

# **Impact of Buyout Programs on Land Use Patterns in the Special Flood Hazard Area of Pitt County, North Carolina**

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The buyout program is a voluntary action by property owners that involves selling their properties after a disaster (such as Hurricane Floyd) to the government and relocating outside the flood hazard risk area. This study examines how buyout parcels affect adjoining properties in the Special Flood Hazard Area.

The study adopts a mixed-method approach involving quantitative and qualitative data collection and analysis. Quantitative aspects include geospatial data acquisition and analysis using descriptive statistics and geographically weighted regression (GWR). The qualitative approach includes semi-structured interviews with key informants and data analysis using descriptive and thematic coding.

This research identified 418 buyout parcels in the study area between 2000-2021. Almost 97% (404) of the parcels are in the special flood hazard area (SFHA). All 418 parcels have been converted into different land uses, including parks, trails, wetlands, and open spaces. The GWR results show that the buyout parcels only explain 5.76% of the SFHA remaining parcels' land value. Further consideration of other explanatory variables, such as parcel size, proximity to school, rescue location, etc., increased the adjusted  $R^2$  from 0.0576 to 0.522, which means that the combination of these variables explains 52.2% of the land value in the SFHA. Study results identified that the buyout timeframe and maintenance cost of buyout parcels were key challenges to the county and the adjoining property owners. This study recommends increasing funding streams to maintain or convert the buyout parcels to the Federal Emergency Management Agency's recommendations, such as parks, bike/hike trails, etc.

Keywords: Buyouts, Land Use Planning.



Impact of Buyout Programs on Land Use Patterns in the Special Flood Hazard Area of Pitt  
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# CHAPTER 1

## 1.1 Introduction

Globally, floods are the most dangerous and consistent natural hazard (Fraser et al., 2006; Lamond et al., 2012; Calil et al., 2015; Highfield & Brody, 2013; Ahmadiani et al., 2019). The threat posed by flooding to human communities, property, businesses, and public infrastructures is second to none (Li & Landry, 2018; Yu et al., 2021). Between 1998 and 2018, flood events recorded more than 3,000 cases globally, estimated at over 556 billion US dollars in damages (Otokiti et al., 2019).

In the United States, losses from natural disasters have grown exponentially since the mid-1900s. For example, Landry and Li (2012) identified that over 80% of the confirmed disaster losses are caused by flooding in the United States. The growth of people and the development of properties in high-risk flood zones, climate change impacts, and shifts in watershed hydrology contribute to the annual increase in flood damages (Ahmadiani et al., 2019; BenDor et al., 2020; Greer et al., 2022). Fraser et al. (2006) have noted that the annual property damage from flooding before Hurricane Katrina cost the nation more than 200 billion dollars; the cost has increased even more since (Highfield & Brody, 2013; Berke et al., 2014; Ahmadiani et al., 2019). The year 2017 was recorded as the most devastating flood event in the United States, with disasters such as Hurricane Harvey, Jose, Irma, and Maria costing over 60 billion USD in economic loss (Nofal & van de Lindt, 2020).

On average, 70 people lost their lives annually between 2006 to 2014 due to flooding in the United States (Li & Landry, 2018; Berke et al., 2014). Before 2006, property damage from flooding was approximately 0.22 billion dollars annually between 1978 and 1992. Between 1993

and 2006, losses averaged a total of 16 billion dollars annually which can be traced to events such as the great Midwest flood of 1993, hurricane Floyd in 1999, and Katrina in 2005 (Fraser et al., 2006; Maly & Ishikawa, 2013; Zavar & Hagelman, 2016). Properties and crops damaged from the direct impact of flooding accounted for approximately 4.47 billion dollars annually between 2006 and 2014 (Li & Landry, 2018; 2012). The alarming loss of human lives and properties calls for flood mitigation efforts. The Federal Emergency Management Agency (FEMA) plays a key role in flood mitigation in the United States.

FEMA is a federal unit with ten regional offices in the United States that assists state emergency management agencies in planning and implementing their hazard mitigation strategies (Godschalk et al., 1999). One of FEMA's tools used for flood mitigation is the Special Flood Hazard Areas (SFHAs) designation. The SFHAs are regions susceptible to flooding and mapped on the Flood Hazard Boundary Map (FHBM) or a Flood Insurance Rate Map (FIRM). The SFHAs include the riverine floodplains (Zones A, AO, AH, A1–A30, AE, A99, AR, AR/AE, AR/AO, AR/A1–A30, and AR/A) and high-risk coastal locations (Zones V, VE, and V1–V30) (Fan, and Davlasheridze, 2016; FEMA, 2020).

Most flood mitigation strategies fall under two broad categories - structural and non-structural approaches (Godschalk et al., 1999; Highfield & Brody, 2013; Consoer & Milman, 2018). The structural flood mitigation approach is cost-intensive and includes constructing engineered seawalls, channels, levees, and revetments to protect flood-prone communities (Highfield & Brody, 2013). The non-structural approach integrates plans and policies that avert physical development in flood-prone areas (Highfield & Brody, 2013). The implementation of non-structural measures, such as restoring floodplains, and protecting riparian buffers, is increasing in the United States as communities move away from costly structural mitigation

measures (Consoer & Milman, 2018). Buyout programs prevalent in the US are a non-structural approach to facilitate a managed retreat for flood mitigation (Zavar & Hagelman, 2016).

Managed retreat entails a collective effort to permanently relocate people and assets away from potentially hazardous areas (Siders et al., 2021; Thaler, 2021; Kraan et al., 2021), coordinated by governments and organizations at multiple scales (Mach & Siders, 2021; Thaler, 2021). Buyout program is a voluntary action by property owners that involves the selling of their residential properties in the floodplains to the government and relocating outside the flood hazard risk area (e.g., Greer et al., 2022; Kraan et al., 2021; Mach et al., 2019; Baker et al., 2018; & Maly and Ishikawa 2013). The county or municipal government then demolishes the acquired property, and the land is to remain an open space for floodplain restoration purposes and managed by the county or municipal government (Binder & Greer, 2016; Tate et al., 2016; Greer & Binder, 2017; Baker et al., 2018; Robinson et al., 2018; Elliott et al., 2020; McGhee et al., 2020). To avoid repetitive loss of properties, home buyouts programs aim to facilitate the permanent relocation of residents outside the proximity of the flood plains (Binder et al., 2015; Calil et al., 2015; McGhee et al., 2020; Pinter & Rees, 2021).

As a response to the high cost of disaster events, including flooding (Greer & Binder, 2017; Nelson & Molloy, 2021), the United States Congress, through FEMA, has provided funding for mitigation through the Hazard Mitigation Assistance (HMA) program (FEMA, 2013; Calil et al., 2015; Greer & Binder, 2017; Nelson & Molloy, 2021). FEMA's Hazard Mitigation Assistance (HMA) program is subdivided into the Hazard Mitigation Grant Program (HMGP), the Building Resilient Infrastructure and Communities (BRIC) (previously Pre-Disaster Mitigation (PDM) grant program), and the Flood Assistance Mitigation (FMA) grant program (FEMA, 2013; Calil et al., 2015; Greer & Binder, 2017; Nelson & Molloy, 2021; Siders, & Gerber-Chavez 2021). The

HMGP plays a significant role in buyout funding nationwide. The program contributes 75% of the funding to buyout an eligible property (Godschalk et al., 1999; Fraser et al., 2006; De Vries & Fraser, 2012; Maly & Ishikawa, 2013; Zavar & Hagelman, 2016; Greer & Binder, 2017; Robinson et al., 2018; BenDor et al., 2020; Atoba et al., 2021). The remaining 25% is the responsibility of the local community and/or the State Government or, in some cases, the homeowners (Fraser et al., 2006; De Vries & Fraser, 2012; Zavar & Hagelman, 2016; Greer & Binder, 2017; Robinson et al., 2018; Atoba et al., 2021). A community can also source the remaining 25% of funds from the U.S. Department of Housing and Urban Development (HUD) 's Community Development Block Grant (CDBG) Program Disaster Recovery funds (Greer & Binder, 2017; Peterson et al., 2020). Following a buyout, the FEMA buyout properties cannot be redeveloped. In contrast, HUD buyout properties can be redeveloped under certain conditions (Siders & Gerber-Chavez, 2021). Other federal government sources of the buyout are the U.S. Army Corps of Engineers (USACE) and the U.S. Department of Agriculture (USDA) (Siders & Gerber-Chavez, 2021). State and Local Governments also fund buyouts using other mechanisms such as municipal bonds, revolving loan funds, local option sales taxes, and stormwater utility fees (Peterson et al., 2020; Siders & Gerber-Chavez, 2021).

There is widespread research on buyout programs in the United States. Researchers have assessed the history, process, and performance of buyouts (Greer & Binder, 2017; Fraser et al., 2006; Maly & Ishikawa, 2013; Godschalk et al., 1999; Binder & Greer, 2016; Baker et al., 2018), the factors responsible for the acceptance or rejection of buyouts (Fraser et al., 2003; Knobloch, 2005; Fraser et al., 2006; Kick et al., 2011; De Vries & Fraser, 2012; Binder et al., 2015; Binder & Greer, 2016; Robinson et al., 2018; Baker et al., 2018; Elliott et al., 2020), the advantages and challenges of buyouts (Zavar & Hagelman, 2016; Mach et al., 2019), the relationship between land

use and buyouts, and the impact of the buyout on homeowners (Knobloch, 2005; Calil et al., 2015; BenDor et al., 2020; Zavar & Hagelman, 2016; Atoba et al., 2021). However, studies that assess the land use change on buyout parcels, the impact of buyout parcels on adjoining properties, and community perspectives of the program are few and far between. Siders & Gerber-Chavez (2021) explain that the land usage of parcels in the aftermath of the buyout determines how successful the buyout was. There are no systematic studies that monitor the land use change following the implementation of a buyout program, including the impact of the buyout on the property value of adjoining parcels within a flood plain. Such a study can examine the county's compliance with FEMA's (1998) stipulation of buyout parcels land usage and evaluate the challenges faced and mechanisms adopted in maintaining the buyout parcels. It can also help identify the potential financial implication of the buyout on adjoining properties. This study intends to fill this gap in the scholarship by evaluating the land use change of buyout parcels and the impact of buyout parcels on adjoining parcels in Pitt County, where multiple buyout programs have been implemented since the Hurricane Floyd event in 1999. The study also seeks local community perspectives on the buyout program, specifically from public officials involved in program implementation.

## **1.2 Research Question**

This study examines how buyout parcels affect adjoining properties in the Special Flood Hazard Area. To answer this key question, the study has the following objectives:

1. Determine whether Pitt County's 2000-2021 buyouts followed FEMA HMGP standards for post-buyout land use and if there were any impacts on the land value of adjoining parcels not bought out in the Special Flood Hazard Area.

2. Investigate key informants' perspectives on the economic, environmental, and administrative results of the buyouts to understand the implementation and challenges attached to the buyout program and whether it impacted adjoining properties in Pitt County.

The findings of this study will help planners, policymakers, and community leaders understand the usage of buyout parcels over a 21-year period (2000-2021), the challenges faced by planning departments in managing the bought-out parcels, and to identify suitable parcels to be bought out in the future.



## **CHAPTER 2**

### **2.0 Literature Review**

This section unfolds the literature on disaster risk and hazard mitigation, the buyout process in the United States, the factors responsible for buyout acceptance or rejection, the challenges of a buyout program, and the links between land use and buyouts.

#### **2.1. Disaster Risk and Hazard Mitigation in the United States**

The annual cost of loss and damage from hazards in the United States is over 15 billion dollars, making hazard mitigation central to long-term community resilience (Cutter et al., 2016). Hazard mitigation involves employing a particular measure to lessen the impacts of hazards on people and properties (Greene et al., 2015). According to FEMA (2022b), hazard mitigation is any long-term measure that minimizes or eliminates the risk of future disasters to persons and property. In other words, hazard mitigation is essential in reducing disaster risks and vulnerability. The most efficient hazard mitigation measures are implemented at the county or municipal level, where development regulation decisions are taken, before an event even occurs (Greene et al., 2015). A hazard mitigation plan is needed prior to mitigation implementation. The mitigation plan follows FEMA guidelines and requires a hazards assessment, which takes place in three phases - hazard identification, vulnerability assessment, and risk analysis - and is essential in understanding potential hazard impacts (Highfield et al., 2014). The other aspects of the mitigation plan following a hazards assessment include identifying mitigation goals & objectives, plan implementation, and monitoring & evaluation of action items in the mitigation plan (Greene et al., 2015).

Hazard identification aims to determine the geographic distribution of hazard risks posed to a community regarding the intensity of hazard factors that might expose a region, such as winds, proximity to the coastline, river, and tributaries (Highfield et al., 2014). The nature of hazard agents, such as storms and their possible impact on a geographical location, determines vulnerability to hazards (Consoer & Milman, 2018; Highfield et al., 2014). Vulnerability assessment considers property and population factors that may enhance or lessen the risk of effect given exposure to varying levels of hazard intensity (Highfield et al., 2014). Risk analysis gives a more comprehensive study of the possibilities of maintaining particular degrees of effect given the nature of the hazards in a region (Highfield et al., 2014). The goal implementation involves identifying the most efficient policies to carry out the mitigation strategies, creating an action plan for the mitigation strategies, prioritizing the policies, identifying funding sources, and assigning implementation responsibilities (Greene et al., 2015). The monitoring & evaluation phase includes preparing an evaluation report at intervals (such as annually) and appropriate plan revisions and updates.

The substantial aspect of hazard mitigation planning starts with the local government. Municipalities must first develop a hazard mitigation plan to stay eligible for federal hazard mitigation funding. These plans can be made at the local, county, or regional levels (Greene et al., 2015). The county or municipal government oversees planning, land use and zoning decisions, and small-scale infrastructure, such as the comprehensive land use plan (Consoer & Milman, 2018), which has been identified as the most promising long-term hazard mitigation approach (Li & Landry, 2012; Berke et al., 2014; Highfield et al., 2014) because of its cost-effectiveness by reducing insured losses from hazards (Li & Landry). FEMA's hazard mitigation assistance funds

qualifying actions such as storm sewer system improvement projects to mitigate disaster losses (FEMA, 2022b).

Apart from funding the state and county governments, the federal government, through its agencies, constructs, operates, and maintains federally owned infrastructures and oversees some floodplain management and stream restoration projects (Consoer & Milman, 2018). The Flood Control Act of 1928 was the first flood mitigation program in the United States, which empowered the Army Corps of Engineers to develop and build flood-control projects. Due to the severe increase in flood damages during the 1960s, the National Flood Insurance Program (NFIP) under the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973 (Platt, 1999) were established as a non-structural program that encouraged land use planning as a hazard mitigation tool (Li & Landry, 2012; Highfield & Brody, 2013; Zavar & Hagelman, 2016; Ahmadiani et al., 2019; McGhee et al., 2020). "The NFIP is a voluntary joint venture between the federal and the state governments, private insurance companies, and local communities," and over 20,000 municipalities in the United States are participating in the program (Li & Landry, 2012). The minimum NFIP requirements consist of adopting and enforcing floodplain regulations based on FEMA-provided flood data (Highfield & Brody, 2013). The regulations include determining the location of structures in the special flood hazard area (SFHA), requiring permits for development(s) in SFHAs, elevating new structures in the SFHA, and ensuring that floodwaters are not raised due to physical development. The SFHAs are usually generated from FEMA's Flood Insurance Rate Maps (FIRMs) by using topographic, meteorological, hydrologic, and hydraulic data to anticipate the geographical bounds of the base flood (100-year event) (Ahmadiani et al., 2019). Currently, over 22,000 municipalities in the United States participate in the NFIP, with

about 5.5 million NFIP policies bought by individual households in those participating communities (Highfield & Brody, 2013; Ahmadiani et al., 2019).

The Community Rating System (CRS) was established by the Federal Emergency Management Agency (FEMA) in 1990. The CRS is a part of the National Flood Insurance Reform Act as a voluntary initiative for NFIP participating communities to raise flood hazard awareness, incentivize flood insurance purchases, and promote flood hazard mitigation (Li & Landry, 2012; Highfield & Brody, 2013; Berke et al., 2014. Brody, and Highfield, 2013; Fan, and Davlasheridze, 2016). To decrease flood loss, the CRS program is structured in a credit accumulation format with eighteen mitigation activities subdivided into four categories: public information, mapping and regulatory, damage reduction, and emergency preparedness (Berke et al., 2014; FEMA, 2021). When a CRS community's flood management measures meet these objectives, the CRS credits the community. The flood insurance premiums for the residents are modified to reflect the community's mitigation efforts to decrease flood risk (Li & Landry, 2012; Berke et al., 2014). The CRS has over 1,500 municipalities across the United States that engage in the program by adopting local mitigation, floodplain management, and outreach efforts that go above and beyond the minimal NFIP standards. Over 3.6 million policyholders in these CRS communities account for more than 70% of NFIP flood insurance coverage (FEMA, 2021).

Various studies have evaluated the implementation of federal government mitigation policies and their influence on local government mitigation plans. Berke et al. (2014) assessed the impact of federal policy on the adoption of land use policies in local mitigation plans compared to the influence of state policy. Berke and his colleagues (2014) adopted comparative statistics to evaluate the adoption of federal policies in selected communities in Florida and North Carolina. The study also adopted the multivariate Poisson regression analysis to examine the influence of

federal and state government policies on local government. They observed that the federal incentives scheme under the CRS is insignificant to local governments' support of preventative land use actions.

On the other hand, the state government mitigation policies influence the inclusion of land use activities in local mitigation plans. While Berke and his colleagues conducted their study in North Carolina and Florida, Li and Landry (2018) conducted a similar study in North Carolina. Li and Landry (2018) assessed the plausible factors that affect communities' willingness to adopt and implement federally incentivized hazard mitigation measures in North Carolina. The study obtained five community-level datasets, including each county's per capita property taxes and unemployment rates. Using the basic dynamic panel-data model to analyze the data, Li and Landry (2018) observed that communities with higher levels of local government tax revenue have higher levels of flood hazard mitigation. Also, communities with high crime, unemployment, and low school quality have fewer mitigation actions.

Highfield and Brody (2013) evaluated the effectiveness of the CRS program in reducing flood-related losses. They randomly selected 450 communities participating in the CRS and evaluated the communities between 1999 and 2009. The study adopted the linear panel regression model to analyze the acquired datasets. The results show that three CRS activities, freeboard requirements, open space protection, and flood prevention, minimize flood damage considerably (Highfield & Brody, 2013). In another study, Fan and Davlasheridze (2016) examined residential location choices resulting from locally implemented flood mitigation measures recognized by the CRS. This study adopted a sorting model and obtained datasets across the United States, including the flood risk regions, demographics of people within the flood risk region, flood plain, and flood

mitigation data. Fan and Davlasheridze (2016) observed that individuals born in high-risk regions are more willing to pay for community-level flood mitigation activities.

In the United States, the number of properties that have experienced repeated flood damage has more than doubled in the last two decades (Siders & Gerber-Chavez, 2021). The federal government sees the buyout program as a viable alternative mitigation approach to avoid repetitive loss. "The National Institute of Building Sciences estimates that buyouts save \$5 to \$9 for every \$1 spent on mitigation" (Siders & Gerber-Chavez 2021, pp 1).

## **2.2. The Buyout Process**

The existing legal template for the first and longest existing voluntary buyout mitigation program, the HMGP, can be traced to the 1988 Stafford Act, Section 404 (Godschalk et al., 1999; Maly & Ishikawa, 2013; Tate et al., 2016; Mach et al., 2019; Elliott et al., 2020; Nelson & Molloy, 2021). The purpose of the 1988 Stafford Act is to aid state and community recovery after a presidential disaster declaration (Godschalk et al., 1999). FEMA, through the HMGP, started home buyouts in Mississippi after the Mississippi and Missouri rivers flooded in 1993 and rural areas such as eastern North Carolina after Hurricane Floyd in 1999 (Fraser et al., 2006; Maly & Ishikawa, 2013; Zavar & Hagelman, 2016; Tate et al., 2016; Greer & Binder, 2017; Elliott et al., 2020; Atoba et al., 2021; Bukvic & Borate, 2021). The devastating mid-west flooding event of 1993 prompted legislative amendments by the United States Congress to prioritize flood prevention (Bukvic & Borate, 2021), and the buyout program is now available to every county in the United States as a tool to prevent repetitive flooding loss (Elliott et al., 2020).

Over 41,000 property owners have benefitted from the FEMA voluntary buyout program funds from its inception until 2022 (Fraser et al., 2006; Greer & Binder, 2017; Mach et al., 2019; Elliott et al., 2020; McGhee et al., 2020; Atoba et al., 2021). Forty-nine states and three U.S.

territories have participated in residential property buyouts, receiving roughly \$779 million between 2000 and 2016 (Mach et al., 2019; Robinson et al., 2018; Siders, 2019).

Mitigation funds are channeled mainly through FEMA and the Department of Housing and Urban Development (HUD) (Atoba et al., 2021; Curran-Groome et al., 2021; Kraan et al., 2021). While FEMA disburses the buyout program funds through the HMGP, the Department of Housing and Urban Development (HUD) funds the program through the Community Development Block Grant (CDBG) Program Disaster Recovery funds. Atoba et al. (2021) explain that FEMA's HMGP is the primary source of buyouts, and HUD's CDBG is the supplementary mitigation fund source. The federal government funds both programs, but they are implemented by the state and local governments of the affected areas (Godschalk et al., 1999; Binder & Greer, 2016; Baker et al., 2018; Siders, 2019).

After a presidential-disaster declaration, about 15% to 20% of federal assistance funds are diverted to mitigation projects such as buyouts, utility, and infrastructure retrofits, and drainage improvement projects (Robinson et al., 2018; BenDor et al., 2020; FEMA, 2021). At the county level, the local flood control districts of the affected municipalities meet to decide how to prevent the future occurrence of such disasters (Greer & Binder, 2017; Elliott et al., 2020; Greer et al., 2022). If a buyout is decided upon as the best alternative to prevent future occurrences (Greer & Binder, 2017), and there is adequate community support for the proposal (De Vries & Fraser, 2012; Robinson et al., 2018), the affected communities apply to the state government (Greer & Binder, 2017). Subsequently, the state reviews the applications, prioritizes the projects, and sends the applications to FEMA's regional office for HMGP funds (De Vries & Fraser, 2012; Robinson et al., 2018).

FEMA considers specific criteria before approving the state's proposal. A benefit-cost analysis (BCA) (Robinson et al., 2018) is conducted, and FEMA grants funds to the affected states if the repair cost is beyond 50% of the pre-disaster property value, the project is in the special flood hazard area, and the project is environmentally sound (De Vries & Fraser, 2012; Robinson et al., 2018). After the funds are approved, the state starts the implementation process by offering the owners of the severely damaged residential properties the pre-disaster market price of their properties (Fraser et al., 2003; Zavar, 2015; Zavar & Hagelman, 2016; Tate et al., 2016; Robinson et al., 2018; Frimpong et al., 2019; BenDor et al., 2020; Greer et al., 2022). A buyout is a voluntary action, and if an affected homeowner accepts the offer, the homeowner must relocate outside the floodplain (Curran-Groome et al., 2021; Mach et al., 2019; Robinson et al., 2018; Baker et al., 2018; Greer & Binder, 2017; Maly & Ishikawa, 2013). On average, property acquisitions take between seven to eighteen months to complete (FEMA, 1998; Greer & Binder, 2017; Robinson et al., 2018), but studies show that in some cases, the buyout process lasted for years which could lead to additional expenses on the part of the homeowners (e.g., Baker et al., 2018; Curran-Groome et al., 2021; Siders & Gerber-Chavez, 2021).

Greer and Binder (2017) have reviewed the effectiveness and progress of buyout programs over the years. They adopted the policy learning theoretical framework to understand the buyout programs' trajectory. Policy learning is an approach that helps to understand which variation leads to a given outcome within a particular context (Siders & Gerber-Chavez, 2021). Greer and Binder (2017) observed that the programs have not evolved and noted that the previous buyout programs' methodology differs, making it difficult to track the policy learning in the program. While Greer and Binder (2017) observed policy learning paucity across buyout programs, they found an exception in Kinston, North Carolina, after Hurricane Floyd. Policy learning was observed in



Kinston because the town understood the mitigation mechanism outcome after Hurricane Fran struck in 1996. Kinston built on that experience after the 1999 Hurricane Floyd. In another study, Curran-Groome et al. (2021) evaluated the budget structure across counties and municipalities participating in the buyout program and observed the dearth of policy learning as the existing buyout budgets and grant awards. Land acquisition prices are generally publicized, while other, less obvious project expenditures, such as communication costs between the buyout participants and administrators, are rarely disclosed. However, property purchase price data gives no foundation for future enterprises to learn from and build on previous experience.

While one of the program's attributes is the voluntariness of participation, Fraser et al. (2003) observed that the buyout programs in four different floodplains (Greenville, North Carolina, Kinston, North Carolina, Grand Forks, North Dakota, and San Antonio, Texas) were not absolutely a voluntary action by the homeowners. A few homeowners were reluctant to participate in the buyout but were pressured as they had no alternative. Furthermore, De Vries and Fraser (2012) have questioned the buyout program participants' voluntariness. They define a voluntary mitigation program as a process that considers the input of all socio-economic groups in project decision-making from when the idea was conceived to the implementation of the project. Using a telephone survey, De Vries and Fraser contacted buyout program participants in the four locations identified by Fraser et al. (2003). De Vries and Fraser (2012) observed that 81% of the buyout recipient experienced flooding for the first time in their homes and had an average of 17 years of residency among homeowners in the study areas. However, the local governments did not offer them other options, such as home elevation or levee construction. Instead, there was intense pressure from the local government on the homeowners to accept the buyout offer. This indicates

that the buyout program is not always voluntary (De Vries & Fraser, 2012), and certain factors determine the acceptance or rejection of the buyout program.

### **2.3. Factors Responsible for Buyout Acceptance or Rejection.**

Over the years, various factors responsible for buyout acceptance or rejection were identified in the literature. Psychological attachment to the environment, demographic and economic aspects, the relationship between flood buyout managers and the community, community resilience, federal policies, and property attribute have been identified as some of the factors (Fraser et al., 2003; Knobloch, 2005; Fraser et al., 2006; Kick et al., 2011; De Vries & Fraser, 2012; Binder et al., 2015; Binder & Greer, 2016; Robinson et al., 2018; Baker et al., 2018; Elliott et al., 2020). Fraser et al., (2003) assessed the feasible factors that prompted the acceptance of the buyout program by affected homeowners in four different flooded urban areas in the United States. They reported that pressure from the local government constricted the affected homeowners to accept the buyout as the only viable alternative or mitigative measure to the flooding event. Elliott and team (2020) evaluated over 40,000 residential buyout properties in the contiguous United States over 25 years. Their results showed that though white communities have more access to buyout programs, people of color are more likely to accept the buyout. Elliott et al. (2020) observed that buyouts are more accessible to white communities as white working-and middle-class residents could organize to lobby for an entire community buyout, such as in the case of Staten Island and along the Jersey shore (Elliott et al., 2020). However, people of color are more likely to be pressured to accept the buyout to promote urban renewal, such as in the case of Kashmere Gardens in Houston (Elliott et al., 2020). These observations contradict those of Robinson and colleagues (2018), who found that the possibility of white respondents accepting a buyout is twice as much as non-white respondents. According to Robinson et al. (2018), the

relationship between income and race may explain why white respondents are more likely to accept a buyout compared to non-white respondents. In their study, 23% of white respondents and 45% of non-white respondents reported incomes of \$50,000 or less. This suggests that low-income homeowners, who have fewer alternatives, are less inclined to accept the buyout offer.

Binder et al., (2015) have observed that Oakwood Beach and Rockaway Park, New York made different decisions despite being affected by Hurricane Sandy and having similar demography. While investigating the possible factors responsible for the significant buyout acceptance in Oakwood Beach, Binder et al. (2015) identified community perception as a factor. Homeowners in Oakwood Beach believed in relocating from an environment deemed unlivable. In contrast, the large buyout rejection in Rockaway Park was ascribed to the community's resilience perception, where Rockaway Park homeowners believed in rebuilding (Binder et al., 2015). Homeowners also influenced one another's decisions in both study areas.

Another study where community cohesion was identified as a factor responsible for relocation was by Knobloch (2005). Knobloch asserted that the Valmeyer community's cohesion played a major role aftermath of the 1993 great flood that struck Valmeyer. Within the first sixty days of the event, the community had already set up seven committees comprising homeowners. These committees included the design committee, infrastructure committee, and other important committees. These committees' input was an essential factor that aided mass relocation after the great 1993 Midwest flood.

Baker et al., (2018) investigated what Oakwood Beach homeowners faced after Hurricane Sandy during the buyout period. They observed that the fear of losing basic amenities in the community if most residents agreed to the buyout, in turn, pushed individual homeowners to accept their buyout offer. In other words, the government could use the 'eminent domain policy' to evict

the few homeowners who rejected the study area's buyout (Baker et al., 2018). These results are consistent with those of Binder and colleagues (2015), which shows that neighbors' decisions affected individual homeowners' decisions.

The financial incentive is also a factor responsible for buyout acceptance. For instance, Baker and co-researchers (2018) observed that financial incentives were a possible factor accountable for buyout acceptance in Oakwood Beach. The buyout program aimed to avoid checkerboarding by offering financial incentives to homeowners who decided to relocate with their neighbors on conterminous properties. This result is consistent with Binder and Greer (2016), who explored the buyout program configuration and the impact on residents in their study area. Binder and Greer (2016) identified financial incentives as a determining factor of buyout acceptance, among other factors.

Fraser and colleagues (2006) have examined factors responsible for accepting or rejecting buyout programs by repetitive loss homeowners. Their results showed that the availability of the 25% matching fund is a determinant of buyout acceptance or rejection (De Vries & Fraser, 2012; Zavar & Hagelman, 2016; Greer & Binder, 2017; Robinson et al., 2018; Atoba et al., 2021). Also, a smooth relationship between the buyout managers and the homeowners was identified as a determinant of acceptance or rejection (Fraser et al., 2006). Other factors identified in their study include the time frame of the buyout process and the homeowners' attachment to their environment, consistent with Binder and team's findings (2015).

#### **2.4. Advantages and Challenges of the Buyout Program.**

The identifiable goals of the buyout programs are to avoid future property loss or repetitive loss from flood events and prevent homeowners from flood-related morbidity and mortality. The buyout programs also reduce the federal government's expenses on emergency response, such as

infrastructure reconstruction, disaster relief funds, and flood insurance subsidies (Robinson et al., 2018). The bought-out properties converted to open space or recreational parks can increase the property value of the adjoining neighborhood, specifically in urban areas, and improve community revitalization (Zavar & Hagelman, 2016; Mach et al., 2019; Atoba et al., 2021).

The performance of buyout programs has been under the microscope of researchers. Researchers have conducted various studies and gathered information about the reliability and efficacy of the program from homeowners, community leaders, and program administrators. While some buyout programs may have achieved their primary objectives, others have faced challenges. In the case of Oakwood Beach, Binder and Greer (2016) and Baker and colleagues (2018) reported that buyouts were offered to homeowners in the floodplain without considering the community's social cohesion. In other words, buyouts were offered to some homeowners within a residential block on the street and not to the other half of the block because they were not geographically in the floodplain. This act produced a negative outcome and disintegrated social cohesion in the affected communities (Baker et al., 2018).

Another challenge of buyouts is property evaluation and financing. Usually, the buyout funding offered to homeowners is the pre-disaster value of the home, but sometimes, that amount may not be adequate to purchase a similar property in another location (Binder & Greer, 2016; Robinson et al., 2018; Fraser et al., 2003; Zavar, 2015; Tate et al., 2016; Frimpong et al., 2019; Greer et al., 2022) which can put homeowners in difficult situations. Baker and colleagues (2018) observed that after Hurricane Sandy, while some homeowners were waiting for the buyout funds, they opted for repair funds from FEMA to repair their homes. Eventually, when they received the buyout funds, the repair funds were deducted because of the "double-dipping" policy, which prevents the federal government from paying duplicate benefits (Greer & Binder, 2017).

Inadequate government involvement has also been identified as a challenge that buyout programs face. Apart from the fragmented power across and among local, state, and federal entities, resulting in inconsistent project advice and interpretations as identified by Curran-Groome et al. (2021), there can be a lack of technical knowledge at the local government level. For instance, Baker et al. (2018) reported that homeowners complained about the incompetency of the implementing agency's representatives. Specifically, these representatives lacked the technical know-how and could not respond to case-specific and programmatic questions. Secondly, the local government does not help identify new habitable homes for flood victims after the buyout (Greer & Binder, 2017; McGhee et al., 2020; Greer et al., 2022; Curran-Groome et al., 2021). The homeowners might eventually relocate to another floodplain because of the lack of guidance from their local government (McGhee et al., 2020). In their Oakwood Beach post-Sandy study, Binder and Greer (2016) identified that homeowners in the study area did not prioritize financial incentives. Instead, homeowners were more interested in obtaining an equivalent, well-secured house.

In some cases, policies determine to whom buyout offers are made. Some programs restrict the amount that may be paid for any home. In contrast, others deem homes worth more than a particular sum unsuitable for buyouts, according to the view that government buyouts are not designed to help affluent property owners (Siders & Gerber-Chavez, 2021). For instance, properties that would cost over \$276,000 for acquisition and demolition in Pitt County were assumed not to be cost-effective by FEMA (Pitt County n.d; Robinson et al., 2018).

## CHAPTER 3

### 3.0 Methodology

Researchers have adopted qualitative and quantitative methods to examine buyouts and relocation-related issues. Anpar (2022) explains the primary goal of qualitative research: to investigate a small group's in-depth behavior, views, and attitudes more openly rather than following a structured list of questions. On the other hand, quantitative research evaluates a mechanism in a numerical form, which is easier for decision-makers to pick up and grasp (Anpar, 2022). For example, De Vries and Fraser (2012) and Binder and Greer (2016) conducted a semi-structured interview in their study of citizens' experience and decision-making on buyouts, which is a qualitative approach. Also, Robinson et al. (2018) and Mayer et al. (2020) conducted telephone interviews with their respondents in their study of buyout acceptance and post-disaster relocations. Barile et al. (2019) conducted a quantitative survey to examine the post-disaster quality of life and recovery. Mach et al. (2019) and Pinter and Rees (2021) adopted the quantitative geospatial method in their studies to examine the performance of the buyout program in the US and community relocation. Some studies adopted the mixed-method approach. For instance, Kick et al. (2011), Binder et al. (2015), and Baker et al. (2018) conducted interviews and carried out surveys in their studies of community recommendations integration into the buyout program and acceptance of the buyout program. The qualitative research approach encourages discussion, is flexible, and explores research in-depth (Anpar, 2022). Qualitative research's weaknesses include the lack of respondents' privacy and sample selection bias (Anpar, 2022). The quantitative method encourages a larger sample size. It offers continuous data usage and anonymity of data. However,

it is limited as answers obtained cannot be followed up and cannot answer beyond the set questions on the survey (Anpar, 2022). Therefore, this study adopts a mixed-method approach that combines quantitative and qualitative approaches to achieve its objectives.

### **3.1 The Study Area**

Pitt County (see Figure 1) was established in 1760 and named after William Pitt, a British leader who backed the colonists' quest for freedom. The historical inhabitants of Pitt County are the Tuscarora Indians, English, and Welsh. The county's seat is Greenville, incorporated in 1771 (Mazzocchi, 2006). With a 2022 estimated population of 170,273, Pitt County is the 48th fastest-growing and 16th most populous county out of the 100 counties in North Carolina (Office of State Budget and Management, 2020). The racial configuration of the study area accounts for 58.9 percent White population, 34.1 percent Black, and other races are 7 percent (Log Into North Carolina, n.d.). Pitt County predominantly engages in agricultural activities related to vegetables, poultry, hog, soybeans, and tobacco production (Mazzocchi, 2006). The county also manufactures fabrics, pharmaceuticals, concrete products, and furnaces (Mazzocchi, 2006).



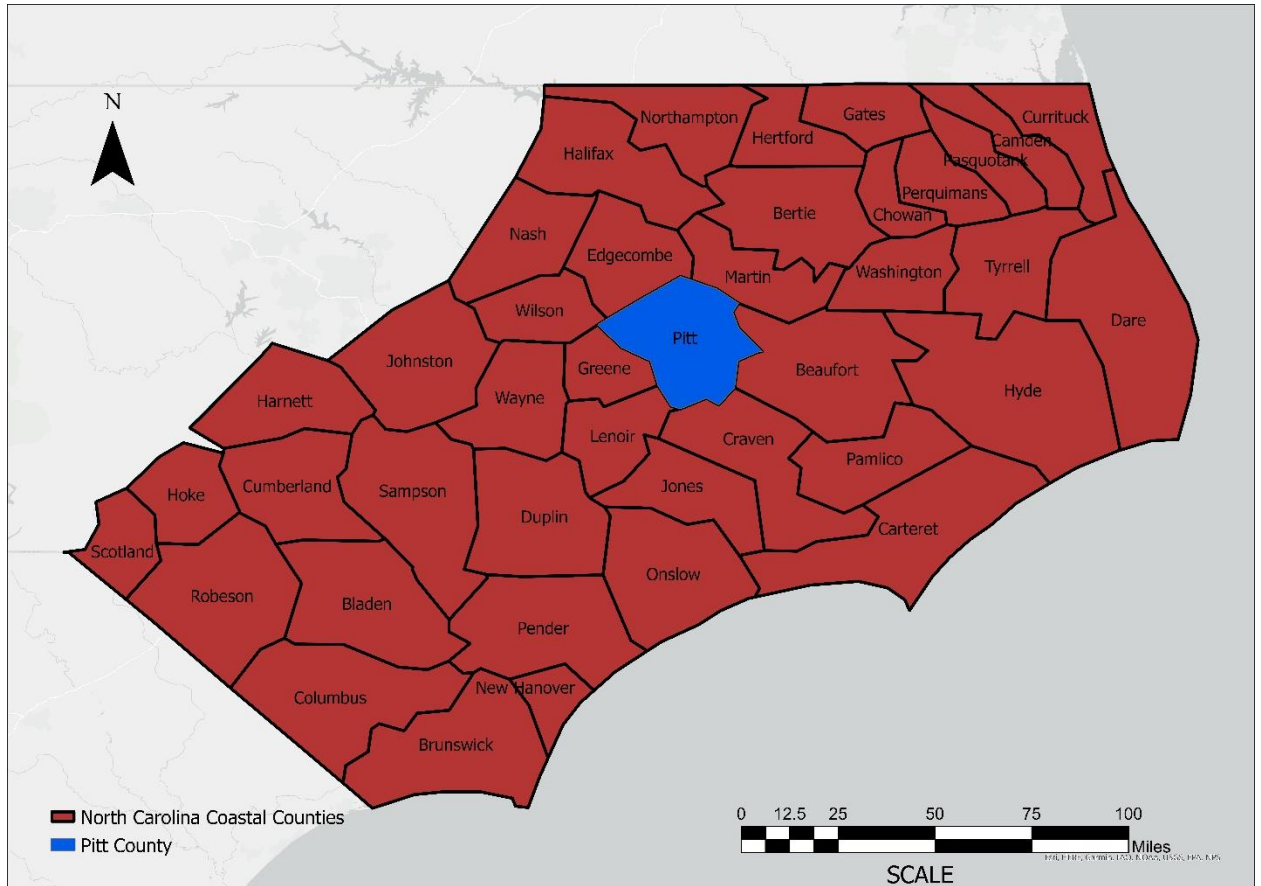


Figure 3.1: The study area

(Data Source: United State Census Bureau 2021).

Pitt County's land area is 651.98 square miles, and the county shares boundaries with Beaufort, Craven, Edgemcombe, Wilson, Greene, Lenoir, and Martin counties. (United States Census Bureau, 2010). The county experienced flooding in 1999 due to Hurricane Floyd, which caused over \$300 billion in damages to communities, infrastructures, and businesses (Mazzocchi, 2006; Pitt County, n.d). The primary type of flooding in Pitt County is riverine, with over thirty potential flood-prone areas including along the Tar River, where major parcels were bought out (Pitt County, NC. n.d). From 1999 to 2022, FEMA declared 20 presidential disasters in Pitt County, comprising two COVID-19-related disasters, two severe storms, and sixteen hurricane-related disasters (FEMA, 2022).

During Hurricane Floyd, over 4,000 structures were damaged in Pitt County, including 1,893 buildings in Greenville. Over one thousand buildings were destroyed beyond repair by the flood event (Pitt County, n.d; Fraser et al., 2003; Department of Planning & Community Development, 2004; De Vries & Fraser, 2012; Greer & Binder, 2017). After Hurricane Floyd, the Pitt County buyout program included five phases and 202 homeowners applied for a buyout. Seventy-eight homeowners withdrew their applications, and a total of 124 properties were bought by the county totaling 288 acres. The City of Greenville had a separate buyout program. A total of 450 homes were bought in the City of Greenville (Pitt County, n.d; Fraser et al., 2003; De Vries & Fraser, 2012). Pitt County demolished the buyout structures and assisted the City of Greenville and the Town of Grifton during their demolition activities (Pitt County, n.d). The county and the City of Greenville made the land parcels from the buyout properties available for lease to private individuals or groups, preferably by the adjoining property owner (Pitt County, n.d; Department of Planning & Community Development, 2004).

### **3.2 Objective One:**

Determine whether Pitt County's 2000-2021 buyouts after Hurricane Floyd followed FEMA HMGP standards and if there were any impacts on the land value of nearby parcels that were not bought out.

According to FEMA (1998) standards, buyout parcels must be left as open spaces such as wetlands, greenways, recreational facilities, and wildlife refuges (FEMA, 1998). To determine whether this was the case for buyouts after Hurricanes Floyd, Irene, Matthew, and Florence in Pitt County from 2000 to 2021, this study calculates buyout descriptive statistics (e.g., mean, standard deviation, etc.) following Zavar and Hagelman (2016) and Mach et al. (2019). The Pitt County Planning Department provided the list of the buyout parcels by the county between 2000-2021 in

a CSV format (standalone table), which was a total of 211 parcels, and the shapefile of the entire Pitt County land parcels, which is 76,767 parcels. The City of Greenville provided a list (in a CSV format) of the buyout parcels by the city after Hurricane Floyd, totaling 310 parcels.

Using the Add Join (Data Management Tool) in ArcGIS Pro 2.9, the common column (parcel ID) between the buyout parcels standalone table and the entire Pitt County parcels attribute table was used to join the buyout parcels list with the Pitt County parcels shapefile. The Select By Attribute geoprocessing tool was used to identify the buyout parcels provided by Pitt County from the joined Pitt County parcel shapefile in the GIS environment. The City of Greenville only provided the buyout parcels' addresses. To identify them in the GIS environment, the 310 parcel addresses were geocoded using the Pandas and Geopy libraries in Python 3.10.0. A total of 207 parcels were geocoded successfully. No spatial data projection was required because the identified 211 and 207 buyout parcels have the same Geographic Coordinate System (GCS) World Geodetic System (WGS 1984).

In total, 418 buyout parcels were identified in the GIS environment. The Pitt County online parcel information system (OPIS: <https://gis.pittcountync.gov/opis/>) was used to verify each parcel's attribute, including the parcel's financial value. The results were presented using descriptive statistics. Google Earth historical imagery was also adopted to visually examine the changes in the bought-out parcels (Zavar & Hagelman, 2016).

This study adopted Anselin Local Moran's I spatial autocorrelation in a GIS, which is a statistical method to understand the spatial dependence of adjoining properties' land value. Spatial autocorrelation examines whether there is spatial clustering, dispersion, or randomness in similar attributes among neighboring locations. (Hu et al., 2016; Esri., n.d). After that, this study employed regression analysis to understand the variables accounting for the land value in the study area.

Previous studies have adopted the Ordinary Least Squares (OLS) regression, Random Coefficient Model (RCM) (Giuliano et al., 2010; Munroe et al., 2007), and Geographically Weighted Regression (GWR) (Hu et al., 2016). The OLS adopted by Munroe (2007) is a global statistical regression model that evaluates the relationships between a dependent variable and explanatory variables. The OLS assumes that the relationships under study are constant over space (Hu et al., 2016, pp 5). The RCM is suitable for hierarchical datasets. For instance, when there are residential and neighborhood datasets, the model can generate an interclass correlation known as the degree of resemblance between micro-units within a macro unit (Giuliano et al., 2010). The RCM and OLS cannot account for non-stationary variations in explanatory variables (Brunsdon et al., 1998; Guiliano et al., 2010; Hu et al., 2016; Mollalo et al., 2020). The GWR was introduced by Brunsdon et al. (1996) to bridge the spatial gap in the OLS and RCM (also known as multilevel modeling) by introducing a nonparametric estimate to the coefficients of explanatory variables, which accounts for the geographical location of each case of the explanatory variable (Brunsdon et al. 1996, 1998). The GWR is a local statistical model that considers the impact of non-stationarity explanatory variables, such as distance, on the dependent variable (Hu et al., 2016). It is also recommended for examining land value across geographical space (Brunsdon et al., 1998). Therefore, to understand the variables accounting for the land value in the study area, this study adopted GWR.

In the GWR, explanatory variables are independent or predictor variables where changes are observed. The dependent variable, also known as the outcome variable, is what changes in reference to the observations in explanatory variables (Bhandari, 2022). In this study, the explanatory variables considered as the determinants of the SFHA parcels' land value totaled seven: 1) distance from each buyout parcel to the adjoining parcel, 2) size of the parcel, 3) distance

to the nearest park, 4) distance to the nearest school, 5) distance to the nearest river, 6) distance to the nearest police department, and 7) distance to the nearest rescue location (Brigham, 1965; Munroe, 2007; Giuliano et al., 2010; Hu, 2016). The Near (Analysis) tool was used to calculate the distances between the nearest explanatory variables to the SFHA parcels. The Geodesic distance calculator method was selected in the Near tool to calculate the shortest distance between the explanatory variables and the dependent variable because the datasets are stored in a geographic coordinate system (WGS 84). The Geodesic method account for the Earth's curvature in calculating the shortest distance between variables. In contrast, the Planar method adopts the Euclidean distance, which assumes a flat plane between the variables' distance. The distance calculation was conducted between the explanatory variables' point feature classes and the centroid of the dependent variable polygon feature class. After that, this study adopted the Variance inflation factor (VIF) to detect multi-collinearity among variables. Multicollinearity is the presence of high intercorrelations between two or more independent variables in a multiple regression model, which can result in skewed or misleading results (Hayes, 2022). While there is no universal VIF threshold, Todd (2015) argued that the smaller the VIF, the lesser the multicollinearity possibility, and a threshold of 5 is acceptable. Therefore, the explanatory variables with  $\leq 5$  VIF value were considered for the GWR model (Todd, 2015; Mollalo et al., 2020).

From the Geographically Weighted Regression (GWR) (Spatial Statistics) tool, the continuous model type was adopted because the datasets are continuous variables, and the square root transformation was conducted to normalize the data. This study also integrated the bi-square weighting scheme because it avoids the influence of far-away observations on bandwidth parameters, unlike the Gaussian kernel. Gaussian kernel assigns values to all observations in a way that far-away observations could influence moderate to large bandwidth parameters (Oshan et al.,

2019; Mollalo et al., 2020). The Golden search method was used to search for the corrected Akaike information criterion (AICc), the model fit criterion (Oshan et al., 2019). Two sets of models were present in this study. The first model integrated only the bought-out parcels' distance to adjoining properties in the SFHA as an explanatory variable to understand how the buyout parcels explain the land values of adjoining properties. The second model presented is the integration of other identified explanatory variables. The outcome of this analysis is to determine the extent to which the explanatory variables explained the land value of the adjoining buyout parcels.

### **3.3. Objective Two:**

To investigate key informants' perspectives on the results of the buyouts to understand the implementation and challenges attached to the buyout program in Pitt County and its impacts on adjoining properties.

To achieve this objective, this study acquires (Kick et al., 2011; Zavar & Hagelman, 2016; BenDor et al., 2020) qualitative data from key informants through in-depth semi-structured interviews. Interview sessions were conducted with planners, emergency managers, and floodplain managers (Zavar & Hagelman, 2016; BenDor et al., 2020). Six key informants participated in the semi-structured interview session. They included one participant from the State, three from Pitt County, and two from the City of Greenville. Table 3.1 shows the breakdown of the interviewed key informants' professions and their participation in the buyout since 2000. The respondents have participated in at least one buyout program, which makes them knowledgeable about the subject matter.

Table 3.1: Buyout Participation Breakdown

Key Informant	Buyout Participation since 2000
Director of Planning and Community Development	3
Assistant Planning Director	4
Planning Director	4
Emergency Management Department Assistant Director	N/A
Flood Recovery Manager	1
Buyout Manager	2

Source: Fieldwork, 2022.

Interview questions asked participants about the buyout processes, its challenges and outcomes, and maintenance strategies of bought-out parcels post-buyout. Because some respondents were unavailable to meet physically, the interview sessions were either virtual or face-to-face. Each interview session was recorded on a Samsung S21 ultra recorder with an auto transcription feature. The transcribed interview was cleaned up by listening and correcting detected errors. The cleaned dataset, about six pages per respondent, was uploaded to the NVivo software for qualitative analysis. Following Curtis et al., (2022), this study adopted two cycles of qualitative coding, which are descriptive coding (Saldana, 2009), and thematic analysis (Ryan et al., 2016; Nowell et al., 2017). Descriptive coding includes assigning a theme to summarize a short passage (Saldana, 2009), and thematic analysis is the pattern recognition in a dataset, including the analysis, organization, description, and reporting of common themes (Ryan et al., 2016; Nowell et al., 2017). Twenty-three themes and 29 sub-themes were created in the first cycle, including ten related to the buyout process, eight related to the buyout challenges, three related to the buyout

land use maintenance, and seven related to mitigation approaches. While the descriptive coding was conducted using the NVivo application, the thematic analysis was conducted in MS Word.



## CHAPTER 4

### 4.0 Research Findings

#### 4.1 Descriptive Statistics Results.

Table 4.1 shows that from the total land area in Pitt County, only 19.53% is designated as a special flood hazard area (SFHA). However, Pitt County’s SFHA land percentage coverage is about 3% higher than the average SFHA land coverage per county in North Carolina, see Table 4.1. Also, the Yes and No columns in Table 4.1 show the landmass in and out of the SFHAs. The Pitt County SFHAs cut across the City of Greenville, and various towns, including Ayden, Farmville, Bethel, and Grimesland (FEMA, 2020; refer to Figure 4.1).

Table 4.1: SFHA Landmass in North Carolina.

	Special Flood Hazard Area (SFHA) Status				Total (Acres)
	Yes (Acres)	%	No (Acres)	%	
North Carolina	6,708,785.70	16.59	33,730,884.50	83.41	40,439,670.20
Pitt County	81,856.0	19.53	337,358.99	80.47	419,214.99

Source: FEMA, 2020; United States Census Bureau, 2021.

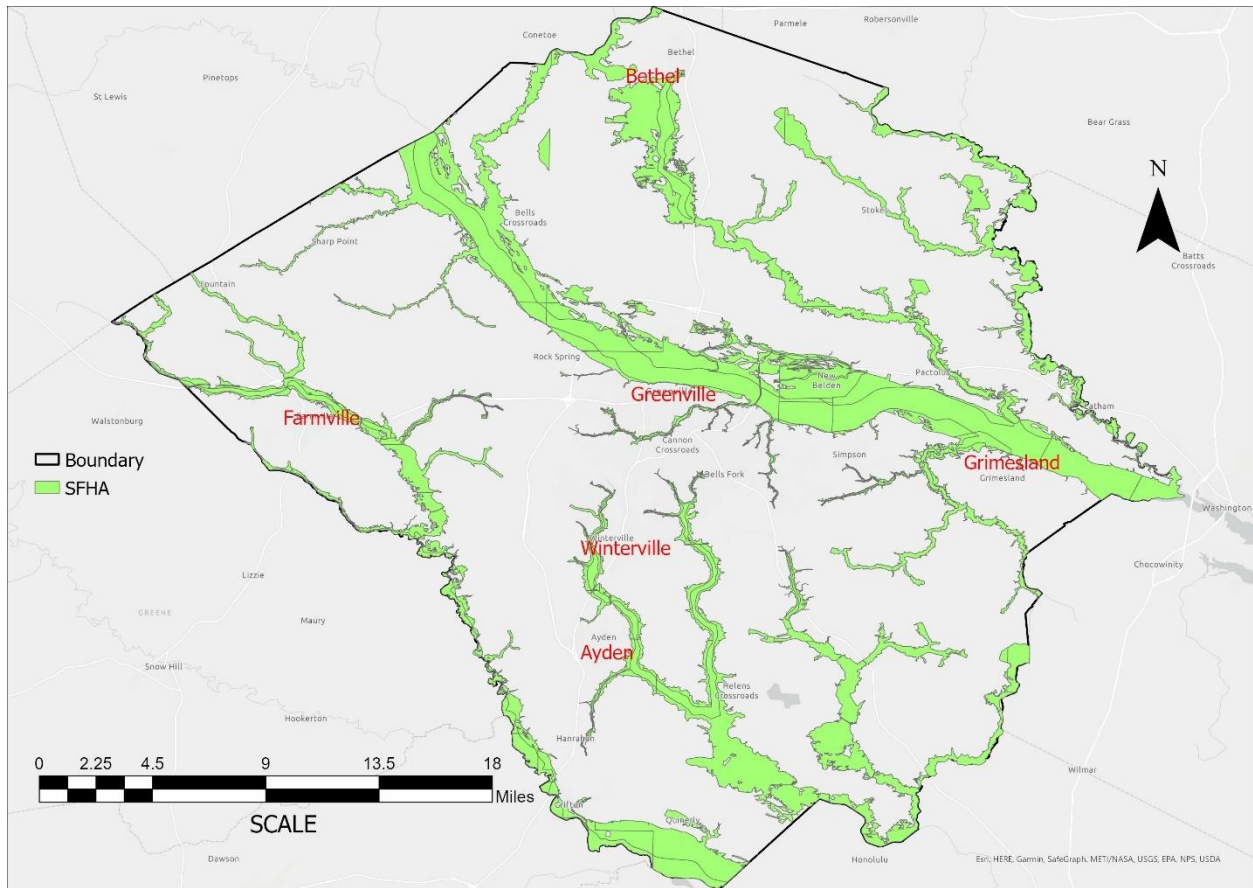


Figure 4.1: SFHA of Pitt County.

Source: (FEMA, Pitt County)

This study identified 418 previous buyout parcels since 2000 in Pitt County, where the City of Greenville bought out 207 parcels, and Pitt County bought out the remaining 211 parcels, amounting to 705.98 acres at an average of 2.81 acres per buyout parcel (Table 4.2).

Table 4.2: Distribution of bought-out parcels in Pitt County.

	Count of Acres	Mean (Acres)	Sum of Acres
Pitt County	251	2.81	705.98
City of Greenville	207	1.32	275.1
<b>Total</b>	<b>418</b>	<b>2.35</b>	<b>981.08</b>

Source: (Pitt County; City of Greenville)

The average size of the buyout parcels by Pitt County (2.81 acres) is bigger than the average size of the buyout parcels by the City of Greenville (1.32 acres), which indicates that the buyout by the City of Greenville could have been majorly residential land use. In contrast, the Pitt County buyout could have included a mixture of farmland and residential land use. The average buyout parcel size in Pitt County is 2.35 acres, which is relatively smaller than the average parcel of land in the SFHA (8.8 acres) and Pitt County (5.2 acres). See Table 4.3.

Table 4.3: Land parcel size assessment.

	<b>Mean (Acres)</b>	<b>Minimum (Acres)</b>	<b>Maximum (Acres)</b>
Pitt County	5.2	0.00061	8,401.4
SFHA	8.8	0.00062	1,129.4
Buyouts	2.35	0.025	247.5

Source: (Pitt County; City of Greenville)

Out of the identified 418 buyout parcels, 404 (974.1 acres) are in the SFHA, while 14 (6.9 acres) are not in the SFHA. See Table 4.4

Table 4.4: Distribution of buyout parcels in Pitt County.

<b>SFHA</b>	<b>Count</b>	<b>%</b>	<b>Size (Acre)</b>	<b>%</b>
In	404	96.7	974.1	99.3
Out	14	3.3	6.9	0.7
<b>Total</b>	<b>418</b>	<b>100</b>	<b>981.08</b>	<b>100</b>

Source: (Pitt County; City of Greenville)

Table 4.5 shows that out of the acquired 418 parcels of land, 111(76.03 acres) parcels share a boundary on one side with a parcel that has structure(s) on it, while 47(223.05 acres) parcels

share a boundary on at least two sides with parcels that have structures on it. Only 260(682 acres) parcels do not share boundaries with parcels with structures. See Figure 4.2, for example.

Table 4.5: Buyout patterns in Pitt County.

<b>Boundary Parcel</b>	<b>Count of Acres</b>	<b>Average of Acres</b>	<b>StdDev of Acres</b>	<b>Sum of Acres</b>
One building	111	0.68	1.43	76.03
More than one building	47	4.75	26.84	223.05
Empty	260	2.62	17.07	682.00
<b>Grand Total</b>	<b>418</b>	<b>2.35</b>	<b>16.20</b>	<b>981.08</b>

Source: Fieldwork, 2022.

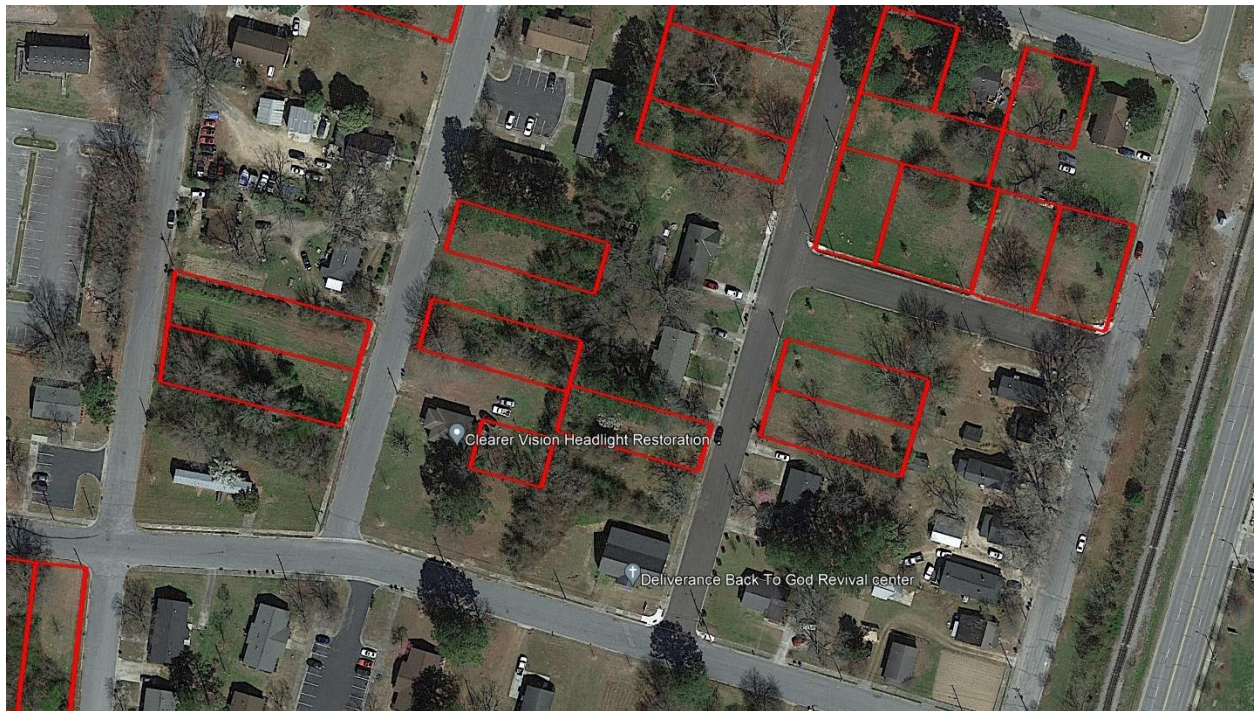


Figure 4.2: An example of the buyout patterns in Pitt County.

Source: Google Earth, 2022.

After exporting the buyout parcels to Google Earth as a Keyhole Markup Language (KML) file format to identify the parcels' land usage, research shows that 19.27 acres (1.96%) of the

buyout parcels were converted into parks, and 14.90 acres (1.52%) have structures on them. Trails accounted for 4.90 acres (0.5%), and 278.98 acres (28.44%) remain as wetlands. Most buyout parcels (67.58%) were converted into open spaces and remained vacant. See Table 4.6 and Figure 4.3.

Table 4.6: Land use of buyout parcels.

<b>Land Use</b>	<b>Parcels</b>	<b>Mean (Acre)</b>	<b>Sum of Acres</b>	<b>Percentage</b>
Park	15	1.28	19.27	1.96
Structure	11	1.35	14.90	1.52
Trail	7	0.70	4.90	0.50
Vacant	291	2.28	663.02	67.58
Wetlands	94	2.97	278.98	28.44
<b>Grand Total</b>	<b>418</b>	<b>2.35</b>	<b>981.08</b>	<b>100.00</b>

Source: Fieldwork, 2022.





pattern among the land values. Despite the high Not significant land values, the presence of high and low land values clusters make the data suitable for a GWR analysis.

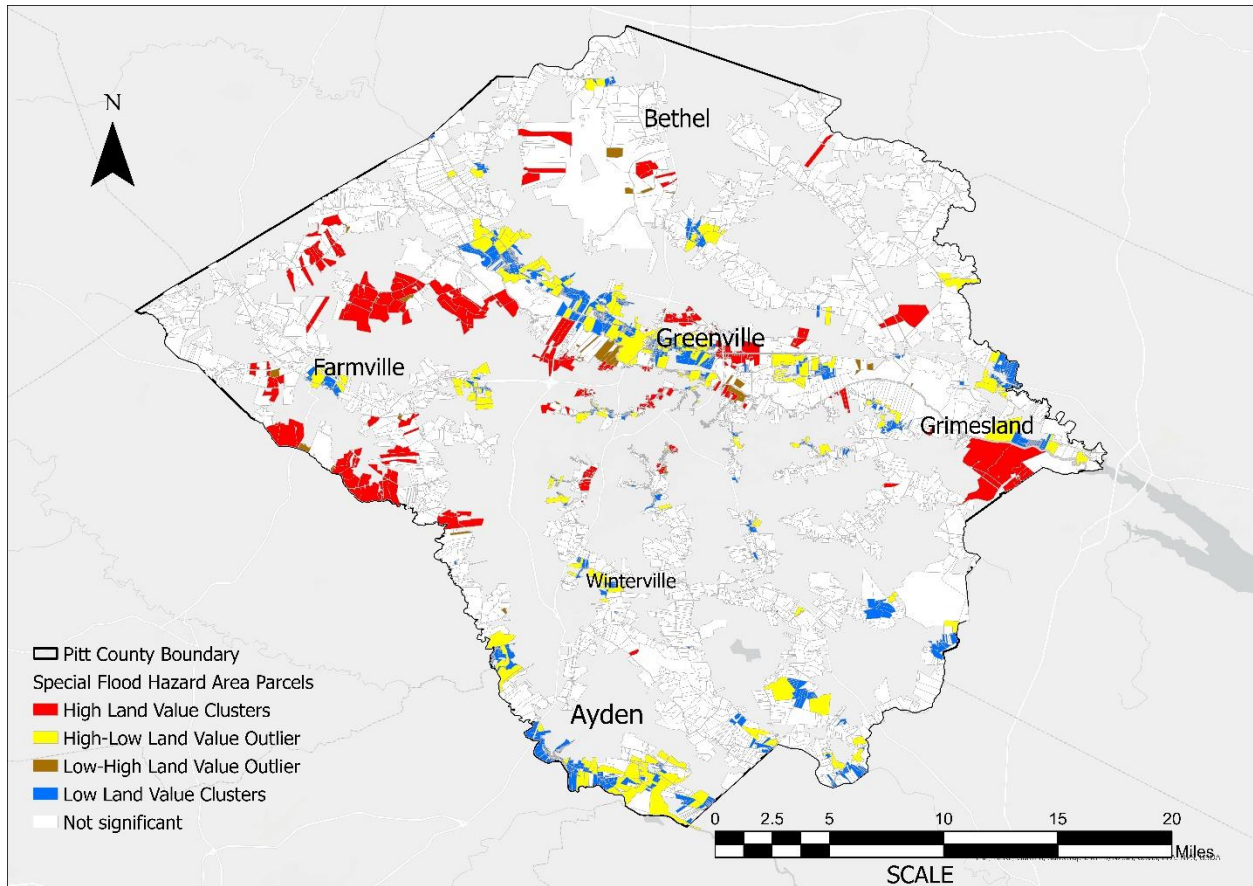


Figure 4.4: Local Moran I's result.

Table 4.7 shows the VIF values of the explanatory variables. Of the seven explanatory variables identified, the distance to park variable has a VIF score of 5.656, beyond the adopted threshold of 5. The variable was, however, not included in the model to prevent multicollinearity. Table 4.8 shows the result of the two models. The first model has the buyout distance to the adjoining parcel as the only explanatory variable. The adjusted  $R^2$  of 0.0576 shows that the distance to buyout can only explain about 5.76% of the land value variation in the SFHAs of Pitt County. The second model, which included all the variables, has an adjusted  $R^2$  of 0.522 and a lower AICc value than the first model. The result implies that the second model can explain 52%

of the land value variation in SFHAs of Pitt County. Besides from the wide gap between the adjusted  $R^2$ , the AICc value of the second model is lower than the first model indicating that the second model is the most parsimonious of the two.

Table 4.7: Collinearity Statistics.

Explanatory Variables	Collinearity Statistics	
	Tolerance	VIF
Distance to Nearest Rescue	.51	1.95
Location		
Distance to Nearest School	.57	1.73
Location		
Distance to Nearest River	.84	1.18
Distance to Nearest	.75	1.31
Buyouts		
Parcel Area	.97	1.02
Distance to Nearest Police	.43	2.27
Department		
Distance to Nearest Park	.17	5.65
Dependent Variable: Current Land Value		



Table 4.8: Models Diagnostic.

Model's Explanatory Variable(s)	R <sup>2</sup>	Adjusted R <sup>2</sup>	AICc
1. All variables	0.5414	0.5222	231389.6193

Figure 4.6 shows the spatial variation in the model's adjusted R<sup>2</sup> (Local R-Squared). While the model is weak in Greenville and its environs with the adjusted R<sup>2</sup> that ranged between  $\leq 0.25$  - 0.5, the model gained strength outwardly to areas like Winterville and Bethel up to an adjusted R<sup>2</sup> of 1. For instance, areas including Farmville and Ayden have an adjusted R<sup>2</sup> ranging between 0.51 – 0.75, while areas such as Winterville, Bethel, and Grimesland have an adjusted R<sup>2</sup> ranging between 0.76 – 1. This result implies that geography played a role in determining the land value in the SFHAs of Pitt County, as clusters of similar adjusted R<sup>2</sup> are visible in the various spatial locations within Pitt County.

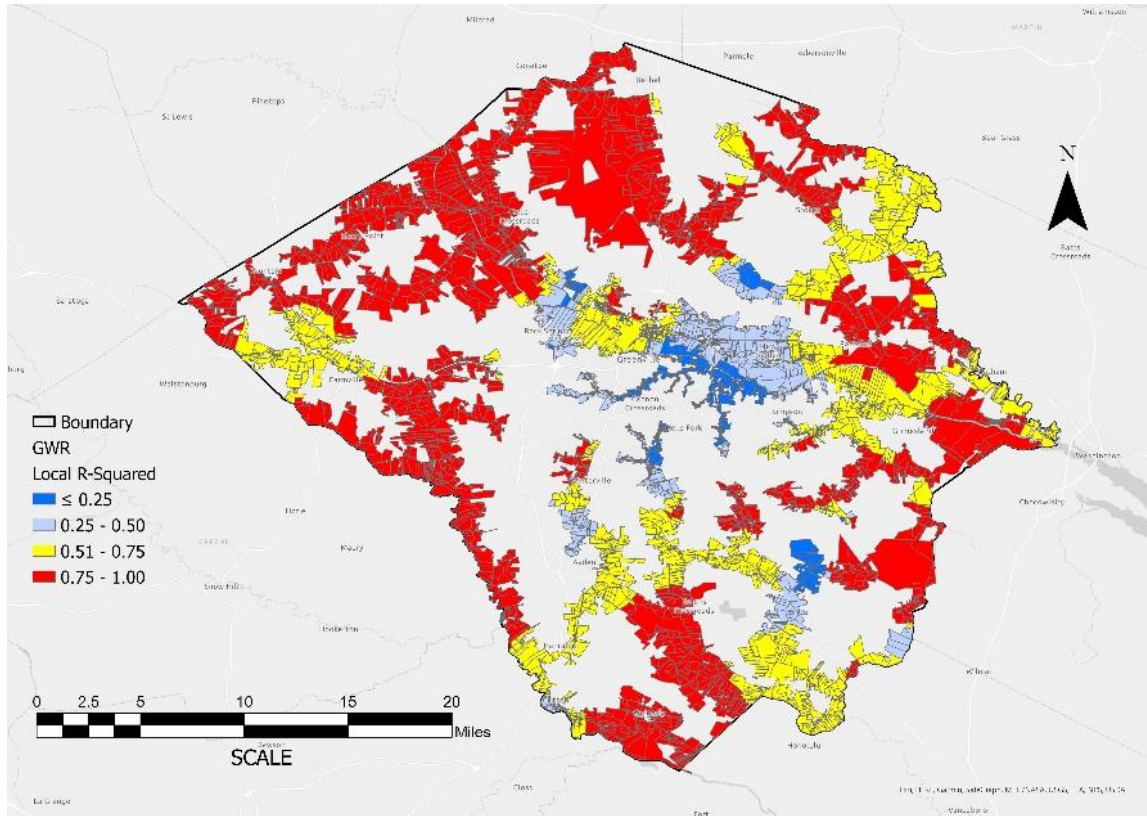


Figure 4.6: GWR with all variables.

## 4.3 Interview Results.

### 4.3.1 The Buyout Process

Each respondent was asked about the buyout process. Respondents indicated that rescue is the first phase after an extreme event. Administrators, including Emergency Managers, Planners, and Health Officials, monitor the event and develop a rescue plan to evacuate the impacted population from the exposed location before discussing recovery. A respondent stated:

*You've got this response phase as you prepare for the event that you monitor when it happens, and you perform rescues, and then you've got an immediate response after they've got food and water removal. Immediately threats and dangers, then you go into the recovery. That's where the buyout comes in in that case.*

As the rescue team works to assist the impacted population, the extent of damage in identified areas is usually monitored by the North Carolina Emergency Management (NCEM) to

determine if the event amounts to a disaster. The NCEM will therefore recommend that the State Governor declare the event a disaster. After the disaster declaration, the impacted homeowners are advised to document their losses and the money spent on repairs for reimbursement purposes. A respondent said:

*So important thing that we try to get out to people who are impacted by the flood initially is to document the flooding on your property and save any receipts for any repairs that you try to make to your home following the storm. That's 1st and foremost, as always, because they can get reimbursed for some of that expenses that they have. Also, we need to know how much water came into the structure just to document the extent of the flooding that they experienced.*

After that, the buyout application will commence at the local government level where the disaster occurred. Despite being a voluntary program, not all applicants are eligible for the buyout program. An eligible applicant must be a homeowner, fill out a form of voluntary participation, have flood insurance, experience repetitive loss, the property value must be less than \$323000, and be in the special flood hazard area (SFHA). If not in the SFHA, the benefit-cost assessment (BCA) must indicate that the property has been damaged beyond 50% of the property value. A respondent summed up some of the eligibility criteria:

*Again, we have to prove that the house is in a floodway. If it isn't in a flood zone, is it cost-effective to buy? If it's a \$450000 home, well, I will tell you that you already exceeded that benefit costs waiver. And if you only have one flooding event on it, I can't say in the next 100 years that the rate of return is going to equal what we need to pay for your house. So, you know, again, there's so much that has to go into it. It takes a little bit of time to get it up.*

After assembling the application documents, the local government will forward the buyout application to the NCEM. The NCEM will review the application. The review process includes verifying the impacted property's address, photographs of the existing situation, environmental, engineering, programmatic, and historical reviews, and budgeting. The environmental review is carried out through the National Environmental Protection Act (NEPA). If an impacted property

is observed to be above 45 years old during the environmental review, the historical preservation office will conduct a historical review of the property. A respondent explained that:

*There is a whole bunch of stuff that has to go into that application. So, we have to come back here. We have to do the math. We have to print the maps. We have to get the photos. It has to go through an environmental review. It has to go through an engineering review. It has to go through a programmatic review. So, all of that happens.*

The final stage of the review at the state level before sending it to FEMA is the budget calculation for executing the project. A respondent summed up what budgeting entails including various aspects such as property appraisal, property closings, property survey, property demolition, and potential restoration tasks like grassing and seeding. If there are any underground storage tanks, they must be removed. Once all these elements are compiled, a budget is formulated, and the complete package is submitted to FEMA for their review and consideration. After that, FEMA notifies NCEM of their decisions for each submitted application. Then the FEMA-approved applicants will be notified by NCEM through the community.

After NCEM informs the local government and the applicants of FEMA's decisions, the next step is to appraise the approved properties, which involves an appraiser and an attorney. The appraisals are based on the fair market value of the day before the extreme event damaged the property. FEMA provides 75 percent of the appraised value through the Hazard Mitigation Grant Program (HMGP). The State of North Carolina provides 25 percent matching funds through the State Emergency Response and Disaster Relief Fund (STRDF).

*North Carolina is unique in the fact that under a disaster grant when we have a disaster, the state picks up the 25 percent match. We maintain what's called the STRDRF. The State Emergency Response and Disaster Relief Fund that provides a 25 percent match for all communities. Again, it's unique across the State. Most States don't do this.*

After that, the property owner would be presented with the check, and the property would be demolished and left as an open space, according to FEMA's requirements. A respondent explained that, "We do have to demolish the house once we retain possession of it. Demolish it and make sure it is deeded and goes back to its natural state." The respondents identified some challenges attached to the buyout process, which will be discussed in the next session.

### **4.3.2 Buyout Challenges**

This section presents the buyout challenges faced by the respondents. Serving as the intermediary between the policymakers and the impacted homeowners, the respondents expressed the challenges they encountered in previous buyout programs from Hurricane Floyd to Hurricane Florence, which led to some of the impacted homeowners opting out of the buyout program.

#### *Credibility of the Buyout Program*

Respondents reported that most of the flood-impacted homeowners were minorities. Interview respondents explained that the buyout administrators faced difficulties in convincing impacted minority homeowners about the credibility of the buyout program. Minority households were suspicious that the buyout program was a spurious scheme by the government to take away their properties. For instance, a respondent shared an example:

*We had one resident who lived north of the river. They said no, I'm not going to do that. Just you are trying to get my property. I've worked hard for years. I've finally had a piece of property of my own I'm gonna stay here. We'll never have flooding like this again.*

Some of the properties were in a household for generations, inherited from grandparents, which made it more difficult for the respondents to convince minority households about the legitimacy of the buyout program.

*And so there was a degree because of the history of particularly in Eastern North Carolina, many poor unfortunately tend to be minorities not at all, but many tend*

*to be minorities, and because of our history in the South with Africans Americans, with race and those issues, there was heightened anxiety, and you could even say paranoia among many of these people that somehow once again they were gonna end up on the wrong side of the deal. That this was possibly the government trying to take their land. The one thing is it wasn't necessarily that they had bought it. Maybe they inherited it from their parents, but you know, in their view, they were very skeptical that they would end up on the right side of this.*

Interview respondents addressed this issue by engaging in activities to gain the trust of minority homeowners. For instance, the respondents engaged in group meetings to explain the objectives of the buyout program to minority households. Respondents also utilized the existing diversity among staff and city council members by assigning a staff or council member of the same racial heritage to address the importance and advantages of accepting the buyout program. A respondent explained:

*Really, the rest, you know, may have been extremely skeptical. And we used every tactic that we could think of because the end goal was to please, try to help these people. So, if we thought that, for some reason, they were uncomfortable or just not going to believe very white color race coming into their house, we had a very diverse staff, and we would just say, hey, maybe they would feel better dealing with Joe who's an African American. Joe, you try to talk to them and see if they'll listen to you. We had city council members who were minorities, and on some tough cases, we would say, " Hey, city council member, so-and-so, do you know this family and say, " Yeah, I know that family. I said can you try to talk to them because they're not listening to us. And you meant maybe you've got some trust with them, and eventually, except for really like less than 10, we managed to convince everybody that this was probably the best thing that was going to come.*

#### *Documentation and Communication*

Buyout programs require the applicants to document their losses. Still, the respondents explained, it is difficult for applicants to document their losses because they might have lost everything they had when the hurricane struck. At that point, the impacted homeowners were probably traumatized by their losses or being displaced, and going through the loss documentation usually triggers their anger, as mentioned by a respondent. Some homeowners lost everything,

including their means of identification, and asking such an individual to document their losses might upset them. A respondent explained that:

*So clearly, the initial challenge was just trying to work with people who had lost everything and were very upset. Not that I think you know, during normal times, people probably would not have reacted this way, but when people are on edge and very upset, just to tell them, like I said, you need to go to the driver's license office or you need to go to the courthouse and try to find records or whatever, it's just one more thing, and perhaps they haven't slept well, they haven't eaten well, their children are upset, and dislocated out of school and it just makes it very difficult.*

Respondents identified communication as an early-stage challenge of the buyout program. While some homeowners went through the loss documentation, they stopped communicating with the buyout administrators over time. This could be because of the long duration of the buyout program process, discussed in the latter part of this report.

*They showed the interest at first. Then they disappear from up to the time when they won't answer phone calls and letters. We have lost. There have been properties kicked out of the program because they cut off contact, but communication is hard.*

Some applicants were willing to participate in the buyout program but needed their property titles to participate, which were not accessible. Titles may not be accessible for heirs' property transferred down through generations. Such historically transferred properties are vulnerable to title loss because the previous owner might not have transferred the properties to their descendant legally before they passed away. Hence, making it difficult for the current homeowner to perform any legal activity on the property, such as buyout participation. A respondent reported that:

*Some of the properties may not have had a clear title to it. So, when you're going through this, it's truly a real estate transaction. So, if the people that resided there didn't have a clear title to the property, it made it impossible to move forward with the buyout program.*

Another challenge is the unwillingness to continue with the program after the property title has been transferred. Respondents recorded cases where the applicants enrolled in the buyout program but died during the process. After that, the children of the deceased might decide to discontinue the buyout process. A similar scenario is when the applicant decides to sell the property to someone else for various reasons, including the duration and appraisal value discussed in the latter part of this report. Considering that the buyout program is voluntary, the new homeowner might decide to opt out of the program by terminating the initial application. According to a respondent:

*Some of them, you know, the mom and dad who lived in the house may have wanted to be bought out, but the son or daughter who acquired the property when their parents passed away maybe no longer want to go through with that. So that you know, you have people that drop out. Obviously, if somebody bought the property after the flood, they may no longer want to move forward with being bought out because they bought the property knowing that it had been flooded. It wasn't a concern of theirs, or they wouldn't bother. So now they need no longer want to move forward.*

### *Staffing and Contracting*

Respondents explained that the need for more staff members at the state level to handle the buyout program was a challenge. The state government would recruit staff only after a major event, leading to an inadequate amount of time to familiarize the newly employed staff with the buyout process. A respondent said that:

*So, the state doesn't maintain a full bench of staffing. They staff up after a major event. You know, you've got some main state administrators that are there in some program. But you know, if you've got multiple county regions, you have to hire up, so we had people that didn't understand the uniform relocation and acquisition act that was a big thing because we had to educate them as to what the Urban Redevelopment Authority (URA) said.*



Similarly, respondents identified private contractors' lack of interest in the program as a challenge. It was not easy to acquire contractors that would demolish the acquired buyout properties because contractors were more engaged in developing real estate, which is more profitable. One respondent said:

*Then the other thing is just the lack of contractors that are interested in assisting with the program. Right now, we're coming out of a fairly good housing market, and so all of your general contractors who may be tearing down the structures, they're building structures, and they're making more money building structures than they could go in and tear it down the old structure. So, the lack of workforce available to help these programs.*

#### *The Value of Property: Personal & Financial*

Personal attachment to property has also been identified as a challenge. For impacted homeowners with heirs' property that has been passed down in the family through generations and is of historical importance, selling such properties has never been an option. A respondent said that "For some of these people who have had that land for generations or they themselves are living in the grandparents' house or their great grandparents' house, it's having to let go of the material, and that is hard."

Another respondent summed up that:

*Number one is a personal decision, and a lot of factors come to play. Especially with hurricane Floyd and just the way the people viewed their property even 20 years ago. It may be a property that was handed down through their family for generations, and they had a very strong tie to that property or to that particular dwelling unit that they resided in. So, with that, they decided, hey, this is part of our family. We want to stay in this particular home, and we're just going of out of the buyout program.*

In terms of financial valuation, during the appraisal process, respondents assert that they can face challenges from homeowners who disagree with the appraisal value. In such a situation, the administrators either double-check the appraisal value or reappraise the property up to three

times and present the mean appraisal value to the impacted homeowner. If the impacted homeowners are unsatisfied, they will eventually opt out of the program. A respondent said that:

*Sometimes when we present that value of the property to the homeowner, they decide that's not, you know, they feel like that's a low number that is worth more money than what we're offering them, and in those cases, you know a few of them might say I'm not gonna sell the property for that amount. I'm just gonna keep it myself. And you know that's obviously their decision to make, and we have to honor it. Sometimes if we get to those situations, we can go back to the appraisals and get them to double-check and make sure that the comparable properties that they compared the home with are actually comparable to what's there on the property. And that the price is fair in their opinion.*

Similarly, another respondent said that “People might not have agreed with the appraisal value, basically, and again there were ways that people who didn't agree with it once, you could get another appraiser come in, and you could actually do it a third time.”

#### *Duration of Buyout Process*

Impacted homeowners have opted out of the buyout program due to its long duration, which poses a significant threat to the program’s success. For instance, a respondent mentioned that “You know, there's a lot of people that go through this process. They get very discouraged because it does take a long time.”

Statutorily, the buyout program should span 24-36 months, according to a respondent. However, there are complaints that the program is extending beyond four years. A respondent asserts that:

*In general, and a normal economy not in current state, it should be from start to finish; ideally, it would be at most two years. In the past, most of ours are 2 to 3 years. Of course, there are special cases where some will need more paperwork or more forms, or more studying. But start to finish, ideally, it's two years. Lately, it's been up more of 3 to 4 years.*

Endless waiting upon the buyout program has erased the flood memory from some impacted homeowners' minds. The longer it takes to complete the buyout process, the lesser the interest of the impacted homeowners in the program. A respondent summed up that:

*Anytime you wait for an extended amount of time, the dynamics always change with the properties. Some people that are still living, they might have been interested in following the flood, but now it's 2 or 3 years have passed, they may no longer want to be bought out because it's not fresh in their minds. You know they've gone through it for years and hadn't had a flood again, so I think I'm just gonna stay here.*

The most recent hurricane in Pitt County was Florence in September 2018. Post-Florence is over four years, and no buyout applicant has been bought-out in Pitt County. Therefore, some applicants have opted out of the program. A respondent said that:

*We're now dealing with hurricane Florence happened four years ago. We don't have the funding yet. That was four years ago. We've had 3 or 4 opt out of the Florence buyout because it's taking so long, which of course, is a huge shortcoming and completely erodes what we're trying to do with the buyout program, and Florence will probably end up being five years by the time it wraps up.*

The respondents identified three factors responsible for the buyout program's longer duration:

1. Bureaucracy
2. The State-centric approach
3. The extended feedback times

Respondents complained about the various stages involved in getting the buyout approval and suggested that the program be reviewed to eliminate the red tape. A respondent said that:

*You're dealing with Local Government, State Government, and Federal Government. That's a lot of bureaucracy, and so it just felt like everything took forever. So many levels of approval were required, so that's you know why it was a three-year, three-year plus process to get this done.*

Results showed that the state-centric program was established two years after Hurricane Florence to accelerate the mitigation process in North Carolina. A respondent said that “The state-centric program is something brand new. We received permission to do it in 2020. So, it's just a little over two years old from the permission standpoint.” The program is expected to transfer all the mitigation processes from the local government level to the state government level, where the state will administer the whole process from commencement to execution including the buyout offers, the appraisals, the actual buying of the property, and the demolition.

The program was conceived to mitigate the unequal economic and administrative power among North Carolina local governments and to reduce the buyout program timeframe. While some local governments find it easy to execute the buyout program, others find it difficult. For instance, a respondent expressed that in the aftermath of Hurricane Matthew, approximately 50 percent of the projects remain unfinished because communities are progressing with the recovery efforts on an individual house basis. Hence, the importance of the state-centric program.

The goal of the state-centric approach is to mitigate these differences among the local governments by executing the buyout program at the state level. With the new approach, local governments are only expected to intermediate between the state government and the impacted homeowners by updating homeowners on the progress of their application. A respondent mentioned that:

*The state-centric model, the state would handle all that. We, the local governments, will serve as an avenue to communicate with the homeowners as to what's going on in the process. But as far as the contractors, and attorneys' appraisals, all of that will be handled through the state. They would acquire those services for the local governments and administer the contracts with those different vendors.*

Pitt County is one of the local governments that opted into the state-centric approach to execute their buyout projects within months after Hurricane Florence. However, the state-centric approach turned out differently than expected. The county waited for over three years and has not received anything from the state. A respondent explained that:

*Pitt County opted into the state-centric model. We waited, we waited, we waited, and kept pushing the state. When's it going to get kicked off? We've got people that are waiting for this program. They could not get the contractors that were needed. Those being whether they were appraisers, surveyors, attorneys, all the people that are needed to go through this buyout program. We've been waiting for three years on the state to get those contractors and attorneys and appraisals and everything in place.*

After that, Pitt County decided to opt out of the state-centric approach and went through the initial buyout program process. A respondent mentioned that:

*So, in turn, we wasted probably a year or more time waiting for the state to gear up, and we'd just decide it's in the best interest of Pitt County and its citizens that Pitt County go back, have a new agreement set up that would allow the county to administer the program. So that's been one thing that slowed this down a bit at the state level.*

Because the State of North Carolina needs to have the legal right to buy out impacted properties at the local level, the State waited about two years to set things right, get the governor's signature on the budget, and the law amendment passed by the legislature. A respondent explained that:

*The challenges as we got in to try and get it up and running that we found, in particular, was that, as the state, we don't have the legal authority to go into communities and buy homes and do all this work. So, we had to go to the legislature, so back to what I talked about when I said I am dealing with the legislature, you have to go back to the legislature and change the law. And so, when the governor signed a budget in November of 2021, so again, we waited for the legislature to do legislature work. It took us about a year and a half to get the law updated that actually gave our office permission to do this.*

With the state-centric approach up and running, the State is expected to execute Hurricane Florence and subsequent hurricane buyouts in less than a year. A respondent explained that:

*So realistically, I would tell you that at this point, the state-centric program is only about nine months old. I'm getting ready to go out with our biggest acquisition contract. So, in a normal methodology, when we submit our applications to FEMA, it takes about 90-120 days for an application to be reviewed by FEMA and approved, and sent back. Now that we have the contractors on hand and the capacity built, if I get that award in 120 days, I can have that under contract within 60 days after that. And depending upon how big it is, I should be able to knock out most projects within less than a year of when it was actually submitted.*

Results also showed that extended wait times from FEMA have contributed to the longer duration of the buyout. Instead of a 90 to 120 days wait period for FEMA to give feedback to the state, it extends between 6 to 8 months. A respondent said that “You know, again, if I put their application in that day you go through it, the fastest you can ever see help is in 6 to 8 months.”

A respondent speculated:

*In my opinion, the overall problem is the frequency of natural disasters. FEMA, I feel like, is dealing with so many different natural disasters, whether it's earthquakes, tornadoes, things that happen natural disasters that happened across the country, and then just the frequency of hurricanes and the size and impact that these hurricanes are leaving.*

In addition to the buyout challenges, the impacts of the buyout parcels on adjoining properties were examined and are discussed in the next section.

#### **4.3.3 The Environmental and Economic Impacts of the Buyouts on Adjoining Properties**

Results show that the buyout properties have slowed down the increase in the property value of the adjoining properties because the buyout properties do not foster development. A respondent explained that:

*Part of what FEMA says is you can't put these properties to any use in the future, so there's not really real estate value on activities to support increased property values for those that don't participate because it has to remain open forever.*

A respondent shared their experience of the adjoining property owner's complaint "I can hear the argument both ways where the sales personnel could be like hey, there's nothing around you, or alternatively, all these lands next to me is only worth \$10000. This hurts my property value."

Furthermore, since buyout programs are voluntary, and not all eligible participants enroll in the program, this has led to random land use patterns in some areas in Pitt County. Results show that the random land use pattern promotes various challenges, such as loss of a sense of community. As observed by a respondent, "it also leads to you having neighborhoods where you have two houses, then six open lots, then another house, then six open lots, and you do lose that sense of community when everyone's getting bought out around you."

Another respondent observed that the random land use pattern could threaten the cost of infrastructure maintenance in smaller municipalities with no strong tax base.

*To the municipal side of things, where the city would be responsible in some cases for road maintenance, for the utilities, that could be a big burden on a small town in particular. It could be a big burden even for the city of Greenville, maybe again, sporadic homes strewn over a large area that's just not as cost-effective to keep that infrastructure running day-to-day.*

Results also showed that the random land use pattern impedes land use change of bought out parcels from residential to FEMA-recommended land usage, such as recreational parks. Recreational parks require a large expanse of land to establish, and land fragmentation resulting from the random land use pattern makes it challenging to convert buyout parcels to parks. A

respondent noted that, “We have multiple areas like this, and it's harder for us to like create parks and things that people use.”

#### **4.3.4 The Buyouts Land Use Maintenance**

A state level database houses a master list of all buyout parcels and their attributes. Pitt County assumes maintenance responsibility for buyout properties within their planning jurisdiction. However, buyout properties in smaller municipalities are deeded to the town administrators to maintain them. The parcels from previously administered buyout programs in Pitt County have generated various impacts on the adjoining properties. FEMA stipulates that the buyout properties be reverted to their natural state. Results showed that in the process of reverting to the natural state, adjoining properties are susceptible to animal encroachment. A respondent recalled a complaint from an adjoining property owner:

*If there are neighbors that chose either their property wasn't flooded, or they chose not to participate and we gotta buyout a property adjoining them, a lot of time, Um, these properties will revert back to its natural state, and they're not used to that property being a wooded grown up, in grass of getting high that sort of thing. And so we do receive complaints from the adjoining property owners as to gosh that property is really growing up, there are snakes coming onto my property from that property. They feel like it's more conducive to snakes, animals, and rodents, that sort of thing.*

Pitt County decided to lease out buyout properties within their jurisdiction because of their maintenance costs and complaints from adjoining property owners. A respondent explained, “We have to lease them out in the hopes that whoever does lease it will live to or have a use for it to be able to maintain it and be able to pick up where we cannot.”

Interview results indicate that Pitt County has enjoyed success leasing out these properties, as explained by a respondent:

*If the property is out in the county's planning jurisdiction, we assume responsibility for that property. We administer floodplain regulations for some*



*local municipalities like Grifton especially and Grimesland. I think those are two major ones. But suppose the properties are located within one of those smaller municipalities. In that case, we then deed the property over to the town to administer and take care of them from there on because we feel like there's a better opportunity for them to oversee that property, being that it is in their town limit or planning jurisdiction. And then, if it's in the county jurisdiction, we've had good success with leasing those properties to anyone interested in using them for allowable uses. We ensure that those lease obligations are being met, so we keep a close eye on it. Well, over 90 percent of our properties are leased out to adjoining property owners or other people that qualify.*

The County has also designated some properties for recreational activities, such as parks and greenways, as explained by a respondent:

*We started doing some more open space park stuff, and so I mentioned the dog park down here, but we extended our Greenway on a lot of this land because it had to remain open, so it gave us an opportunity to grow our park system it gave us an opportunity, provides citizens with urban garden spots and so gave us a chance to create more green space opportunities which were good, and it came back from our reuse plan. We had a plan that says, here is how we gonna redevelop the land and when I say redevelop, not put structures on it, make it available for open space opportunities.*

The county also engages in an annual inspection of the buyout properties to ensure that no structure whatsoever is erected on the property. A respondent said that:

*Yes, so we do annual inspections of these properties once a year, typically in the summer. We'll go out and do an inspection of all the buyout properties to make sure that they are been used for the purposes that they are supposed to be used for. If no one's leasing them, we make sure that no one is doing anything on the property they shouldn't be doing. So we do that.*

However, the county lacks sufficient funds to maintain the unleased buyout properties as explained by a respondent. “But the county doesn't have the resources to go out there and mow the grass and keep it like it was. The whole idea is that it goes back to its natural state.”

The annual inspection approach is insufficient because results showed a breach in compliance with stipulated regulations in some locations. As two respondents stated:

*I'll let people go garden on the property, they may lease the property out to let you know so somebody can cut the grass cause it may be in the middle of a neighborhood. Keep it looking nice, so that makes the yard. They may have requested to use the property as a parking lot to their greenway or something like that. The big thing is that while some of those have been properly requested, some haven't. So, we're going back and checking on all those and try to make sure that we get back into full compliance with the 44th CFR that oversees part of this program. Specifically, section 80.19 which is what you do with the properties after it is bought and how you maintain them.*

The second respondent said:

*Recently, we just got word from the state via FEMA that any use that we plan to use on the property, we have to get approval from them. So those lease agreements will now have to be approved. It's great right now, but I anticipate we're going to have to get approval from FEMA in order to lease the property and make sure that each lease has the appropriate restrictions listed on it.*

## CHAPTER 5

### Discussion

This study adopted descriptive statistics, geographically weighted regression, and in-depth interview sessions with key informants to understand the buyout process, challenges, maintenance approaches, and the impacts on adjoining properties in Pitt County. This study started by examining the special flood hazard areas (SFHAs) of Pitt County, and it was observed that Pitt County's SFHAs are 19.53% of the 419,214 acres of land. This is higher than the state SFHAs average of 16.59%. This could be due to the increased frequency of storms in eastern North Carolina (ENC), including Pitt County (Curtis et al., 2022). For instance, Floyd (1999), Irene (2011), Matthew (2016), and Florence (2018) were experienced in Pitt County (Bales, 2003; Musser et al., 2017; Aly et al., 2021). It could also be because Pitt County is located in the coastal plains of North Carolina.

The identified buyout parcels in the study area are 418 parcels bought between the City of Greenville and Pitt County. The city bought 207 parcels with an average of 1.32 acres per buyout parcel, while Pitt County bought 211 parcels with an average of 2.81 acres per buyout parcel. Despite the minute difference in the number of buyout parcels between the city and the county, the noticeable difference between the average buyout parcel size could be because the City of Greenville bought more residential properties, usually smaller land sizes per parcel. In contrast, Pitt County bought a mixture of farmland, residential, and wetland uses in Farmville, Bethel, Ayden, and Grimesland, usually bigger land sizes per parcel.

Of the 418 parcels that were bought, it was observed that 404 are in the SFHAs, while 14 are not in the SFHAs. All buyout properties are supposed to be in the SFHAs. However, the observed changes could be because of sea level rise and changes in extreme weather events (Gori et al., 2020), leading to various environmental dynamics, including instability of the SFHAs. Results showed that most buyout parcels (260) have no structures on adjoining properties, while 158 parcels share boundaries with adjoining properties with at least one structure on them. This means that the 260 buyout parcels could easily be converted to other FEMA-stipulated land uses, such as parks (Zavar & Hagelman, 2016), while the 158 parcels could lead to a checkerboarding (Baker et al., 2018), making it difficult to build a greenway or park (BenDor et al., 2020).

Study findings show that most buyout parcels (291) are vacant, 94 parcels have been converted to wetlands, 22 parcels have been converted to trails and parks, and 11 parcels have structures on them. This finding is consistent with Zavar & Hagelman (2016), who observed most buyout parcels as vacant in their study. The ample number of vacant parcels results from local administrators' approaches, which include leasing the buyout properties to adjoining property owners. One of this study's interviewees explained that they lease the buyout parcels to interested adjoining property owners, with a clause that the adjoining property owner must maintain the buyout parcels and not erect structures on them. There are two overarching factors responsible for implementing the leasing of the buyout parcels to adjoining property owners, a. cost of buyout parcels maintenance; and b. animal encroachment.

Results show that the cost of buyout parcel maintenance is significantly high without any tax generation from such a parcel. This result is consistent with BenDor et al. (2020). BenDor et al., observed that some communities lease the buyout properties for as low as \$1 annually because

the communities could not afford the maintenance cost of the parcels. Hence, the need to transfer the maintenance cost to interested adjoining property owners.

Also, respondents explained that adjoining property owners usually complain about animal encroachment on their properties. Therefore, the county utilizes this as a window of opportunity to present leasing the buyout property as an option to the adjoining property owner. After acquiring these parcels, the adjoining property owners are expected to maintain these parcels and not erect structures on the parcels. However, findings showed that some adjoining property owners are contravening by erecting structures on these buyout parcels. For instance, this study identified eleven parcels with structures in the study area. This could be because of the low monitoring rate at the state and local levels. As observed in this study, the state only keeps the records of the buyout parcels, and the local government monitors the buyout parcels annually, usually during the summer months. Due to the national increase in buyout properties contravention, FEMA recently stipulated that whosoever is interested in leasing the buyout properties must seek approval from FEMA through the local and state governments to ensure that the lease documents contain the appropriate restrictions.

Results showed that 94 buyout properties were converted to wetlands. This could be because of community financial constraints to maintain the buyout properties or the ecological importance of wetlands, including floodplain restoration, stormwater storage, and biodiversity habitat (Atoba et al., 2021; Zavar & Hagelman, 2016; Conrad et al., 1998).

This study identified 22 parcels converted into recreational parks and trails. This could be because parks possess multipurpose recreational values such as hike/bike trails, water recreation, playgrounds, and parking lots (Zavar & Hagelman, 2016).

The spatial autocorrelation results showed that land values are clustered in the study area, where high-value lands are within clusters and low-value lands within clusters, which is consistent with Hu et al. (2016)'s study in Wuhan, China. This study observed many low-land value clusters around the City of Greenville and high-land value clusters outwards of Greenville towards Grimesland, Farmville. These clusters could be attributed to the GWR model parameters such as parcel sizes, as it was observed that small parcels are clustered in Greenville, majorly residential parcels. Grimesland and Farmville, on the other hand, are predominantly rural areas with agricultural activities. As such, the parcel sizes tend to be bigger, affecting the land values.

The geographically weighted regression model results showed that the buyout parcels could not solely determine the land value of parcels in the SFHAs. This result is contrary to assumptions by (Zavar & Hagelman 2016; FEMA, 1998) that buyout parcels can increase the property value of adjoining properties, but consistent with BenDor et al. (2020) that the financial impact of buyout parcels on adjoining properties is negligible because the properties are in the floodplains. Also, the result showed that variables such as distance to the nearest rescue location, distance to the nearest school, distance to the nearest river, distance to the nearest police department, and parcel area explain 52.2% of the land value in the SFHAs. This result is consistent with other scholars who argue for the importance of these variables in determining the property values in their respective study areas (Giuliano et al., 2010; Munroe et al., 2007; Hu et al., 2016).

This study observed that FEMA funds 75% of the buyout program through the HMGP in North Carolina, including Pitt County, which is consistent with other scholars (e.g., Godschalk et al., 1999; Fraser et al., 2006; De Vries & Fraser, 2012; Maly & Ishikawa, 2013; Zavar & Hagelman, 2016; Greer & Binder, 2017; Robinson et al., 2018; BenDor et al., 2020; Atoba et al., 2021). In other states, the remaining 25% could be funded through the CDBG disaster recovery

program (Greer & Binder, 2017; Atoba et al., 2021; Robinson et al., 2018). This is different in North Carolina, as this study observed that North Carolina funds the remaining 25% through the State Emergency Response and Disaster Relief Fund (STRDF).

To qualify for the buyout program, this study observed that the applicant must be a homeowner, fill out a form of voluntary participation, have flood insurance, must have been repetitively flooded, must be in the SFHAs, and the property value must be less than \$323,000. These criteria are consistent with Greer and Binder (2017) but slightly different from Robinson et al. (2018). Robinson et al. (2018) identified the property value cap as \$276,000, which is different from the \$323,000 identified in this study. The discrepancy could be the difference in years, as Robinson et al. (2018) obtained their property value cap from FEMA (2015), and the present study was conducted in 2022.

The study also observed that the buyout process in Pitt County, including the application documentation at the local level, reviews at the state level, and approval at the federal level, is longer than FEMA's stipulated duration of seven to 18 months (Robinson et al., 2018), which is one of the reasons some impacted homeowners opted out of the program. For instance, Pitt County has yet to buy out a property over four years since Hurricane Florence struck in 2018. The longer duration could be ascribed to two overarching factors at the federal and state level. Due to the alarming rate of disaster occurrence, including 32 hurricanes and 52 flooding events locations since 2018 (FEMA, n.d) in the US, the federal government might encounter difficulties managing these events. Hence, leading to a longer duration of rendering help, including buyout programs to impacted homeowners. At the state level, the recently implemented state-centric program by the NCEM could have prolonged the buyout program duration. The state-centric program was implemented in 2020 to mitigate the unequal economic and administrative power among the local

governments in the state. The state-centric program is expected to aid the transfer of all mitigation processes to the state level. Still, after the program's implementation, it became clear that the state does not have the legal right to buy out properties from the impacted homeowners. As such, the state-centric program was further delayed for two years to set things right, including the governor's signature on the budget and the law amendment by the legislature.

The other buyout challenges observed in this study include the program's credibility. We observed that most impacted homeowners are minorities and were reluctant to accept the buyout offers, probably because of the history of racial issues. The local administrators needed to persuade the people of color before they accepted the buyout offers. This result is consistent with Elliot et al. (2020), which observed that people of color were compelled to accept the buyout offers in Kashmere Gardens, Houston.

The program's bureaucracy, including the application documentation and reviews, inefficient communication among officials, and impacted homeowners were identified as major challenges impeding the program's operation in Pitt County. In their study, Fraser et al. (2006) identified that effective communication between the community and the officials would improve the program's outcome.

The findings also identified the factors responsible for the buyout rejection in the study area, including unsatisfactory property evaluation and attachment to the property. Considering that the property value in SFHAs is lower than their non-SFHAs counterpart, a fair market value offered by the government might not be sufficient to secure a similar property in non-SFHAs. Some impacted homeowners also believed their properties were worth more than the fair market value. Financial incentives (Robinson et al., 2018; Baker et al., 2018) have been identified to mitigate the property evaluation challenge. This study finding that attachment to the property can



impede the acceptance of the buyout offer is consistent with previous studies (e.g., Kick et al., 2011; Fraser et al., 2006; De Vries & Fraser, 2012; Maly & Ishikawa, 2013).

## CHAPTER 6

### Conclusion

This study examines how the buyout parcels affect the adjoining properties in the Special Flood Hazard Area. Findings show that most buyout parcels in Pitt County between 2000-2021 are vacant, with few parcels converted to parks and trails. Most of these vacant parcels have been leased to adjoining property owners because the county lacks funds to maintain these properties. Also, this study observed low buyout property monitoring as local administrators only drive through these properties once annually. This study recommends an increase and equal access to the funding stream to procure adequate resources for maintenance. Resources such as lawnmowers to prevent wildlife encroachment on adjoining properties and staffing to increase the workforce carrying out tasks such as monitoring.

The study found that the financial impact of buyout properties on adjacent properties in the Special Flood Hazard Areas (SFHAs) is insignificant. Instead, factors such as parcel sizes and proximity to facilities were identified as the main determinants of land value in SFHAs. Based on these findings, the study recommends exploring alternative uses for vacant buyout parcels in accordance with FEMA regulations, which could enhance their utility and potentially generate revenue for the county. For example, Zavar and Hagelman (2016) suggested various permissible uses in other states, such as campgrounds, first responder training facilities, and labyrinths. This study identified some of the program's challenges, including duration, communication, property appraisal methodology, and red tape. While the state has implemented the state-centric approach to fasten the buyout program's administration, this study recommends improving the communication between the government and the impacted homeowners. Better communication

will provide the buyout applicants with the necessary information about their application status and aid in reducing participants' anxiety. This study also recommends reviewing the buyout policy to address the appraisal methodology. Notably, the fair market value paid by the government to acquire a buyout property might not be sufficient to acquire a similar property on higher ground. The government's financial incentives (Fraser et al., 2006) can make up for the price gap. To mitigate the red tape challenge, this study recommends a modeled application review process to aid decision-making and reduce wait time.

In conclusion, this study contributes to the body of knowledge about the present state of the buyout program in Pitt County, including the buyout land usage and the program's challenges. Also, this study can help policymakers navigate the direction of improving the buyout program. This research is timely and relevant, as it offers essential insights into the effectiveness of buyouts in Pitt County since Hurricane Floyd that could be of value to communities within and beyond Pitt County. This study is an output of local administrators' perspectives. Future studies can evaluate the adjoining property owners to understand how the buyout parcels affect their livelihood. Also, a future study can examine the buyout parcels by testing for the most suitable land use. For instance, some parcels might be suitable for residential farming, where the adjoining property owners would farm on the buyout properties.

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## Appendices

### Appendix A: List of Interview Subjects

**Department of Geography, Planning, and Environment  
Thomas Harriot College of Arts and Sciences  
East Carolina University  
Greenville, North Carolina.**

### Buyout Program Key Informant Semi-Structured Interview Guide

Interviewee/ Pseudonym:	
Gender:	

#### **Section A: Demographics.**

*I want to start the interview with a few questions about you.*

1. If I may ask, what is your job title?
2. What are your job roles?
3. How is your present/previous job role related to the buyout programs?

#### **Section B: Buyout Programs in Pitt County**

*I now would be asking you specific questions about buyout programs in Pitt County.*

1. How many buyout programs have you participated in as an administrator in Pitt County?
2. Can you please explain the buyout program process in your jurisdiction? (Probes: Duration, Funds allocation)
3. What challenges have you encountered in carrying out your duties related to the buyout program?



4. What are the outcomes of the buyout programs you have participated in? (Probes: challenges, funding, success stories)
5. Why did some homeowners opt out of the buyout program in your jurisdiction? (Probes: attachment to the property, unsatisfactory property evaluation, duration)
6. What are the impacts of the buyout program on adjoining properties?
7. What is your opinion on the random (checkerboard) land use pattern? (Probes: Utilities, Tax base)
8. What are the adopted mechanisms to maintain the bought-out properties? (Probes: property landscape maintenance, present property usage)
9. Mitigation strategy
10. Is there anything else we are yet to discuss regarding the buyout programs in Pitt County?

**REFERRAL**

*If you don't mind, I would want you to recommend a few government officials in Pitt County who have participated in past buyout programs for me to contact. I would also be grateful if you could give me the names of community leaders, heads of organizations, or associations actively participating in this process.*

<i>Name</i>	<i>Agency/Organization/Community</i>	<i>Contact Information (Address, Tel., Email)</i>

## Appendix B: IRB Approval



EAST CAROLINA UNIVERSITY  
University & Medical Center Institutional Review Board  
4N-64 Brody Medical Sciences Building · Mail Stop 682  
600 Moye Boulevard · Greenville, NC 27834  
Office 252-744-2914 · Fax 252-744-2284  
[rede.ecu.edu/umcirb/](http://rede.ecu.edu/umcirb/)

### Notification of Exempt Certification

From: Social/Behavioral IRB  
To: [Kayode Adeniji](#)  
CC: [Anuradha Mukherji](#)  
Date: 9/19/2022  
Re: [UMCIRB 22-001593](#)  
Impact of Buyout Programs on Land Use Patterns in Pitt County, North Carolina

I am pleased to inform you that your research submission has been certified as exempt on 9/19/2022. This study is eligible for Exempt Certification under category # 2ab & 4ab.

It is your responsibility to ensure that this research is conducted in the manner reported in your application and/or protocol, as well as being consistent with the ethical principles of the Belmont Report and your profession.

This research study does not require any additional interaction with the UMCIRB unless there are proposed changes to this study. Any change, prior to implementing that change, must be submitted to the UMCIRB for review and approval. The UMCIRB will determine if the change impacts the eligibility of the research for exempt status. If more substantive review is required, you will be notified within five business days.

Document	Description
Adeniji Proposal_v4.docx(0.01)	Study Protocol or Grant Application
Adeniji_Interview instrument.docx(0.01)	Interview/Focus Group Scripts/Questions
Consent Form(0.01)	Consent Forms
Invitation Email(0.01)	Recruitment Documents/Scripts

For research studies where a waiver or alteration of HIPAA Authorization has been approved, the IRB states that each of the waiver criteria in 45 CFR 164.512(i)(1)(i)(A) and (2)(i) through (v) have been met. Additionally, the elements of PHI to be collected as described in items 1 and 2 of the Application for Waiver of Authorization have been determined to be the minimal necessary for the specified research.

The Chairperson (or designee) does not have a potential for conflict of interest on this study.