggest that locational attainment was a motivating factor. On the other hand, it is possible that all available housing units were located outside of buyout neighborhoods, in which case buyout participants may not have had a choice about where to move, and might have preferred to stay in the neighborhood if they could. Or, participants may move to other neighborhoods for other reasons, such as proximity to family or employment.

Out-migration of buyout participants could also relate to self-selection of buyout participants. Self-selection could operate at the household level or the neighborhood level. Households with lower place attachment or stronger desire for locational attainment might have greater motivation to take a buyout rather than stay in place and rebuild. Because buyouts are a voluntary program, the element of self-selection is likely to be present to some degree in most places. However, researchers have found that many buyout participants feel they have no good alternatives other than to take a buyout (de Vries & Fraser, 2012; J. C. Fraser et al., 2003), which may limit the role of individual self-selection in out-migration.

It is also possible that self-selection influences participant out-migration at the neighborhood scale. Neighborhoods that are already declining in socioeconomic status may be places where homeowners are more likely to accept a buyout. Or, neighborhoods with pre-buyout out-migration may be more likely to interest local government officials as an appropriate area to target for buyouts, because the tax base may already be declining. Because many parts of the rural United States were not covered by Census tracts and blocks before the 1990 Census, the pre-1990 data that might offer support to this explanation is unavailable. The research design in the present study aimed to limit the effect of neighborhood self-selection on the results by controlling for characteristics that have been associated with growth and development in recent decades, including the percent urbanized and the region of the state. Nonetheless, further research on self-selection and the motivations of residents and decision-makers is needed.

The results also support a finding that white flight is occurring in and around buyout areas. As captured by the literature on “tipping,” during white flight, white households move out of a neighborhood in reaction to people of color, especially Black households, moving in. There is some evidence that white flight is occurring in buyout neighborhoods, but the clearest evidence is that white flight is occurring in neighborhoods around buyouts. Chapter Three demonstrated that buyouts are associated with higher shares of African Americans in a neighborhood. Therefore, it is reasonable to conclude that buyout participants are disproportionately African-American. In conjunction with the finding that buyout participants are likely relocating outside their original neighborhood to an adjacent neighborhood, this suggests that buyouts result in an influx of black households moving into neighborhoods near buyouts, which causes a “tipping” effect in which white residents move out. The white flight explanation is also supported by the finding that neighborhoods near buyout areas did not see

statistically significant associations with change in housing inventory or vacant units, while they did see clear change in racial mix, which suggests that buyout participants replace other residents.

A critical question is whether real estate agents might have used racial steering to prompt buyout residents. Despite its illegality, racial steering continued to be a pervasive practice through at least the 1990s (Charles, 2003). Real estate agents can actually benefit from pushing neighborhood turnover because it spurs additional real estate transactions for them. Local governments or housing counselors could also have influenced the location of the housing that buyout participants considered for relocation. The question of agency in neighborhood racial turnover associated with buyouts merits further detailed investigation of program implementation.

The suggestion that buyouts play a role in disinvestment and white flight refer to data from North Carolina but they shed light on patterns of buyouts and neighborhood change that are likely to be found in other parts of the nation. While North Carolina was extraordinary in its early and widespread adoption of buyouts, buyouts are becoming more and more popular. Buyouts in North Carolina almost exclusively took place in locations adjacent to rivers and streams, rather than beaches and bays, which is typical of buyout programs across the United States<sup>10</sup>. Finally, the reasons that buyout participants in North Carolina may have self-selected into buyouts, such as lower place attachment and the desire to move to a neighborhood of higher socio-economic status, are not unique to North Carolina. A limitation of this research is that

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<sup>10</sup> Two exceptions are the post-Sandy New York buyouts and the post-Ike Bolivar Peninsula (Texas) buyouts which occurred in coastal areas.



most, but not all, of North Carolina's buyouts occurred in smaller towns along rural landscapes. Buyouts concentrated in areas with urban development pressures may play different roles in neighborhood change.

## **Implications**

There are multiple policy and planning strategies that could mitigate the effects of buyouts on disinvestment. All governmental stakeholders, including local, state, and federal government, ought to be sensitive to the effects of disinvestment and disproportionate impacts in African-American communities. State and local decision-makers need to identify whether the current housing stock is likely to accommodate buyout participants. Opportunities for developers to build new housing or redevelop in safer parts of the buyout neighborhood should be highlighted, and public-private partnerships can assist in implementation. The local government should plan for the buyout land itself, to ensure that it does not become a disamenity for the local population, which could engender further disinvestment. For example, managing land as a park or community garden, or allowing adjacent neighbors to use the land as yard space or a garden, could provide local benefits.

One major challenge to adopting these recommendations is limited capacity of local governments to implement them. Particularly in the months after a devastating flood, local officials are overloaded with responsibilities. Even under blue skies, officials in smaller communities often play multiple roles, and developing the expertise or funding to manage the buyout land or develop relocation housing may not be realistic. Therefore, other partners with existing capacity need to be identified. These actors can include state government, regional government, or nonprofit partners. For example, councils of government or regional planning organizations often have planning expertise and capacity that can serve local government. In

addition, capacity may be needed at the neighborhood level to advocate for generating neighborhood amenities through buyout land. This capacity can be built through community organizing and training local organizations, houses of worship, and residents about involvement and advocacy in local government.

There are also special roles that state and federal government can play. State governments are often the formal HMGP applicant, and as such they have the ability to set some standards about how the program will be implemented. North Carolina set forth several policies that likely reduced the disinvestment effect, such as purchasing buyout homes at pre-flood value and providing additional flexible funding for households through the State Acquisition and Relocation Fund. Alternatively, FEMA allows up to \$31,000 in a supplemental payment to buyout participants under certain circumstances (FEMA, 2015, p. 26). These practices should be replicated in other places that pursue buyouts.

In addition, the emerging body of guidance on buyouts should identify the challenges of disinvestment and highlight strategies to overcome disinvestment. FEMA issues formal policy guidance on HMGP, and many nonprofits have issued their own reports on buyouts or opinion pieces with recommendations. Some of these reports mention concerns with disinvestment but most focus on the mitigation benefits or the ecological benefits (Freudenberg et al., 2016; Kihlslinger & Salvesen, 2017; Scata, 2017). All guidance that deals with intended and unintended outcomes of buyouts should at least mention, and preferably address, the issue of disinvestment. This may require expertise from groups outside of the environmental conservation organizations that have studied and advocated for buyouts more prominently.

Some who advocate for buyouts as a means of managed retreat may not see disinvestment in a negative light, because it signals further removal of development from risky areas. HMGP may be a tool for managed retreat, but the overall goal of retreat from an area must be addressed outside the context of HMGP alone. The goal of retreat must be supported by local leadership, community conversation, and comprehensive planning, which is not required by HMGP and demands a much longer timeframe than the implementation of HMGP after a disaster. This planning and conversation should occur in highly vulnerable regions before disaster or otherwise outside the immediate period of response and recovery, where there is little capacity for such difficult deliberation.

White flight is a more vexing challenge to address through governmental or stakeholder action. White flight is rooted in individual prejudice and centuries of unequal treatment that privileged the accumulation of wealth through homeownership among white households. It may be exacerbated by racial steering among real estate agents or by the placement of new housing for buyout participants. The practice of racial steering by real estate agents has actually increased in recent years (Oh & Yinger, 2015), so fair housing enforcement ought to be implemented during buyout programs. When the state or local government builds new housing that is intended to serve buyout participants, that housing should not perpetuate segregated neighborhoods or segregated housing markets. Changing individual prejudices is beyond the scope of this paper, but there are general findings from the research literature about policies that support or challenge white flight. Fiscal policy that spreads tax base and community services over a larger geography disincentivizes the formation of enclaves of wealthy or white residents, or at least, it mitigates the effect of white flight on those residents left behind. Rigorous anti-discrimination laws and

testing can combat the housing discrimination and racial steering that is still present in today's housing market.

This paper also highlights the need for further research in this growing area of policy and practice. The first major area of need is more research on the neighborhood change impacts of buyouts. A parcel-by-parcel analysis of housing unit change in buyout areas, compared with non-buyout areas, will inform an understanding of the degree to which disinvestment is occurring through a lack of new construction or through the loss of additional existing units. Longitudinal case studies are needed to provide a more in-depth understanding of the processes of neighborhood change in buyout areas, and particularly how disinvestment and racial dynamics interface with one another. Greater research on the roles of local officials, program officials, housing counselors, and real estate agents should examine their potential roles in racial steering. Exceptional neighborhoods where buyouts encourage new investment or racial integration should be understood, as well. All of these research questions should examine buyout programs funded by other federal agencies, as well, as programmatic rules and regulations could change program design and therefore neighborhood effects.

A second area of research need is qualitative research on the impact of program and policy design decisions and their impact on the outcome of buyouts. For example, practitioners and researchers would benefit from a greater understanding of how additional relocation funds affect the residential decision-making of residents and the subsequent neighborhood change impacts. A foundation for this research has been laid by several buyouts researchers who studied how the design of buyout policies and programs has evolved, and how it affects participant satisfaction (Baker et al., 2018; Brokopp Binder & Greer, 2016; Greer & Brokopp Binder, 2017). However, some of the buyout programs that have spurred this research, especially the post-

Sandy buyout programs in New York and New Jersey, are too early in implementation to connect program and policy design to long-term community change. However, ongoing collection of evidence on the effect of policy and program design on participants is critical to support recommendations for implementing buyouts in an equitable and just manner.

This paper has demonstrated that post-disaster buyouts affect neighborhood change. Buyouts are associated with disinvestment and retrenchment of racial segregation patterns. These findings are supported by statewide data from North Carolina and twenty years of neighborhood change data documented by the Census. They suggest the need for policies and programs that encourage equitable investment in safer parts of buyout neighborhoods, support community development in and near buyout areas, and discourage the racially disparate impacts of white flight. Further research on the neighborhood change effects of buyouts will provide a service to the growing numbers of states and local governments that are implementing buyouts.

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## CHAPTER FIVE. CONCLUSION

This dissertation has explored the ways in which buyouts reflect or interface with pre-existing systems of racial and economic inequality. Through qualitative and quantitative methods, I have demonstrated that buyouts reflect and generate significant social equity concerns. Policy and program design may resolve some of the equity issues in buyouts, but others require a more fundamental re-thinking of how land use is changed after disaster, and how property owners and communities are empowered during the process of decision-making and implementation.

### **Summary of Research Findings**

In the first paper, using a comparative case study approach, I find that two local governments representing marginalized communities made different decisions about environmental relocation based on differences in leadership, perception of climate risks, and competing priorities. In one community, buyouts permanently reduced flood risk and bolstered home equity for participants. However, the buyout program also had negative consequences for the area around the buyout land because the buyout generated an environmental disamenity and supported a cycle of disinvestment. By comparison, *not* taking a buyout garnered publicity and greater recognition that benefitted the other community. However, that decision against buyouts resulted in devastating flood losses just 17 years later. These cases demonstrate several problems pertaining to social equity in buyouts, including potential concentration of marginalized communities in buyout programs, designing a fair decision-making process, and unintended social risks of environmental relocation, including loss of marginalized histories and loss of

social networks. Addressing these problems should guide the research and innovation agenda on equitable climate adaptation toward workable solutions to these enduring problems.

In the second paper, I find that buyouts are concentrated in segregated, African American communities in Eastern North Carolina. The association between buyouts and race holds even after controlling for poverty and floodplain exposure. I explore a few explanations for these findings. The historic disinvestment in African American communities may lead town officials to identify African American neighborhoods as target buyout areas, or this disinvestment may lead residents of those neighborhoods to take buyouts as a means to move elsewhere.

Finally, in the third paper, I find that buyouts are negatively associated with change in the number of housing units in a neighborhood. I also find that buyouts triggered racial turnover from white to African American in the neighborhoods adjacent to buyouts. These findings suggest that buyouts have contributed to disinvestment effects in the neighborhoods where they occur. The findings of this study warrant additional quantitative and qualitative investigation, including a close analysis of the relocation process for buyout participants, to understand if racial steering is at play.

Together, these studies make two primary contributions to fill gaps in the literature on buyouts. First, this research examines long-term outcomes associated with buyout implementation, both through the comparative case study and the analysis of neighborhood change associated with buyouts. The research literature on buyouts has blossomed in recent years, but much of the analysis has focused on more recent buyout programs, such as the post-Sandy buyouts, which were implemented in the years since the storm in 2012. More importantly, the research literature has largely focused on questions that are concurrent to buyout

implementation, such as participant experiences and program design, which leaves a major gap in understanding how buyouts affected people and places after implementation. As demonstrated in Chapter Two, there are similar gaps in climate adaptation research in general, because of the newness of adaptation efforts. This dissertation demonstrates that in North Carolina, buyouts have had some negative impacts on the communities that implement them, as they spur disinvestment over time in the neighborhoods where they occur. By articulating these long-term impacts, this dissertation offers support for researchers and practitioners to explore how unintended negative consequences might be mitigated in the future.

In addition, this dissertation contributes to the research literature on buyouts because it uses empirical data to analyze social equity issues. Only two academic research papers have actually focused on social equity in buyouts, and both of them analyze the government administration of buyouts (de Vries & Fraser, 2012; Siders, 2018). This dissertation provides an explicit focus on race in buyouts, and explores issues across the buyout lifecycle, from decision-making to long-term impacts. It demonstrates that buyouts reflect and may perpetuate racial inequality in communities where they are implemented, through the administration of buyouts, the geography of their implementation, and their long-term impacts. Through bringing to bear this variety of perspectives on the social equity problems in buyouts, this dissertation contributes findings as well as analytical approaches that merit repetition and expansion by further research.

### **Limitations of the Research**

Like all research, this dissertation has limitations. Its exclusive focus on North Carolina is one. The racial profile of the state's rural eastern plains, where buyouts were concentrated, is similar to other Southern states, with a white majority but significant black minority and a Native American presence. Rural poverty of all races is another feature of North Carolina's eastern

plains. However, other places that have pursued buyouts, such as New York after Hurricane Sandy, have different sociodemographic characteristics. In addition, while some urban buyouts occurred in North Carolina, the majority were in rural areas without strong real estate markets. Equity issues related to buyouts in urban settings or other places with hot real estate markets like oceanfront towns, may look different.

In addition, the time period of the study created limitations for both the quantitative and qualitative portions. The quantitative analysis was limited by a lack of pre-1990 data at the neighborhood level, which made it challenging to control for pre-existing trends like out-migration at the neighborhood scale. For the qualitative analysis, interviewing key informants about events that occurred nearly two decades prior generates a risk that interviewees are limited by their memories and the passage of time. Other key informants were unable to be located or had passed away due to the length of time between the buyouts and this dissertation.

### **Implications for Policy and Planning**

Buyouts work for reducing risk of property loss and human suffering in areas prone to repeat flooding. In the current scheme of disaster risk reduction and climate adaptation, buyouts may be one of the most effective tools available, especially to communities and households which do not have their own resources to invest in physical resilience. That said, there are entrenched systems of inequality embedded in our land use patterns, political systems, and private property values, and each of the three papers in this dissertation finds that buyout programs in North Carolina became entangled in these inequalities in multiple ways. The findings from each paper suggest potential strategies that could reduce buyouts' engagement of systemic inequalities. I review these policy and planning implications in the following section, and provide some overall thoughts about addressing inequality in disaster resilience.



## *Planning*

The first major recommendation, one which encompasses all the recommendations that follow, is to use principles of community development planning to guide buyouts. Practices from community development planning are uniquely suited to assist in decisions, in which the decision is irreversible, as with buyouts, and when information about the future is uncertain, as in the case of future flood events (Hopkins, 2001). These techniques span visioning, community engagement, goal-setting, scenario exercises, mapping and spatial data analysis, visualizations, conflict resolution, implementation guidance, and synthesis of multiple perspectives and data sources (G. Smith, 2011, 2014c). Through its interdisciplinary approach, planning can help buyouts achieve their goals of hazard mitigation while also reducing unintended negative consequences for marginalized communities. Planners also typically deal with time frames of twenty years or more, examining how a place might develop and change over time. This skill is badly needed for buyouts planning. As the findings from this dissertation identify a range of issues that surface over the twenty years following buyouts, from repeat disasters to neighborhood change. Planning is also uniquely suited for dealing with interdependencies (Hopkins, 2001) and this dissertation has shown that buyouts have complex community and societal impacts from land use to social capital to wealth generation. Decisions about buyouts should be made in light of, and in conjunction with, other decisions on alternative or redundant mitigation strategies, community development investments, historic preservation and continuity of social networks, and open space maintenance.

Planning for buyouts should ideally occur before disaster strikes. A community that plans for a buyout program has more time for meaningful public engagement and consideration of alternatives under “blue skies” than it does during the confusion and trauma of the post-disaster

recovery. Areas which have had repetitive flooding or know that climate change will worsen their vulnerabilities should particularly consider pre-disaster planning for buyouts. However, using techniques of community planning after the disaster still offers significant opportunities to align multiple objectives in the implementation of a buyout program.

There are a number of existing vehicles for buyouts planning, depending on the local government. For example, a hazard mitigation plan is an ideal context for buyouts planning, because of the alignment of objectives and because hazard mitigation plans are required by FEMA to be updated regularly. Comprehensive plans and their implementing code are another logical context for buyouts planning. Comprehensive plans typically integrate a broad range of issues, such as housing, land use, and economic development, which is an approach that could serve the interrelated equity impacts of buyouts in areas like housing, community development, and open space amenities. Some local jurisdictions have disaster recovery plans and/or redevelopment plans, which also could be a natural home for buyouts planning. Of course, planning for buyouts can occur independently of ongoing planning efforts as well.

#### *Engagement and accountability*

Addressing the racial and social justice problems presented by buyouts requires an approach that spans both procedural justice – inclusion in decision-making – as well as distributive justice – equity in the distribution of resources and opportunities. Achieving greater procedural justice requires improving community representation and participation in the design and implementation of buyout programs. High quality community engagement is a sensible strategy for buyouts programs in general; research has documented that poor community engagement is associated with lower satisfaction with buyout programs (Baker et al., 2018). Meaningful community engagement where individuals and groups are empowered to represent

their interests is critical to reducing unintended consequences and improving the impact of buyouts on communities which have historically been marginalized and under-resourced (Siders, 2018).

There are several instruments which can contribute to more inclusive decision-making processes. These processes might address the tension, illustrated in the case comparison between Kinston and Princeville, between engaging the community in a collective decision about a buyout while respecting individual homeowners' ability to decide for themselves about selling their homes. Best practices in planning call for a decision-making structure which does not simply consult the public, but empowers communities with voices and authority to affect the decision (Arnstein, 1969; Forester, 1982; Innes, 1996; Innes & Booher, 2004). It is also important to recognize that buyout participants and the neighborhoods where buyouts occur are not monolithic groups. They may have diverse needs and values which should be recognized and addressed. Mediated consensus-building is one approach that can provide a structure and role for community interests that may not otherwise have political power. Consensus-building processes are particularly useful in situations of complex environmental decisions with multiple stakeholders and multiple interests (G. Smith, 2011; Susskind, McKearnan, & Thomas-Larmer, 1999), but have not been tested for post-disaster buyouts, to my knowledge. This approach could allow community representatives to articulate the value of their homes and land and their interests in payments or relocation services, which ideally would inform a buyout program with higher uptake, higher satisfaction, and fewer racial and social justice implications. For example, neighbors may have insights about the benefits that would convince potential participants to sell their properties, ways to memorialize a community lost to a buyout, or priorities for the use of open space, like active or passive recreation, gardens, education, or environmental restoration.

Consensus-building also supports conflict resolution in contentious policy environments, which buyouts can easily become, as the Princeville case study demonstrates. Consensus building is just one of many techniques that can be used for quality community engagement.

This engagement is not the sole responsibility of the local government, although the local government should play a significant role, as the first paper demonstrates is typical for an HMGP buyout. FEMA is in a position to fund decision-making and planning processes for HMGP buyouts. States similarly could incentivize engaged decision-making processes for buyouts through obligation of state funds or through the implementation of HMGP or other federally funded programs.

For the sake of accountability, local government and other implementers that consider buyouts should communicate honestly among themselves and to the public about their plans, capacity and commitment to implement any programming beyond what is required by a federal- or state-funded program. Local goals, strategies, and commitments related to the buyout should be formalized in writing and adopted by the appropriate decision-making body to reduce the effect of low political will down the line, which limited follow-up investments in the buyout land in Lincoln City.

A major challenge to adopting these recommendations is that the general responsibilities of disaster recovery already overload the limited capacity of local governments. It may not be realistic for local government to lead quality planning or execute the implementation of a multifaceted buyout program. However, if the local officials are committed to this outcome, partnerships with state or regional government, nonprofits, or academia can assist, and there are many examples of such partnerships providing capacity in post disaster communities (e.g.

Seidman, 2013). In addition, capacity may be needed at the neighborhood level to advocate for generating neighborhood amenities through buyout land. For example, as interview data for Paper 1 show, in Kinston, there have been multiple plans for their buyout land, but there is no political will to implement the plans in a highly distressed, poor, African American neighborhood. This capacity can be built through community organizing and training local organizations, houses of worship, and residents about involvement and advocacy in local government.

Finally, to support greater community engagement and accountability, grey literature on buyouts should detail engagement and accountability techniques and case studies. There is a growing body of guidance on buyouts put out by both government agencies and nonprofits (FEMA, 2015b, 2015a; Freudenberg et al., 2016; Kihlslinger & Salvesen, 2017; NOAA, 2017). However, coverage of community engagement issues – and of issues affecting marginalized communities in general – remains poor. This grey literature should address these critical issues. Organizations with racial justice, social justice, or housing missions could have the relevant expertise to author or co-author such publications.

#### *Reducing unwanted and unintended consequences*

Addressing the equity problems with buyouts also requires investing in distributional equity. There are several strategies, discussed in the previous chapters and reviewed here, which could reduce negative impacts and improve participant and community outcomes in places that implement buyouts. These strategies should center the needs and experiences of communities affected by buyouts that have been subject to historic and continuing marginalization.

First, buyout land can become an amenity for its neighbors. This strategy would address the problem demonstrated by the Kinston study, in which buyout land became a disamenity for the residents “left behind.” There are multiple open space land uses allowable under FEMA regulations, including outdoor recreational facilities, a park, a community garden, or a restored ecosystem. A historic marker or other reflection and preservation of the site’s history can also preserve memories and histories that may be marginalized or simply untold. Creating a community amenity of buyout land may help stem the housing disinvestment associated with buyouts that was documented in Paper 3. However, without proactive planning, it is unlikely that these value-added uses will occur in places that are poor or isolated from development assets, such as Lincoln City in Kinston.

Second, buyouts can promote or sustain homeownership and wealth generation. For example, with the additional funding provided by the State Acquisition and Relocation Fund, buyout participants in Kinston were able to increase the equity in their new, higher-value home. This incentive program was designed to address affordability issues in relocating participating households to housing of an equivalent size elsewhere. However, sustaining homeownership and generating wealth for participants are not incompatible with the hazard mitigation goals of buyouts – a buyout program might have multiple objectives. Federal and state government are in a position to incentivize, fund, or require additional planning to ensure that affordability or homeownership goals are incorporated into the design and implementation of buyouts.

In addition, programs should proactively plan for resident relocation. In Kinston, the local government did significant work to redevelop sites that could house buyout participants, and housing counselors worked with buyout participants to facilitate simultaneous closings – selling their buyout property and purchasing a new home at the same time, in the same place.

Without such support, it is easy to imagine that participants, especially those who are less literate or do not have experience purchasing a home, could get lost in the program or fail to find new housing that properly uses their buyout proceeds and any additional funds from the program. Relocation support should include wraparound services that address the complex needs of households that are moving – not just selecting a new home, but addressing changes in transportation or access to healthcare that may accompany such moves.

#### *New approaches to buyouts and resilience*

In this final section of implications for policy and planning, I would like to present a few thoughts on new or different ways to approach buyouts and resilience that may have potential to serve communities in more equitable and still effective ways. First, I recommend that government officials and other proponents of buyouts move from a conception of buyouts as a property-based hazard mitigation program to an understanding of buyouts as a relocation program. Buyouts have impacts on places and people, and without a deliberate focus on the needs of *people* and their futures after the buyout, it is easy to brush off the inequitable impacts to Black communities or other marginalized populations as outside the scope of the program. Modern federal relocation programs, such as The Department of Housing and Urban Development’s Move to Opportunity or HOPE VI programs, have learned many well-documented lessons about the needs and outcomes of participants in relocation programs. These lessons ought to be understood as relevant to buyouts, and incorporated into buyouts policy. This is the topic of a forthcoming paper that I am writing.

An alternative to parcel-by-parcel buyouts is whole community relocation. Whole community relocation may reduce some of the community-wide effects of buyouts, such as worsening disinvestment among those “left behind” by the buyout, loss of social networks, and

loss of place attachment and identity. Over 20 years ago, emergency management scholars Perry and Lindell outlined insightful recommendations for relocating whole communities, with major emphasis on building community capacity, effective communication, social and personal needs of relocating households, preservation of social networks, and attention to cultural and organizational differences among minority groups (Perry & Lindell, 1997). These principles for relocation, if implemented, would permit the reduction of flood risk while minimizing community-wide losses that may be especially acute in communities of color. As Perry and Lindell write, whole community relocation requires deep engagement and careful planning to be successful.

A final thought on new directions in buyouts and resilience concerns social vulnerability. Social vulnerability is understood as the ways in which social systems make people of different characteristics differentially vulnerable to disaster (Wisner, Blaikie, Cannon, & Davis, 2004). In the United States, our risk reduction and resilience programs focus on reducing physical vulnerability, but we might also consider how investment in socioeconomic sources of vulnerability increase disaster resilience. This practice is more common in developing countries but it also holds the relevance in the United States and other developed nations (Broto, Oballa, & Junior, 2013; Bulkeley, Edwards, & Fuller, 2014; Kuhlicke et al., 2011). Investment in poverty reduction and wealth generation increases the ability of households to withstand disasters and recover without permanent setback and loss. With greater economic security, households live in higher quality houses, can afford flood insurance, and have economic resources to tap when in need. Social resilience also relies on social networks for strength. Investing in strong community bonds and building capacity for civil engagement will support resilience in addition to providing many other benefits (Adger, 2003; Norris, Stevens, Pfefferbaum, Wyche, & Pfefferbaum, 2008).



While the conversation about disaster resilience in the United States primarily concerns infrastructure, insurance, and land use, enhancing resilience through addressing underlying drivers of social vulnerability may better meet the challenge of entrenched inequalities.

### **Future Research Needs**

This research demonstrates the need for more research on racial and social justice components of buyouts programs in their design, implementation, and the lived experience of participants and neighbors. In this dissertation, I asked questions about who participates in buyouts and where they happen, and about the benefits and burdens of buyouts for participants as well as for the communities where buyouts happen. While I have answered these questions in the context of North Carolina and FEMA's Hazard Mitigation Grant Program, they need repeat analysis in other places and across other buyout programs funded through different mechanisms. North Carolina bears topographical, demographic, and development patterns similar to other southeastern states, which lends external validity to the dissertation results, but repeating these lines of inquiry may yield similar or different results in other places. The buyouts field needs to understand the patterns in the social equity implications of buyout programs.

Additional longitudinal research on buyouts is especially needed. Longitudinal research will better capture the effects of buyouts for people and for places. For example, a controlled study could compare households that took buyouts to those that did not, to better understand how the lived experience of relocation and flood risk reduction affects life changes and opportunities later on. A parcel-based analysis could examine how property values change in response to proximity to buyout sites over time. Understanding the long-term interplay between sociodemographic context and buyout outcomes will better inform buyouts decision-making in the future. In addition, the impact of buyouts on the housing stock, especially the stock of

housing affordable to low- and moderate-income households, must be understood. The opportunity to study places and people many years after buyout will only become more tenable as many buyout programs have been implemented in the past twenty years.

To achieve this research, improved data are needed. Standardized data on buyouts for use in research is completely lacking. Even basic data about where buyout participants move is largely missing (McGhee, 2017). FEMA might collect and track this information, as might HUD whose CDBG-DR program also frequently funds buyouts. A national nonprofit or academic group with an interest in buyouts might work to develop a standardized database of who takes buyouts, where they move, and what happens to the buyout land in subsequent years and decades.

A final area of research that is needed is an analysis of the ethical issues raised by the first paper, which documented the ways in which Kinston encouraged people to take buyouts through a construction moratorium. Construction moratoria are recommended in the grey literature on post-disaster recovery and buyouts (e.g. FEMA, 2013; A. Siders, 2013), and ostensibly a moratorium allows for more time for deliberation about how to rebuild, but some places such as Kinston have used them to encourage buyout take-up (de Vries & Fraser, 2012). It is unclear if it is ethical for a voluntary program to steer its residents toward an outcome by eliminating alternatives – especially when their alternatives are already limited by their economic background. Hazard mitigation and resilience advocates may believe that such measures are truly the right thing to do because they reduce participants' exposure to future risk. However, local governments may not be the most appropriate actor to determine what's in the best interest of individual participants.

This dissertation has demonstrated that buyouts, a permanent land use solution to development located in areas at risk for flooding, reflects and engages longstanding racial and social inequalities. The field of buyouts research is maturing rapidly, and as the scholarly conversation advances, it is critical that the lens of justice and equity be applied to this work. With careful planning and additional research, it is conceivable that buyouts programs can be implemented with more progressive outcomes for social justice. Since the research for this dissertation began in 2016, North Carolina has experienced two major flooding disasters, Hurricanes Matthew and Florence, that caused catastrophic damage to the housing stock. Many homes were rebuilt after Matthew, only to be damaged again by Florence. As climate change brings more increasing flood risk, government officials, researchers, and community leaders need to prioritize the intentional inclusion of racial and social justice in our recovery and resilience strategies.

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APPENDIX 2.1. LINCOLN CITY WITH RESPECT TO CENSUS TRACTS

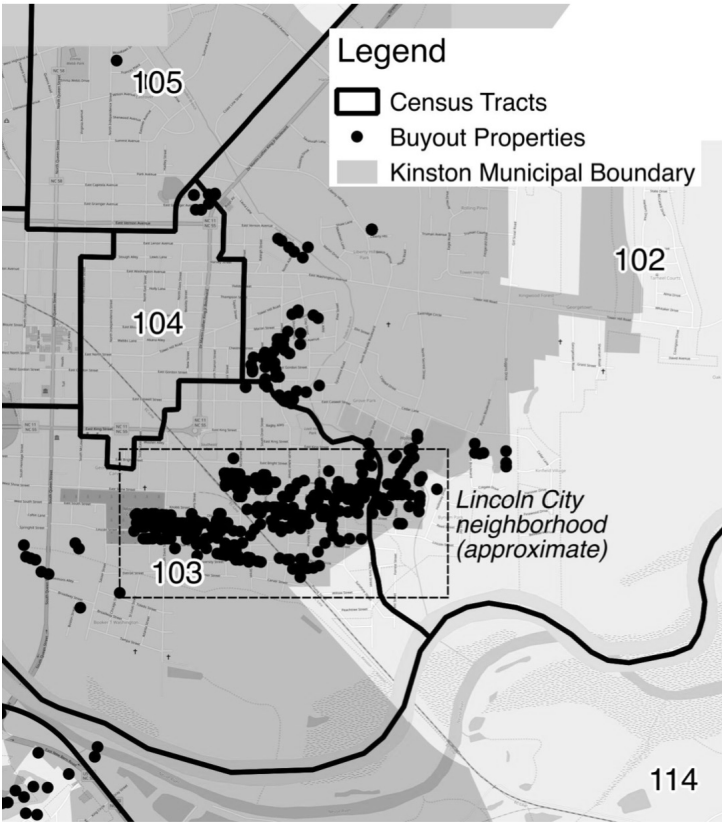


Figure 2. Lincoln City with respect to Census tracts

### APPENDIX 3.1. CORRELATION COEFFICIENTS

	African American	Segregation	Poverty	Hurr. Floyd	Hurr. Fran	100-yr FP	500-yr FP	V-Zone	Seniors	Rural	Mobile Home	Home Value	Older Homes	New Development	County Pop.	County Growth	Tract Pop.
African American	1.000																
Segregation	-0.092	1.000															
Poverty	0.661	-0.171	1.000														
Hurr. Floyd	0.253	-0.276	0.125	1.000													
Hurr. Fran	0.181	-0.261	0.142	0.673	1.000												
100-yr FP	0.007	-0.151	0.137	0.133	0.054	1.000											
500-yr FP	0.060	-0.138	0.156	0.151	0.083	0.547	1.000										
V-Zone	-0.078	-0.059	-0.030	0.073	0.055	0.309	0.211	1.000									
Seniors	0.021	-0.083	0.220	-0.101	-0.016	0.139	0.085	0.063	1.000								
Rural	-0.263	-0.373	-0.062	-0.022	-0.021	0.105	0.069	0.065	0.050	1.000							
Mobile Home	-0.162	-0.424	0.019	0.072	0.117	0.108	0.098	0.046	-0.075	0.758	1.000						
Home Value	0.383	-0.202	0.456	0.002	-0.014	-0.024	-0.029	-0.123	0.116	0.089	0.248	1.000					
Older Homes	0.261	-0.030	0.446	-0.032	-0.026	0.021	0.009	-0.080	0.500	-0.097	-0.135	0.343	1.000				
New Development	-0.325	0.055	-0.412	0.031	0.055	0.018	0.027	0.106	-0.457	0.121	0.094	-0.538	-0.653	1.000			
County Pop.	0.050	0.553	-0.249	-0.145	-0.115	-0.225	-0.169	-0.073	-0.384	-0.478	-0.461	-0.392	-0.210	0.268	1.000		
County Growth	-0.138	0.040	-0.176	0.131	0.104	0.236	0.214	0.206	-0.189	-0.041	-0.017	-0.412	-0.276	0.413	0.296	1.000	
Tract Pop.	0.170	-0.156	0.164	0.093	0.096	-0.047	-0.044	-0.109	0.080	-0.091	-0.018	0.349	0.131	-0.375	-0.239	-0.284	1.000



## APPENDIX 3.2. ALTERNATIVE SPECIFICATIONS

<b>Alternative Specification A</b>					
	Model 1	Model 2(c)	Model 3(c)	Model 4(c)	Model 5(c)
<b>Race and Segregation</b>					
African American	-0.66 (0.81)	2.40** (0.74)	1.48 (1.01)	3.40*** (0.71)	0.38 (0.41)
Segregation	-0.23 (2.50)	0.27 (1.87)	4.14** (1.57)	5.06** (1.89)	3.14*** (0.79)
<b>Poverty and Vulnerability</b>					
Poverty	4.51 (2.42)	-1.62 (1.52)	-0.78 (2.79)	-5.77* (2.36)	-1.48 (1.17)
Hurr. Floyd	-0.37 (1.00)	-1.07 (1.98)	0.22 (0.72)	0.52 (0.91)	0.67 (1.24)
Hurr. Fran	2.14* (0.94)	1.51 (1.85)	2.15* (0.95)	1.60 (0.97)	-0.13 (1.25)
100-yr FP	24.64 (13.40)	11.31* (4.95)	3.20*** (0.95)	2.44 (1.86)	1.36 (0.86)
500-yr FP	10.64 (10.33)	1.59 (2.98)	6.24*** (1.83)	8.33*** (2.52)	4.66** (1.66)
V-zone	-1.86 (2.98)	-13.08* (5.89)	0.00 (.)	0.00 (.)	-7.99*** (1.39)
<b>Other Controls</b>					
Seniors	-6.55 (3.40)	5.58 (3.89)	4.99 (4.35)	10.22* (4.85)	1.39 (2.99)
Rural	-0.51 (0.56)	-0.24 (0.62)	-1.29 (0.86)	-0.58 (1.19)	-0.60 (0.49)
Mobile Home	2.21 (1.60)	2.18 (1.87)	4.39 (2.31)	4.39 (2.87)	1.94 (1.37)
New Homes	1.81* (0.77)	-3.11** (0.99)	-0.82 (1.66)	-1.56 (2.07)	-1.75 (1.10)
County Pop.	0.08** (0.03)	-0.02 (0.02)	-0.13* (0.06)	-0.10 (0.06)	-0.02 (0.01)
County Growth	-0.04 (1.31)	-0.91 (1.16)	-1.88 (1.46)	-1.91 (1.58)	-0.38 (0.51)
Total Population	-0.00 (0.00)	0.00*** (0.00)	0.00** (0.00)	0.00*** (0.00)	0.00** (0.00)
Constant	-1.65 (1.74)	-2.30 (1.59)	-7.30*** (2.00)	-9.30*** (1.62)	0.73 (0.86)
lnalpha		2.57*** (0.16)			0.19* (0.08)
Observations	2178	1597	1526	1526	258
Pseudo R-squared	0.336	0.079	0.328	0.338	0.068

Standard errors in parentheses

=\*\* p<0.05

\*\* p<0.01

\*\*\* p<0.001"

<b>Alternative Specification B</b>					
	Model 1	Model 2(c)	Model 3(c)	Model 4(c)	Model 5(c)
<b>Race and Segregation</b>					
African American	-0.24 (0.87)	2.50** (0.97)	1.61 (1.27)	3.10*** (0.93)	0.29 (0.51)
Segregation	0.21 (2.56)	-0.07 (1.90)	3.99** (1.49)	4.70** (1.74)	3.01*** (0.79)
<b>Poverty and Vulnerability</b>					
Poverty	3.40 (2.97)	-2.75 (2.55)	-1.11 (3.41)	-4.52 (2.57)	-1.35 (1.30)
Afr. Amer. Poverty	0.97* (0.49)	1.68 (0.89)	0.62 (1.13)	0.21 (1.38)	0.09 (0.51)
Hurr. Floyd	-0.39 (1.01)	-1.01 (2.26)	0.17 (0.68)	0.26 (0.89)	0.48 (1.44)
Hurr. Fran	2.20* (0.95)	1.38 (2.08)	2.52* (1.08)	1.61 (1.04)	0.10 (1.40)
100-yr FP	27.09 (15.38)	12.02* (5.34)	3.91*** (1.10)	2.44 (1.91)	1.32 (0.86)
500-yr FP	8.80 (9.93)	1.71 (3.39)	5.95*** (1.70)	8.90*** (2.49)	4.82** (1.61)
V-zone	-2.44 (3.11)	-11.60 (6.29)	0.00 (.)	0.00 (.)	-7.70*** (1.48)
<b>Other Controls</b>					
Seniors	-8.60* (3.48)	3.33 (3.90)	3.23 (4.21)	10.95** (4.18)	1.97 (3.11)
Rural	-0.77 (0.53)	-0.43 (0.62)	-1.39 (0.84)	-0.46 (1.19)	-0.65 (0.50)
Mobile Home	3.97* (1.55)	2.72 (1.81)	4.52 (2.56)	3.70 (3.39)	2.07 (1.35)
New Homes	1.70** (0.65)	-2.98** (1.07)	-2.36 (1.71)	-4.93* (2.42)	-1.78 (1.13)
County Pop.	0.08** (0.03)	-0.01 (0.03)	-0.13* (0.06)	-0.11 (0.06)	-0.02 (0.01)
County Growth	-0.36 (1.33)	-1.14 (1.19)	-1.71 (1.44)	-1.64 (1.49)	-0.53 (0.54)
Total Population	0.00 (0.00)	0.00*** (0.00)	0.00** (0.00)	0.00* (0.00)	0.00* (0.00)
Home Value < \$100K	-1.43 (0.81)	-0.23 (0.42)	-0.81 (1.85)	-0.41 (3.20)	0.08 (0.55)
Older Homes	1.51 (1.09)	0.06 (1.51)	-1.47 (1.48)	-4.68 (2.87)	-0.42 (1.11)
Constant	-0.96 (1.81)	-2.30 (1.68)	-6.34** (2.42)	-7.04* (2.81)	0.64 (0.92)
Inalpha		2.54*** (0.17)			0.19* (0.08)
Observations	2122	1556	1491	1491	251
Pseudo R-squared	0.357	0.084	0.348	0.350	0.068

Standard errors in parentheses

=\*\* p<0.05

\*\* p<0.01

\*\*\* p<0.001"

Alternative Specification C					
	Model 1	Model 2(c)	Model 3(c)	Model 4(c)	Model 5(c)
<b>Race and Segregation</b>					
African American	0.50 (0.70)	1.92** (0.67)	1.34 (0.79)	2.15* (0.86)	0.01 (0.39)
Segregation	0.37 (2.59)	0.03 (1.90)	4.04** (1.48)	4.88** (1.83)	3.01*** (0.80)
<b>Poverty and Vulnerability</b>					
Afr. Amer. Poverty	1.43** (0.54)	1.24 (0.76)	0.27 (1.08)	-1.41 (1.28)	-0.22 (0.53)
Hurr. Floyd	-0.43 (0.99)	-0.85 (2.23)	0.22 (0.65)	0.52 (0.90)	0.57 (1.46)
Hurr. Fran	2.24* (0.93)	1.35 (2.07)	2.51* (1.08)	1.57 (1.01)	0.09 (1.42)
100-yr FP	28.86 (15.21)	11.65* (5.25)	3.89*** (1.11)	2.40 (1.72)	1.17 (0.83)
500-yr FP	8.42 (9.48)	1.87 (3.51)	5.89*** (1.68)	8.52*** (2.38)	4.80** (1.65)
V-zone	-2.64 (3.10)	-11.72 (6.18)	0.00 (.)	0.00 (.)	-7.81*** (1.47)
<b>Other Controls</b>					
Seniors	-8.36* (3.46)	3.84 (3.88)	3.35 (4.28)	11.29** (4.24)	2.57 (3.13)
Rural	-0.77 (0.52)	-0.44 (0.62)	-1.38 (0.83)	-0.37 (1.22)	-0.64 (0.50)
Mobile Home	4.15** (1.48)	2.90 (1.84)	4.51 (2.55)	3.56 (3.41)	2.14 (1.38)
Home Value < \$100K	-1.25 (0.74)	-0.37 (0.44)	-0.88 (1.88)	-0.67 (2.88)	0.02 (0.53)
Older Homes	1.84* (0.94)	-0.43 (1.24)	-1.57 (1.35)	-5.05 (2.78)	-0.64 (1.00)
New Homes	1.67** (0.64)	-3.09** (0.99)	-2.38 (1.71)	-5.10* (2.45)	-1.78 (1.09)
County Pop.	0.08** (0.03)	-0.01 (0.02)	-0.13* (0.06)	-0.11 (0.06)	-0.01 (0.01)
County Growth	-0.31 (1.32)	-1.28 (1.14)	-1.73 (1.46)	-1.64 (1.51)	-0.62 (0.53)
Total Population	-0.00 (0.00)	0.00*** (0.00)	0.00** (0.00)	0.00** (0.00)	0.00* (0.00)
Constant	-1.07 (1.82)	-2.44 (1.64)	-6.34** (2.42)	-7.06** (2.62)	0.52 (0.91)
Inalpha		2.54*** (0.17)			0.20* (0.08)
Observations	2122	1556	1491	1491	251
Pseudo R-squared	0.354	0.083	0.348	0.346	0.067

Standard errors in parentheses

=\*\* p<0.05

\*\* p<0.01

\*\*\* p<0.001"

## APPENDIX 4.1. RESULTS OF ADDITIONAL MODELS

Table 14. Regression Results: Buyouts and Change in Number of Vacant Housing Units, 1990-2010				
	Entire State	Eastern Plains	Entire State	Eastern Plains
DIRECT EFFECT				
Number of buyouts	-0.199 (0.122)	-0.223 (0.141)		
High-Buyout Block Group			-8.861 (9.225)	-10.48 (11.14)
SPILLOVER EFFECT				
Number of buyouts	0.0998 (0.247)	0.195 (0.287)		
High-Buyout Block Group			5.955 (18.70)	15.39 (22.30)
CONTROL VARIABLES				
Proportion White	60.13 (62.36)	274.3 (238.8)	59.58 (62.37)	262.5 (238.7)
Proportion Black	62.15 (62.04)	279.7 (238.4)	61.42 (62.05)	267.4 (238.3)
Proportion Latino	49.98 (85.83)	136.1 (224.9)	51.64 (85.96)	134.2 (225.1)
Proportion Native American 1990	68.28 (63.48)	265.9 (238.2)	67.94 (63.48)	254.6 (238.1)
Proportion Seniors	48.67*** (14.67)	-25.23 (35.79)	48.51*** (14.67)	-25.96 (35.81)
Proportion Owner-Occupied HU	26.68*** (5.344)	31.24** (12.68)	26.77*** (5.346)	31.76** (12.70)
Proportion HUs Occupied	-338.9*** (8.771)	-365.5*** (13.91)	-338.9*** (8.786)	-365.5*** (13.94)
Proportion HUs in Urban Area	1.254 (2.649)	11.73** (5.347)	1.246 (2.650)	11.65** (5.352)
Block Group Population	0.00727*** (0.00210)	0.00518 (0.00376)	0.00715*** (0.00210)	0.00483 (0.00376)
Land Area (100,000 sq meters)	0.00505* (0.00267)	0.000229 (0.00393)	0.00508* (0.00267)	0.000281 (0.00393)
Housing Units Built in 1980s (2010)	0.0311*** (0.0111)	0.0728*** (0.0247)	0.0312*** (0.0111)	0.0726*** (0.0247)
Housing Units Built in 1950s (2010)	0.0260 (0.0197)	0.00953 (0.0447)	0.0260 (0.0197)	0.00913 (0.0447)
Housing Units Built Before 1939 (2010)	-0.0123 (0.0200)	0.0258 (0.0483)	-0.0118 (0.0200)	0.0274 (0.0484)
Region (Western = reference)				
Central	-8.822*** (2.635)		-8.798*** (2.636)	
Eastern	-14.60*** (2.926)		-14.71*** (2.947)	
Constant	262.7*** (62.52)	57.43 (239.7)	263.2*** (62.54)	69.12 (239.7)
Observations	6,096	1,780	6,096	1,780
Pseudo R-Square	0.245	0.327	0.245	0.326
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				

Table 15. Regression Results: Buyouts and Newly Constructed Housing Units

	Recently Built Housing Units (2000-2010)				Recently Built Housing Units (2005-2010)			
	Entire State	Eastern Plains	Entire State	Eastern Plains	Entire State	Eastern Plains	Entire State	Eastern Plains
DIRECT EFFECTS								
Number of buyouts	-0.0466 (0.272)	-0.120 (0.242)			-0.113 (0.120)	-0.136 (0.113)		
High-Buyout Block Group			-15.08 (20.63)	-17.96 (19.09)			-13.41 (9.127)	-15.27* (8.901)
SPILLOVER EFFECTS								
Number of buyouts	-0.186 (0.554)	-0.233 (0.493)			-0.161 (0.245)	-0.145 (0.230)		
High-Buyout Block Group			1.744 (41.81)	-2.653 (38.21)			-11.19 (18.50)	-6.873 (17.82)
CONTROL VARIABLES								
Proportion White	838.8*** (139.5)	1,003** (409.4)	838.7*** (139.5)	997.8** (409.1)	313.8*** (61.71)	402.9** (191.0)	313.9*** (61.70)	399.6** (190.8)
Proportion Black	816.2*** (138.8)	955.4** (408.7)	816.2*** (138.8)	949.9** (408.4)	304.7*** (61.40)	382.6** (190.6)	304.8*** (61.39)	379.4** (190.4)
Proportion Latino	791.0*** (192.0)	494.0 (385.6)	791.5*** (192.2)	492.2 (385.7)	403.1*** (84.94)	414.3** (179.8)	400.3*** (85.04)	409.3** (179.9)
Proportion Native American 1990	767.1*** (142.0)	879.6** (408.4)	767.1*** (142.0)	874.3** (408.1)	281.7*** (62.82)	351.1* (190.5)	281.5*** (62.81)	347.6* (190.3)
Proportion Seniors	-232.8*** (32.81)	-402.9*** (61.37)	-232.9*** (32.81)	-403.5*** (61.37)	-72.24*** (14.52)	-134.3*** (28.62)	-72.31*** (14.52)	-134.8*** (28.62)
Proportion Owner-Occupied HU	96.83*** (11.95)	67.66*** (21.73)	97.11*** (11.96)	68.78*** (21.75)	34.45*** (5.288)	22.48** (10.14)	34.50*** (5.289)	22.97** (10.15)
Proportion HUs Occupied	53.79*** (19.62)	86.40*** (23.85)	53.66*** (19.65)	86.24*** (23.89)	22.66*** (8.680)	39.04*** (11.13)	22.99*** (8.692)	39.34*** (11.14)
Proportion HUs in Urban Area	76.58*** (5.924)	52.23*** (9.167)	76.69*** (5.926)	52.44*** (9.171)	32.43*** (2.621)	23.70*** (4.276)	32.49*** (2.622)	23.85*** (4.277)
Block Group Population	-0.0330*** (0.00469)	-0.00315 (0.00645)	-0.0330*** (0.00469)	-0.00317 (0.00644)	-0.0104*** (0.00208)	0.000143 (0.00301)	-0.0104*** (0.00208)	0.000120 (0.00300)
Land Area (100,000 sq meters)	0.0328*** (0.00598)	0.0158** (0.00674)	0.0328*** (0.00598)	0.0158** (0.00674)	0.0126*** (0.00265)	0.00622** (0.00314)	0.0127*** (0.00265)	0.00628** (0.00314)
Housing Units Built in 1980s (2010)	0.139*** (0.0248)	0.268*** (0.0423)	0.139*** (0.0248)	0.268*** (0.0423)	0.0352*** (0.0110)	0.101*** (0.0197)	0.0350*** (0.0110)	0.0999*** (0.0197)
Housing Units Built in 1950s (2010)	-0.351*** (0.0441)	-0.397*** (0.0767)	-0.351*** (0.0441)	-0.396*** (0.0766)	-0.133*** (0.0195)	-0.157*** (0.0358)	-0.133*** (0.0195)	-0.157*** (0.0357)
Housing Units Built Before 1939 (2010)	-0.177*** (0.0448)	-0.188** (0.0829)	-0.177*** (0.0448)	-0.189** (0.0829)	-0.0713*** (0.0198)	-0.0833** (0.0387)	-0.0710*** (0.0198)	-0.0835** (0.0386)
Region (Western = reference)								
Central	34.07*** (5.894)		34.05*** (5.895)		11.82*** (2.608)		11.77*** (2.608)	
Eastern	25.25*** (6.544)		25.17*** (6.591)		10.74*** (2.895)		10.95*** (2.916)	
Constant	-846.8*** (139.8)	-984.3** (411.0)	-846.9*** (139.8)	-979.5** (410.7)	-326.6*** (61.87)	-409.0** (191.7)	-327.0*** (61.87)	-406.2** (191.5)
Observations	6,096	1,780	6,096	1,780	6,096	1,780	6,096	1,780
Pseudo R-square	0.125	0.162	0.125	0.162	0.089	0.129	0.089	0.129
Standard errors in parentheses								
*** p<0.01, ** p<0.05, * p<0.1								

Table 16. Regression Results: Buyouts and Change in Racial Mix (Latinos and Native Americans)

VARIABLES	Change in Proportion Latino				Change in Proportion Native American			
	Entire State	Eastern Plains	Entire State	Eastern Plains	Entire State	Eastern Plains	Entire State	Eastern Plains
DIRECT EFFECT								
Number of Buyouts	0.000114 (0.000141)	0.000220* (0.000116)			-1.13e-05 (1.96e-05)	-1.41e-05 (3.25e-05)		
High-Buyout Block Group			0.00430 (0.0107)	0.0111 (0.00912)			-0.00150 (0.00148)	-0.00176 (0.00256)
SPILLOVER EFFECT								
Number of Buyouts	-0.000279 (0.000287)	-0.000115 (0.000235)			-6.17e-05 (3.98e-05)	-6.03e-05 (6.60e-05)		
High-Buyout Block Group			-0.00670 (0.0216)	0.0131 (0.0183)			-0.00458 (0.00301)	-0.00507 (0.00512)
CONTROL VARIABLES								
Proportion White	0.0814 (0.0722)	0.496** (0.196)	0.0809 (0.0722)	0.496** (0.195)	-0.00191 (0.0100)	0.00321 (0.0549)	-0.00190 (0.0100)	0.00309 (0.0548)
Proportion Black	0.102 (0.0718)	0.481** (0.195)	0.101 (0.0718)	0.482** (0.195)	0.00111 (0.00997)	0.00752 (0.0548)	0.00110 (0.00997)	0.00741 (0.0547)
Proportion Latino	0.592*** (0.0994)	0.710*** (0.184)	0.594*** (0.0995)	0.723*** (0.184)	-0.0263* (0.0138)	-0.0231 (0.0517)	-0.0269* (0.0138)	-0.0247 (0.0517)
Proportion Native American 1990	0.106 (0.0735)	0.487** (0.195)	0.106 (0.0735)	0.488** (0.195)	-0.0997*** (0.0102)	-0.100* (0.0547)	-0.0998*** (0.0102)	-0.100* (0.0547)
Proportion Seniors	-0.0995*** (0.0170)	-0.108*** (0.0293)	-0.0993*** (0.0293)	-0.108*** (0.0293)	0.00650*** (0.00236)	0.0200** (0.00822)	0.00653*** (0.00236)	0.0201** (0.00822)
Proportion Owner-Occupied HU	-0.0863*** (0.00621)	-0.0205** (0.0104)	-0.0861*** (0.00621)	-0.0196* (0.0104)	0.00111 (0.000863)	0.00537* (0.00291)	0.00112 (0.000863)	0.00536* (0.00291)
Proportion HUs Occupied	0.0128 (0.0102)	0.0467*** (0.0114)	0.0125 (0.0102)	0.0453*** (0.0114)	0.00228 (0.00141)	0.00404 (0.00320)	0.00236* (0.00141)	0.00418 (0.00320)
Proportion HUs in Urban Area	0.00881*** (0.00310)	-0.0228*** (0.00438)	0.00881*** (0.00310)	-0.0228*** (0.00438)	-0.00120*** (0.000430)	-0.00260** (0.00123)	-0.00119*** (0.000430)	-0.00258** (0.00123)
Block Group Population	-5.57e-06** (2.43e-06)	-6.11e-06** (3.08e-06)	-5.54e-06** (2.43e-06)	-6.02e-06* (3.08e-06)	9.83e-07*** (3.38e-07)	2.56e-06*** (8.64e-07)	9.87e-07*** (3.38e-07)	2.58e-06*** (8.63e-07)
Area (100,000 sq. meters)	8.71e-07 (3.28e-06)	-4.61e-06 (3.22e-06)	8.44e-07 (3.28e-06)	-4.71e-06 (3.22e-06)	2.98e-07 (4.56e-07)	-4.89e-07 (9.03e-07)	3.06e-07 (4.56e-07)	-4.77e-07 (9.03e-07)
Housing Units Built in 1980s (2010)	2.79e-05** (1.28e-05)	4.40e-05** (2.02e-05)	2.80e-05** (1.28e-05)	4.50e-05** (2.02e-05)	2.87e-06 (1.78e-06)	4.54e-06 (5.67e-06)	2.85e-06 (1.78e-06)	4.39e-06 (5.67e-06)
Housing Units Built in 1950s (2010)	9.19e-05*** (2.28e-05)	4.77e-05 (3.66e-05)	9.16e-05*** (2.28e-05)	4.68e-05 (3.66e-05)	-3.16e-06 (3.17e-06)	-1.59e-05 (1.03e-05)	-3.20e-06 (3.17e-06)	-1.59e-05 (1.03e-05)
Housing Units Built Before 1939 (2010)	-3.39e-05 (2.32e-05)	0.000110*** (3.96e-05)	-3.41e-05 (2.32e-05)	0.000109*** (3.96e-05)	-1.65e-06 (3.22e-06)	1.03e-06 (1.11e-05)	-1.62e-06 (3.22e-06)	9.17e-07 (1.11e-05)
REGION								
Region = Central	0.0194*** (0.00305)		0.0194*** (0.00305)	0 (0)	0.000487 (0.000424)		0.000481 (0.000424)	
Region = Eastern	-0.0111*** (0.00339)		-0.0114*** (0.00342)	-0.443** (0.196)	0.00183*** (0.000471)		0.00188*** (0.000474)	
Constant	0.0275 (0.0724)	-0.442** (0.196)	0.0280 (0.0724)	0 (0)	-0.000779 (0.0101)	-0.0109 (0.0551)	-0.000854 (0.0101)	-0.0108 (0.0550)
Observations	6,095	1,780	6,095	1,780	6,095	1,780	6,095	1,780
Pseudo R-square	0.130	0.061	0.130	0.060	0.255	0.303	0.255	0.303

Standard errors in parentheses  
 \*\*\* p<0.01, \*\* p<0.05, \* p<0.1