

# Are Floodplain Buyouts a Smart Investment for Local Governments?

Final Report for the UNC Policy Collaboratory

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## Table of Contents

Executive Summary .....	4
Introduction .....	6
Background .....	8
Methods .....	14
Results .....	21
Discussion .....	27
Conclusion .....	31
Recommendations .....	33
Limitations .....	35
References .....	37
Supplemental Material 1: List of Interviewees .....	43

## **Executive Summary**

Floodplain buyouts--the acquisition and removal of homes damaged or destroyed by flooding--have played an increasingly important role in federal disaster policy. Over the past 25 years, the Federal Emergency Management Agency (FEMA) has funded the acquisition of more than 55,000 flood-damaged properties across the U.S., including over 5,600 homes in North Carolina.

By moving people and property out of harm's way, buyouts can help lessen the emotional and financial toll of future flooding. Buyouts can reduce disaster-related costs for evacuation, sheltering and debris removal, while creating green space - parks, community gardens or even wetlands - that can absorb and hold floodwaters, potentially reducing flooding downstream. However, buyouts can also result in a loss in local property taxes, if homeowners who sell their flood-damaged home relocate to another city or town. Also, local governments often become saddled with the cost of maintaining the now-vacant properties. In rare cases, annual infrastructure maintenance costs may be reduced if entire segments of road, water, and sewer infrastructure are permanently removed from an uninhabited neighborhood where all of the residents participated in a buyout.

There has been little research on the fiscal gains and losses to a local government that implements a buyout. The goals of our research were to (a) assess the net fiscal impacts of floodplain buyouts on municipalities in North Carolina, (b) establish a user-friendly process for estimating true range of financial outcomes for different types of communities, and (c) create a spreadsheet tool for estimating the financial impacts for both past and future buyouts.

For our analysis, we selected eight communities in North Carolina that either had implemented a buyout following Hurricane Fran or Floyd, or were in the process of implementing a buyout following Hurricane Matthew (see Figure 2). We conducted interviews with key informants, visited each of the sites selected, assessed the costs and avoided losses from buyouts, and developed and tested a model that enabled us to explore how different community characteristics, policies and approaches to program design could affect the fiscal impact of a buyout over time.

## **Findings**

Our research sought to answer a simple question: what is the fiscal impact of buyouts on municipalities? The answer depends on at least three key factors: 1) the spatial distribution of the acquired properties, 2) whether buyout participants relocate within the community, and 3) how the acquired properties are managed or maintained.

*Spatial distribution* –The spatial layout of the acquired properties largely determines how they can be used afterwards. If the acquired properties are sufficiently clustered or contiguous, the municipality could create an amenity, such as a park or greenway, that could add value to surrounding properties, thus boosting the tax base. If the acquired properties are scattered throughout the community, the most likely use will be vacant lots.

*Relocation* – One of the main fiscal impacts of a buyout is the loss of tax revenues from homes that are acquired and demolished. Those tax revenues will be lost if homeowners that sell their

homes move outside the municipality. Some state and local governments have offered financial incentives to encourage buyout participants to relocate within the same municipality.

*Management* – After the buyout is complete, local governments end up paying to maintain the acquired lots. The costs for maintenance can be substantial, particularly for smaller communities. Some communities (e.g., Greenville) simply lease the vacant lots to adjacent property owners for a nominal fee.

### **Recommendations**

*At the local level*, to minimize the costs and maximize the benefits of buyouts, communities should design and implement buyouts that adhere to the following principles:

- Acquire a sufficient number of contiguous properties to create a public amenity,
- Look for opportunities to connect to existing open space, such as a park or greenway,
- Create incentives and strategies for homeowners to participate in a buyout and relocate within the community,
- Partner with third parties such as land trusts, conservation groups, state or local park systems to manage lands acquired as part of a buyout,
- Plan for buyouts in advance of the next flood and incorporate these plans into the local hazard mitigation plan,
- Identify and prioritize buyout areas in advance and create list of willing sellers, and
- Incorporate plans for a buyout into hazard mitigation plans.

*At the state level*, the state should:

- Develop incentives for more complete or efficient buyouts,
- Provide funds for long-term maintenance and management of buyout lands,
- Create incentives for buyout participants to relocate within the same community,
- Work with local governments to identify relocation areas in advance,
- Coordinate with local governments to collect data on the costs and benefits of buyouts,
- Look for opportunities to coordinate planning and funding for buyouts across state agencies and programs, such as the Division of Emergency Management, the Department of Parks and Recreation and the Clean Water Management Trust Fund.

## Introduction

In October 2016, Hurricane Matthew rolled along the Atlantic Coast, leaving a path of destruction that extended from Florida to North Carolina. The storm dropped over 20 inches (508 mm) of rain in Eastern North Carolina (Lang and Gutro, 2017), leading to extensive flooding. A year later, Hurricanes Maria, Irma and Harvey caused record flooding in Puerto Rico, Florida and the Virgin Islands, and Texas, respectively. Each of these storms caused over \$50 billion in damages (NOAA, 2018). These record-breaking storms could become the norm, as the Earth continues to warm, and as the nation's flood-prone area may increase by nearly 40 percent by the year 2100, putting more people and property at risk (AECOM, 2013).

For much of the 20th century, US policy toward controlling floods focused primarily on taming rivers with structures such as dams, floodwalls and levees (Conrad, 1998; Wright, 2000). Following record-breaking flooding in the Midwest in 1993, federal policy began to shift more toward non-structural measures, such as land use planning and regulation to prevent development in hazard-prone areas, and the acquisition and removal of flood-damaged homes (Godschalk, et al., 1999). Efforts to acquire flood-damaged homes, known as “buyouts,” are aimed at facilitating homeowner relocation to new areas that are free from flooding. This practice dates back to at least the late-1970s, when Soldiers Grove, Wisconsin, moved its entire downtown to higher ground, out of the Kickapoo River floodplain (Greer and Brokopp Binder, 2017).

Buyouts have since become a major focus of US flood mitigation strategy (FEMA, 1998), as the US Federal Emergency Management Agency (FEMA) has funded the acquisition of more than 55,000 flood-damaged properties across the U.S. since 1993 (FEMA, 2018), including over 5,600 homes in North Carolina (NCEM, 2017; NCEM 2018). The number of buyouts has increased dramatically within the last few years following events such as Hurricane Sandy (2012), Hurricane Matthew (2016), and Hurricane Harvey (2017), which caused extensive damage in New York and New Jersey, North Carolina, and Texas, respectively. After Hurricane Sandy, FEMA approved the purchase of 587 properties in New Jersey, costing approximately \$158 million in federal funds (FEMA, 2016). Likewise, up to 1,000 flooded homes damaged from Hurricane Harvey in Texas may soon be acquired after \$25.6 million was approved for approximately 169 home buyouts (Cusick, 2018). . Increased costs from flood damage will likely continue to rise given recent projections about more extreme flooding events from increased development in floodplains, urbanization, and climate change (National Climate Assessment, 2014).

Recent research has explored various aspects of buyouts, including social equity and cost-effectiveness (Tate, et al., 2016), land use impacts (Zavar and Haglemen, 2016), and factors affecting homeowner's decisions about buyouts (Bukvic and Owen, 2017; Binder, et al., 2015). Additionally, several studies have shown that buyouts can reduce the losses from future floods (FEMA, 2009b; FEMA 2016a). These studies focus on “avoided losses,” estimating the flood-induced economic losses that would have occurred if homes had not been acquired and removed from flood hazard areas. For example, after major flooding in 2008, a study of avoided losses across eight communities in Missouri concluded that buyouts saved roughly \$96 million in flood damages (FEMA 2009b: 5-8).

However, there has been little empirical research on the fiscal impacts of buyouts from the perspective of municipal governments. On the heels of the 1993 Midwest flood, the Federal Interagency Floodplain Management Review Committee (IFPMRC) learned during discussions with local governments that lost tax revenues due to land acquisitions from buyouts were becoming a pressing issue (IFPMRC, 1994). Other authors have also claimed that floodplain buyouts remain a drag on municipal budgets (Zavar, 2016). For example, as properties are purchased and demolished, local governments typically inherit responsibility for maintaining a significant number of now-vacant lots (Freudenberg, 2016).

However, the overall municipal financial impacts of buyouts remain uncertain. Freudenberg, et al. (2016, pg. 38) assert that the impacts of removing property from the tax rolls may be less significant than public officials estimate. They argue that, while floods cause damage that lowers property values over the long term, "...local governments do not lose taxes that are calculated as a share of the pre-flood value of the property; they lose taxes on the post-flood value of the property."<sup>1</sup> Recent work by Wiley (2018) also asserts that buyouts can be designed such that they minimize local tax revenue losses, or even increase local revenues by coupling the buyouts to strong land use planning strategies that enhance the community. By removing homes from flood hazard areas, buyouts can permanently reduce a community's vulnerability to flooding, as well as lower their response and recovery costs, including, evacuation, sheltering, debris removal, and emergency services. If entire blocks or neighborhoods participate in a buyout, a community may also realize savings through avoided costs for maintenance of roads and infrastructure (e.g., water and sewer).

When a flood buyout program is carried out, the fiscal gains and losses to the local government are rarely evaluated. This type of assessment, however, is crucial to understanding the full costs and benefits of a buyout to a local government. The goals of this paper are to (a) assess the net fiscal impacts of floodplain buyouts on municipalities in North Carolina (b) establish a user-friendly process for estimating true range of financial outcomes for different types of communities (even in data sparse environments), and (c) create a spreadsheet tool for estimating these financial impacts for both past and future proposed buyouts. This work could help communities make more informed decisions about the financial implications of buyouts and improve the outcomes of buyouts as well.

These goals are relevant and timely for communities in Eastern North Carolina that are still struggling to recover from Hurricane Matthew. Our hope is that the spreadsheet tool created by this project can help guide local governments to collect and use better information in order to improve both the process and outcomes of buyouts. This aligns directly with the UNC Policy Collaboratory's mission of "facilitating the dissemination of the policy and research expertise of the University of North Carolina for practical use by state and local government."

We begin this report by providing a brief background on the funding sources, common spatial patterns, and financial impacts of buyouts. Next, we will discuss selection of eight, highly flood-prone case study communities for this study. We will then discuss acquisition of buyout data

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<sup>1</sup> This raises a question as to the magnitude of long-term land value loss due to flooding if flood-damaged properties can regularly be repaired to their pre-flood status.

from the North Carolina Division of Emergency Management (NCDEM), as well as techniques used to map buyout properties in order to better understand their spatial layout and fiscal impacts. Following this, we will discuss interviews with key informants ( $n=25$ ) to understand data availability and cost profiles. The results of this research include a simple, user-friendly model to help communities estimate financial gains and losses as a result of their implementing a buyout program. Using scenario analysis, we apply this model to the City of Lumberton, NC to examine how different municipal actions can affect the net fiscal impacts a buyout program. This model can also be used to help communities predict the potential future net fiscal impact of a prospective buyout program, with the ability to run multiple scenarios given the range of implementation goals and strategies that may exist.

## **Background**

### **Financing buyouts**

The primary sources of funding for floodplain buyouts are Community Development Block Grants (CDBG) from the U.S. Department of Housing and Urban Development (HUD) and Hazard Mitigation Assistance grants from FEMA. Under the CDBG program, HUD offers flexible grants to help cities, counties, and states to recover from large-scale disasters, especially in low-income areas. The grants, known as CDBG-DR (for “Disaster Recovery”), can be used for “...necessary expenses related to disaster relief, long term recovery, and restoration of infrastructure, housing, and economic revitalization...(HUD 2018, pg. 14).” This could include, for example, rebuilding homes and infrastructure damaged by a disaster. CDBG-DR funds may also be used to provide the non-federal match for FEMA Hazard Mitigation Assistance grants, discussed below (HUD 2018).

FEMA administers three types of Hazard Mitigation Assistance grants: 1) Pre-Disaster Mitigation, 2) Flood Mitigation Assistance, and the 3) Hazard Mitigation Grant Program (HMGP; FEMA, 2017a). All three grant programs are intended to reduce or eliminate risks from future disasters while also reducing the reliance on federal disaster funding.

The Pre-Disaster Mitigation Grant Program, authorized by the 1988 Stafford Act, (42 U.S.C. 5133), provides funds for pre-disaster natural hazard mitigation programs, such as elevating, floodproofing or acquiring homes. Similarly, the Flood Mitigation Assistance grant program -- which was created as part of the National Flood Insurance Reform Act of 1994 (FEMA, 2017) -- can be used for mitigation, including the acquisition of homes, although funds are limited to projects that reduce or eliminate risks to properties insured under the National Flood Insurance Program (NFIP; 42 USC 4104c).

Although Pre-Disaster Mitigation and Flood Mitigation Assistance provide substantial financial assistance to communities (over \$160 million in Flood Mitigation Assistance during FY 2017 alone; FEMA, 2018), the primary source of buyout funding is FEMA’s Hazard Mitigation Grant Program, which was authorized under Section 404 of the 1988 Stafford Act (FEMA 2017b) and awards grants after a disaster occurs. For example, in fiscal years 2011 - 2014, FEMA obligated over \$3 billion for HMGP post-disaster mitigation while the Pre-Disaster Mitigation Grant Program received only \$222 million (USGAO, 2015).



Applications for Pre-disaster Mitigation, Flood Mitigation Assistance, and HMGP can only be initiated by U.S. states, tribes, or territories. In general,<sup>2</sup> these grants cover up to 75% of the total cost of a project and require a 25% non-federal match, which may consist of cash, third party in-kind services, or materials (FEMA 2015). After a Presidentially-Declared Disaster (a special disaster designation), the HMGP provides grant funding to states to carry out hazard mitigation measures in order to decrease the “loss of life and property” from future disasters (FEMA 2015). States then allocate these funds to local and tribal governments for mitigation, including buyouts (USGAO, 2015). Federal law requires states, territories, federally-recognized tribes and local jurisdictions to have a mitigation plan prior to receipt of HMGP funds (FEMA. 2015a). Grants can be used for a variety of mitigation activities, including building elevation, reconstruction, flood-proofing and buyouts (FEMA 2015a).

An important aspect of buyout policy is that the procurement of properties through FEMA is strictly voluntary – homeowners cannot be forced to sell their homes (FEMA 2015c). While homeowners are paid pre-flood, fair market value for their properties (FEMA 2014), in some cases, state or local governments will provide additional funds as an incentive. For example, after Hurricane Sandy, the State of New York provided bonuses of up to 15% of a home’s pre-storm price in an effort to increase participation in the buyout (Polefka 2013, Pgs. 9-10).

Properties acquired using FEMA funds must be demolished and the site must be maintained in perpetuity for “uses compatible with open space, recreational or wetlands management practices,” (44 CFR 206.434(e)). Federal funds cover the cost of appraisal, acquisition and demolition as well as clearing the site, but typically exclude maintenance. The lands publicly acquired through buyouts can -- in theory -- be used for numerous purposes, including parks, community gardens, or wildlife habitat, or as spaces for restoring the natural flood storage capacity of floodplains. However, the most common use of buyout lands is vacant lots, defined as mowed grass or bare soil (Zavar and Hagelman 2016).

### **Buyout spatial patterns**

The voluntary nature of buyouts complicates efforts to predict the future land use and maintenance requirements of a buyout project. Rather than accept a buyout, some homeowners will inevitably decide to rebuild after a flood, often with the assistance of NFIP disbursements. These so-called buyout “hold-outs” often occur due to homeowners being given either inadequate information or incentives (financial or otherwise) to participate (Binder, 2014). Hold-outs may also be unwilling to move as a result of strong attachment to the home, land, or social aspects of neighborhood (Henry, 2013). Alternatively, they might not be able to afford to buy a similar house outside the floodplain.<sup>3</sup>

A few studies have explored the different factors that affect homeowners’ decisions about whether or not to accept a buyout (e.g., Binder and Greer, 2016; Bukvic and Owen, 2017) For

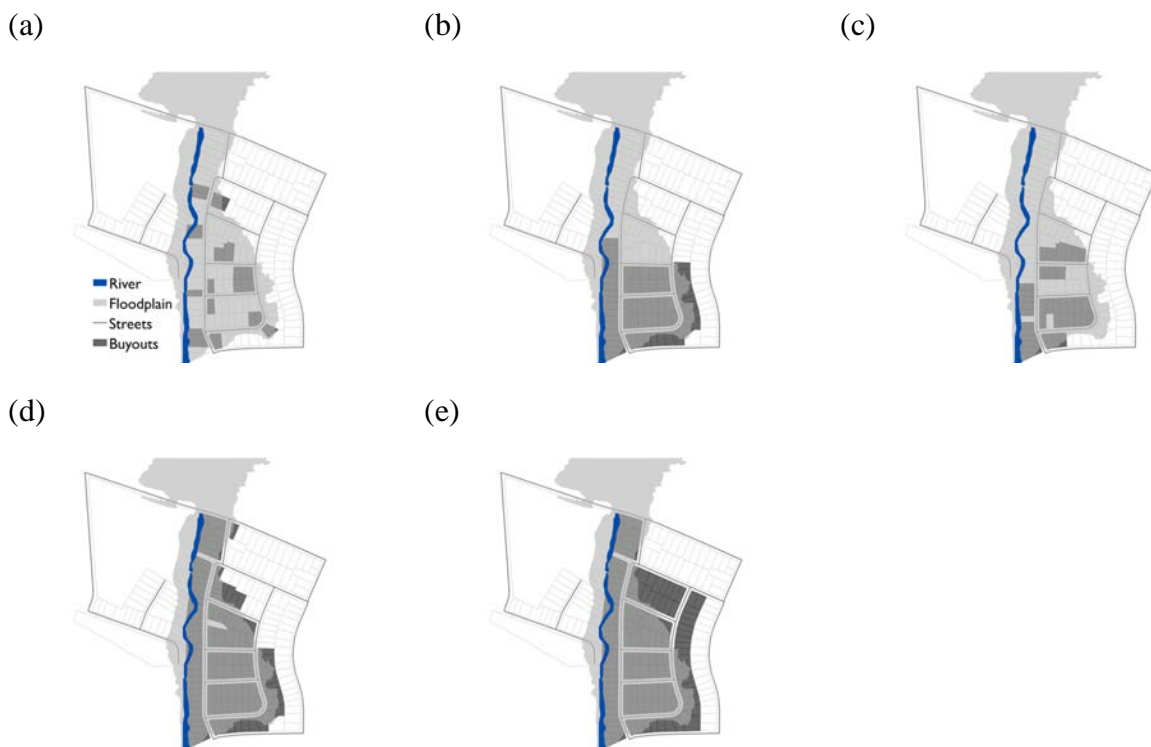
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<sup>2</sup> Exceptions to the 25% non-federal match requirement include Pre-disaster Mitigation grants for “small, impoverished communities” (only a 10% match required) and under Flood Mitigation Assistance grants for severe, repetitive loss properties, in which case FEMA can waive the local match entirely (FEMA 2015).

<sup>3</sup> For this reason, the State of North Carolina supplemented FEMA buyout compensation with additional financial incentives made available through its State Acquisition and Relocation Fund following Hurricane Floyd in 1999 (Freudenberg et. al., 2016; NCEM, 2015:95).

example, in their case study of buyouts in Oakwood Beach, New York, following Hurricane Sandy, Binder and Greer (2016) found that financial incentives appeared to encourage participation, although the incentives did not necessarily relieve financial burdens for buyout participants. Contrasting this, in a survey of 46 homeowners across seven coastal communities affected by Hurricane Sandy, Bukvic and Owen (2017) found that most respondents would make their decisions about whether to rebuild or relocate regardless of what their neighbors, friends and/or family decided to do.

**Figure 1.** Categories of buyout patterns, including (a) scattered or random patterns, clustered patterns that would facilitate (b) extensive or (c) minimal infrastructure maintenance cost savings, (d) complete buyouts, and (e) “more than complete” buyouts (beyond the affected floodplain itself).



Hold-outs (or lack thereof) can lead to a variety of spatial patterns of remaining homes in a buyout area. The spatial patterns of remaining homes can determine infrastructure cost savings as well as what local governments can do with acquired properties. We can categorize these general patterns across two continuums, sparse-to-full and “efficient”-to-“non-efficient” patterns: 1) a scattered or random pattern (sometimes called “checkerboarding”; Figure 1A), a clustered pattern that leads to either 1) large (Figure 1B) or 2) minimal infrastructure cost savings (Figure 1C), and 4) a complete buyout (all houses in an area; Figure 1D). These general patterns -- with the exception of the last -- can be seen in buyouts that took place our eight study communities (discussed in the next section; Figure 3). We can also consider an additional situation, whereby 5) a “more than full” buyout takes place, which could include opportunistic purchases of houses beyond the flooded area (Figure 1E).

### **Financial impacts of buyouts**

Fiscal impact assessment has long been an approach for aiding municipal decision-making (Burchell 1978). Used to project changes in costs and revenues of governmental units as a result of development (or redevelopment), a variety of techniques are frequently used to estimate the costs incurred by municipal governments in providing services. In particular, techniques such as “per-capita multipliers” (using average cost per capita to extrapolate costs of development changes), “proportional evaluation” (assigning development an area-weighted portion of municipal costs as measured across the entire city), and “case study” or “comparable city” methods (getting estimates from interviews and using reference cases in other areas; Harrison and French, 2018).

Significant work has used fiscal impact assessment to evaluate the economic impacts of buyouts on the public, generally. Several studies have shown that, in general, buyouts are effective ways of reducing the public costs of future floods, including expenditures on emergency services, evacuation, emergency shelters, and debris removal (FEMA, 2017). Under the Stafford Act, projects funded by HMGP, including buyouts, must be shown to be cost-effective. That is, the total net benefits must be greater than the total costs (44 CFR 206.434(c)(5)). Most buyouts meet this cost-benefit test; a review of HMGP grants awarded between 1993 and 2003 found that the average benefit-cost ratio for FEMA floodplain acquisition grants was about 5 to 1 (Rose et al., 2006). Confirming this, a recent study by the National Institute of Building Sciences found that the impact of federal mitigation grants, including grants for property acquisition, resulted in an economic impact of \$6 for every \$1 invested (Multihazard Mitigation Council, 2017).

Overall, FEMA has conducted fourteen flood-related “avoided loss” studies throughout the United States in Alabama, Colorado, Missouri, Iowa, Louisiana, Mississippi, California, Oregon, Washington, and Wisconsin (FEMA, 2018b). Focusing on determining the avoided flood damage and effectiveness of land acquisitions, removal of structures in Special Flood Hazard Areas, relocations and mitigation projects funded by HMGP, the studies projected damages that would have occurred had the buyout or mitigation measure had not taken place and compared them to the cost of the mitigation projects or land acquisitions. Four categories which were used in determining overall avoided losses throughout these studies include: physical damage, loss of function, emergency protective measures and nontraditional benefits.

Nine out of the fourteen studies have generated a return on investment of above 1.00, meaning these buyout projects were successful in saving money for the communities through avoided losses.<sup>4</sup> The greatest return on investment was found to be an ROI of 18.29 for 2009 Iowa flood reduction projects (FEMA 2018b), and the lowest of 0.37 for the Southern California Flood Control Mitigation study (FEMA 2018b). This variation in ROI calculations may be due to numerous factors influencing the effectiveness of a buyout or mitigation project, including the location and number of buyouts as well as the extent of an elevation or mitigation measure.

A 2010 study in Moorhead, Minnesota found that buyouts that took place between 1995 and 2010 resulted in avoided losses of over \$9 million. The study estimated damages that would

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<sup>4</sup> Conversely, a ROI < 1.00 means that the total costs of the flood buyout project have exceeded the avoided losses, a low return on investment.

have occurred as a result of five storms that struck the area after the buyouts were initiated (FEMA, 2010). Between 1995 and 2008, FEMA and the state of Missouri purchased 4,045 repetitive-loss properties across eight eastern counties. From 1999 to 2008, Missouri faced 14 presidential disaster declarations due to flooding. Analyzing the performance of buyouts in 2009, FEMA and Missouri found that for the 885 properties for which there were adequate data, nearly \$97 million in losses was avoided during those 14 flood disasters, representing a 212 percent return on investment for the \$44 million of public funds that had been invested in those particular buyouts (Polefka, 2013). More recently, in Harris County Texas, the acquisition of over 2000 structures was estimated to have avoided nearly \$18 million as a result of flooding in 2015 (Ward, et al., 2016)

While FEMA’s loss avoidance studies consider federal financial impacts, our study is focused on estimating *municipal* financial impacts, which require us to be careful to only consider costs incurred at the municipal level, alone. Therefore, we can consider the financial impacts of buyouts in terms of four different categories, including 1) avoided future infrastructure costs (annualized), 2) avoided future emergency response and recovery costs (annualized), 3) tax revenue impacts, and 4) buyout site maintenance costs. This amounts to a calculation that follows Equation 1:

$$\text{Net fiscal impact (\$)} = \text{avoided annual infrastructure costs} + \text{avoided emergency response and recovery costs} - \text{net tax revenue loss} - \text{buyout site maintenance costs} \quad (\text{Equation 1})$$

#### *Avoided annual infrastructure costs*

An “efficient” buyout implies that remaining infrastructure (i.e., roads, water distribution lines, sewer lines, etc.) in a buyout area will not be used and the municipality will no longer have to pay for regular operations, maintenance, or repairs. If the infrastructure is permanently removed or cut off from the existing system, it represents an avoided cost that is usually funded through a capital improvement program. However, since capital improvement budgets are often quite large and it is rare for more than just a small percentage of the total public infrastructure to be decommissioned, the avoided costs may not amount to a very large amount, even over several decades. For example, if a municipality with 10,000 housing units has an annual roads maintenance budget of \$1,500,000 that covers 150 miles of roads, and 1% or 1.5 miles of road is removed from a neighborhood where 20 homes have been bought out, total avoided infrastructure costs<sup>5</sup> for one year would amount to just \$30 per year.

#### *Avoided emergency response and recovery costs*

Following significant flooding events, municipalities often engage in a series of immediate response and recovery activities including “Emergency Work” (i.e., debris removal, swift water rescues, opening and operating shelters, etc.) or “Permanent Work” (i.e., restoration of roads, bridges, utilities, buildings, equipment, etc.) as defined through FEMA’s Public Assistance (PA)

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<sup>5</sup> The example figures are based loosely on the characteristics of housing and roads found in the City of Lumberton, NC.

Program (FEMA, 2018). While some of these costs would be avoided during a flood if several homes had been bought out, most municipalities get full reimbursement through FEMA (75%) and their state emergency management agency (25%) during major, declared disasters (FEMA, 2018). In North Carolina, for state, but not federally-declared disasters, the local government must cover 25% of the costs for response and recovery activities, while the State reimburses for the other 75% (NCEM, 2015). As a result, municipalities can often transfer these costs to federal and state governments.

### *Tax revenue impacts*

Communities are often concerned about the loss of tax base due to the removal of homes (Bukvic and Owen, 2017). Unless homeowners relocate elsewhere within the same community, each home acquired and demolished reduces property and sales tax revenues to local governments.<sup>6</sup>

It is difficult to determine whether buyout participants remain in the same taxing jurisdiction or move somewhere else as there is no requirement for local governments to track where people move after a buyout. Also, few studies have estimated whether (and to what extent) buyouts actually contribute to a change in tax revenue (McGhee 2017). Another complicating issue concerns the spillover impacts of buyouts; a rich literature has looked into the impacts of proximity to open space on home value (Brander and Koetse 2011), with several studies observing home values increase due to added open space (e.g., Geoghegan 2002). However, these studies tend to focus on parks or greenways, not buyout lands. There have been no empirical studies on the impact of buyouts on the value of homes located adjacent to buyout parcels.

### *Buyout site maintenance costs*

As mentioned previously, the most common product of buyouts is vacant land, which remains over long periods as either mowed grass or bare dirt (Zavar and Hagelman, 2016). These vacant lots could affect the value of nearby homes. While some communities lease buyout lots to neighboring residents, who are then given responsibility for upkeep (Greenville, 2004), maintaining these vacant sites can become a financial burden to local governments (Zavar & Hagelman (2016)).<sup>7</sup>

Municipal governments lack the information they need to estimate the true costs of buyouts, including changes to property values and the long-term cost of maintenance. In addition, local governments lack guidance on strategies to manage homeowner participation in buyouts, which could reduce the number of holdouts and expand the range of options for using the acquired

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<sup>6</sup> In our analysis, we exclude the impacts of buyouts on sales tax revenues as these funds are often difficult to analyze at municipal level, requiring significant additional economic impact analysis. Moreover, in our North Carolina study areas, sales taxes are collected by the state and redistributed to municipalities, complicated by the recent (2016) enactment of a series of additional “Local Option Sales Taxes” at the county and municipal levels (UNC SOG 2017).

<sup>7</sup> There have not been any studies of the cost of maintaining buyout lands over time, although anecdotally, a representative of a small community (Town of Clyde, NC) we interviewed mentioned that they spend over \$40,000 each year just to mow the lots on buyout properties.

lands for community benefit. In this project, we have endeavored to create a tool to address local government questions and concerns about the long-term financial implications of buyouts, specifically, the loss of property tax revenues and increased maintenance costs.

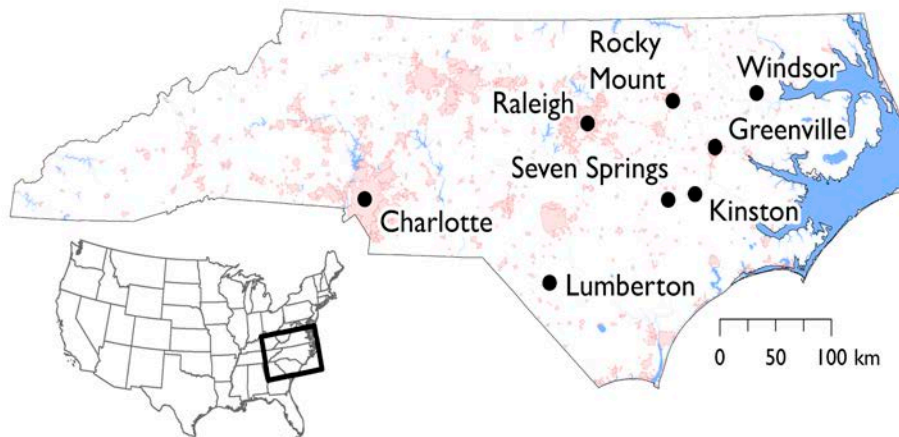
## Methods

We set out to create two versions of a municipal fiscal impact assessment model of buyouts. The first will be applied to past buyouts, as tested against our eight case study communities. The second can be used by communities to evaluate the fiscal impacts of future, planned buyouts, as well as identify the data necessary to determine buyout policy or incentives.

### Community site selection

To establish and test our tool, we selected eight communities in North Carolina that either had implemented a buyout following Hurricane Fran (1996) or Floyd (1999), or were in the process of implementing a buyout following Hurricane Matthew (2016). To establish representative case studies (Yin 2008), we sought to select communities with wide variations in population, buyout extents, and past flood protection investment. We also sought communities where we had established contacts in place and where data and key informants were readily accessible. Our case study selection process yielded eight communities (Figure 2), ranging from the City of Charlotte (pop. ~850,000; Mecklenburg County) to the Town of Seven Springs (pop. ~110; Wayne County).

**Figure 2:** Map of case study communities



The four smallest communities, Lumberton, Kinston, Windsor and Seven Springs, are still in the process of recovering from Hurricane Matthew and are considering a variety of mitigation measures, including buyouts. The other four communities -- Rocky Mount, Greenville, Raleigh and Charlotte, have had significant flood buyouts in the past, are of larger size, and in general have more robust data availability and planning capacity. All eight communities and their characteristics are summarized in Table 1.

**Table 1.** Eight NC case study communities for fiscal impact analysis. Buyout count includes total past buyouts with reliable data

<b>Municipality</b>	<b>County</b>	<b>Size</b>	<b>Population</b>	<b>Number of Buyouts*</b>
Charlotte	Mecklenburg	Large	842,051	166
Raleigh	Wake	Large	458,880	37
Greenville	Pitt	Medium-Large	91,500	189
Rocky Mount	Edgecombe, Nash	Medium	55,500	322
Lumberton	Robeson	Small-Medium	21,500	29
Kinston	Lenoir	Small-Medium	21,000	685
Windsor	Bertie	Small	3,769	32
Seven Springs	Wayne	Small	110	10

\*Represents total HMGP properties that could be mapped successfully

These communities exhibit a range of flood mitigation measures, from a dike built along the Lumber River to reduce flooding risk for neighborhoods south and west of downtown Lumberton, to a stormwater utility in Charlotte that collects stormwater fees that go towards a “rainy day fund” that enables the City to actively implement projects to reduce flood risk (Love, 2018). Using these funds, the city actively engages in the acquisition of properties that repeatedly flood (municipal-level buyouts), aiming to provide financial assistance for the relocation of the homeowner in advance of the next major flood event.

### **Mapping buyout properties**

Using the statewide database of FEMA-funded hazard mitigation project data provided by the State Hazard Mitigation Officer from the North Carolina Division of Emergency Management (NCDEM), along with county tax parcel data, the buyout properties found within municipal limits were mapped using Geographic Information Systems (GIS) software (Figure 3). While unique parcel identification numbers (PINs) found in both datasets facilitated joining the majority of the buyout datasets, errors in the NCDEM data prevented mapping of ~25% or about 523 of a total 2,059 recorded buyouts. Incomplete or inconsistent latitude/longitude and address data was likely a product of unestablished or poorly executed protocol during initial data

collection at the time of the buyouts in the 1990s. In some cases, missing data such as home purchase price had to be manually corrected and augmented using the original HMGP project close-out sheets for the buyouts provided by NCEM. Along with a PIN and address, each property record contained the associated grant number, and total purchase price of acquired home.

For communities that were able to acquire a cluster of neighboring properties, some greenway recreational amenities have been put in place (e.g., Lumberton, Figure 3). In other cases, the “checkerboard” effect of scattered buyouts is more prominent (e.g., Seven Springs, Figure 3).

**Figure 3:** Spatial patterns of buyouts in eight North Carolina communities



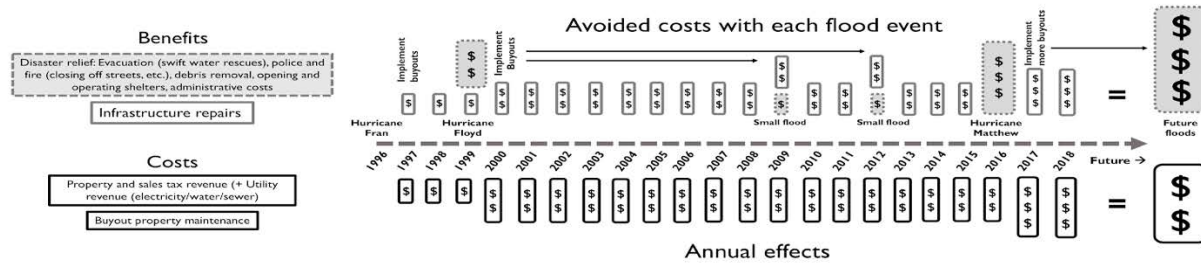
### Estimating buyout fiscal impacts

To determine the net fiscal impacts of buyouts, we sought to create a streamlined method for simplifying the theoretical fiscal analysis discussed in our background section (Figure 4). Along with cadastral and infrastructure GIS data, we relied on 25 semi-structured interviews with key informants (Gillham 2005), including state emergency management personnel (involved in specific buyouts) as well as local planning, budgeting, and public works staff that were involved with flood recovery or administration of the buyout program. A list of all key informants is provided in Supplementary Material 1.



A number of variables were not included either because of a lack of reliable data or because it would estimate a cost or benefit that is beyond the scope or jurisdiction of the municipality. For example, including sales tax revenue or utility revenue as factors were not feasible since they are often not confined to just the municipality.

**Figure 4.** Buyout fiscal impact assessment framework



### *Avoided emergency response and recovery costs*

To accurately determine the net fiscal impacts of emergency response on municipal governments, we included only those costs to the municipality that were not reimbursed by the state or federal government. We estimated avoided emergency response and recovery costs by confirming with key informants the actual level of reimbursement municipalities received for various emergency and permanent work activities.

### *Avoided annual infrastructure costs*

Annual infrastructure operating and maintenance costs can be avoided only if the municipality has removed or permanently closed off either road or water and sewer infrastructure in the course of a buyout project. Among our case studies, our interviews revealed that municipalities rarely removed infrastructure. Where removals did take place, they were rarely documented, leaving insights from key informant interviews again as our chief tool for estimating avoided costs. We estimated these avoided costs by calculating the ratio of removed infrastructure (e.g., length of road) to the total city-wide amount and relating it to the number of housing units that support the capital improvement funding stream, as well as the annual amount of money the municipality budgets for activities (e.g., total road maintenance and repair budget). Within fiscal impact assessment methodology, generally, this well-established (but flawed; see discussion section) technique is known as a *per-capita multiplier technique* (e.g. Burchell 1978)

### *Buyout site maintenance costs*

Our key informant interviews revealed that expenditures specifically towards maintaining buyout properties (i.e., through mowing, landscaping, fertilizing, etc.) are also not a well-documented aspect of buyouts in most municipalities. Therefore, our interviews aimed to determine annual, municipal spending on maintenance for all city-owned park land or vacant lots (which we determined were the dominant post-buyout land use). Along with the known acreage of buyout lands, calculating this per-area unit cost allowed us to determine the relative cost of buyout

property upkeep. This calculation is greatly affected by existing staff capacity and quality of equipment and -- like our avoided infrastructure cost estimation -- it assumes that buyout site maintenance costs are equivalent to other municipal properties. However, this calculation was unnecessary in cases, such as in Greenville, NC, where buyout properties were leased to nearby residents or commercial property owners, who were then tasked with the responsibility for site maintenance and associated costs, in exchange for being allowed to use the acquired land for low-impact uses such as gardening or parking.

### *Property tax revenue impacts*

To estimate the total amount of property tax revenue lost due to a buyout, we multiplied city and/or county property tax rates by the total assessed value of the properties (the value that is subject to property taxes) prior to the buyouts. However, there are two main caveats to this process.

First, there are many challenges with identifying the historic assessed value of a property from before the various flooding events prompting buyouts, which most commonly were Hurricanes Fran and Floyd in 1996 and 1999, respectively. Most local governments do not keep digitized, historic assessed value records and, if they do exist, they are typically only available for the past 10-15 years. While some records can be individually obtained by manual archival research, these data are obtained only with enormous effort.

Given the variation and uncertainty with collecting historic assessed property values, we elected to use sales values as a proxy measure for assessed value. Buyout participants receive the pre-storm fair market value (FMV) of their home, data that were available as part of the NCDEM dataset on historical buyout properties. To determine if the buyout sale price could sufficiently estimate property tax revenue, we compared current (2017) sale prices and assessed values for 1,029 homes in Greenville, NC (Pitt County, 2018).<sup>8</sup> When dividing the current tax value by the historical sale price, we found that assessed value averaged 7.2 percent higher than sales values (avg. ratio = 1.072, *sd* = 0.485). However, when summed, there was just a 2.64% total difference between sale price and assessed value. We acknowledge that sale price and assessed value are often quite divergent (Clapp and Giaccotto 1992), and that a current analysis is not necessarily indicative of past relationships between assessed and sales values. However, when averaged across a large number of buyout properties, the differences between sales and assessed values likely had a minimal impact on our analysis. Moreover, few alternative methods exist for more precise estimates in such a data-sparse environment. Therefore, all calculations for property tax revenue utilized the FMV that was offered to the buyout participant at that time.

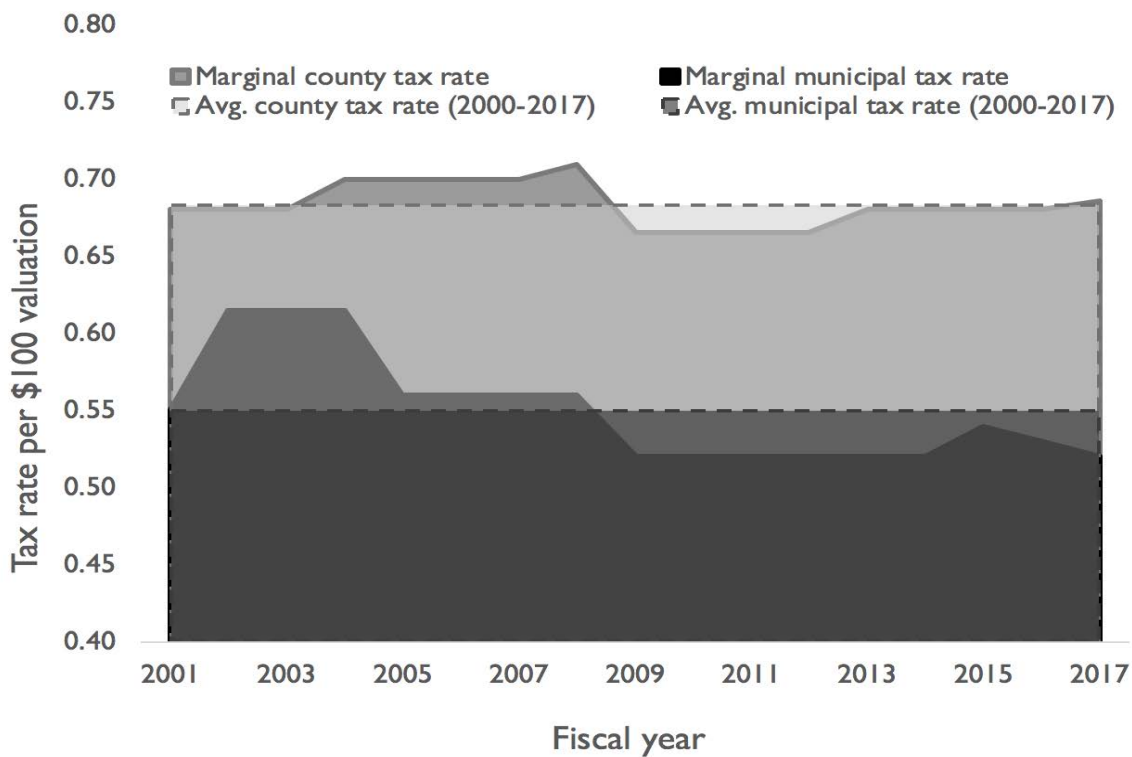
Second, calculating historic property tax revenue loss should take into account how local property tax rates change from year to year. We obtained historic property tax rates for each of the 8 case study municipalities and counties described above between 2000 and 2017 from the North Carolina Department of Revenue (NCDOR, 2018). To calculate how a changing property tax rate affected revenue generation over time, we compared calculations of marginal annual revenue to that of an averaged tax rate.

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<sup>8</sup> This analysis included parcels in Greenville, North Carolina that sold January 1, 1996 - January 1, 2003, and which contained only one 1000-2000 ft<sup>2</sup> building (avg. = ~1,500 ft<sup>2</sup> in buyout area).

As an example, we can take a hypothetical \$40,000 property (assuming a static value) for Greenville, North Carolina, and calculate the property tax revenue generated from 2000 to 2017, taking into account the specific, yearly property tax rate at both city and county levels. We can then compare this to an average of property tax rates over the same time period and used it to estimate the property tax revenue generated over time. The results showed less than 1 percent difference between the two methods (\$8,397 using the marginal method and \$8,384 using the averaged method; Figure 5). Therefore, we use the simpler and relatively accurate averaged property tax rate method, which exploits on the stable property tax rates in our study area communities over time.

**Figure 5.** Marginal and averaged (2001-2017) approaches to estimating longitudinal property tax revenue from a hypothetical \$40,000 property in City of Greenville, NC



*Net present value adjustments*

Given our dual goal of creating a tool for estimating the impacts of both past and future buyouts, we must establish methods for adjusting for inflation and social discount rates (i.e., the time value of money). To estimate the total net fiscal impact due to a *future* buyout, we can simply take the net present value of the stream of losses:

$$n_i = \sum_{t=0}^N \frac{(c_i + c_e - t_l - c_b)}{(1+r_d)^t} \quad (\text{Equation 2})$$

$n_i$  = Net fiscal impact (present \$USD)

$t_l$  = Annual property tax revenue lost ( $dvr_p$ )

$d$  = Percentage of buyout residents departing the municipality

$v$  = Buyout property value (present \$USD)

$r_p$  = Property tax rate (assumed static)

$c_i$  = Avoided annual infrastructure costs (present \$USD)

$c_e$  = Avoided emergency response and recovery costs (present \$USD)

$c_b$  = Buyout site maintenance costs (present \$USD)

$r_d$  = Social discount rate

$N$  = Number of years until end of period (e.g., calculate net impact over 10 or 20 years)

$t$  = time of cash flow

To estimate the total net fiscal impact due to a *past* buyout, we must adjust for inflation associated with the tax revenue impacts using the consumer price index for housing in the buyout year relative to the current year (Bureau of Labor Statistics, 2018). This simulates the cumulative property taxes a homeowner would be paying if they still lived in a home on the now vacant property. We are already collecting (or estimating) data on the rest of the fiscal impacts based on current values; therefore, we multiply the annual net impact (including the inflation-adjusted tax revenue impact) by the number of years since the buyout occurred. The resulting equation allows us to flexibly estimate net impacts given varying values, frequency, and timing of buyouts:

$$n_i = \left( c_i + c_e - c_b - (dvr_p \frac{C_c}{C_b}) \right) t \quad (\text{Equation 3})$$

$n_i$  = Net fiscal impact (present \$USD)

$v$  = Buyout property value (buyout year \$USD)

$r_p$  = Property tax rate (average)

$d$  = Percentage of buyout residents departing the municipality

$c_i$  = Avoided annual infrastructure costs (present \$USD)

$c_e$  = Avoided emergency response and recovery costs (present \$USD)

$c_b$  = Buyout site maintenance costs (present \$USD)

$C_c$  = Consumer price index (housing) in current year

$C_b$  = Consumer price index (housing) during buyout year

$t$  = Number of years since buyout

## Results

We organize our results based on the four types of financial impacts that we have characterized and incorporated into our model, each with summaries of relevant interview findings and data availability in our study communities. This is followed by a detailed scenario analysis for the Town of Lumberton, NC -- the study area where we were able to collect the most detailed and complete information -- where we explore eight different scenarios that we hypothesized would affect buyout financial impacts.

### **Disaster response and recovery costs avoided**

Our interviews ( $n=25$ ) confirmed that most, if not all, of the avoided costs due to buyouts are eligible for reimbursement by a 75-25% federal-state cost-share through the FEMA PA program. Key informants from two of communities noted that of the costs avoided-- the removal of debris associated with damaged or destroyed buildings and its contents or fallen tree limbs--often make up the largest percentage of known expenses that would be avoided due to buyouts. Many municipalities may have incurred slightly lower costs for swift water rescues, shelter operations, and overtime for police or fire departments due to past buyouts and less people being affected.

One interviewee stated that one of the largest benefits of the buyout is "...not having to worry about the buyout properties during a flood event from a police and rescue standpoint." But, after a Presidentially Declared Disaster guarantees 100% reimbursement of these eligible costs, informants made it clear that the reduced number of people affected due to past buyouts is fiscally insignificant to a municipality.

While federal and state governments will often end up incurring the costs and would therefore stand to benefit from additional buyouts, interviews also revealed that much of the response and recovery work completed in the municipality is done by volunteers, faith-based groups or officials from neighboring towns or counties. Identifying how many hours of in-kind services and the costs those groups might avoid due to past buyouts remains extremely difficult to calculate after-the-fact and is beyond the scope of this project.

Another cost that was neither well documented nor easy to estimate concerned the amount of avoided staff time or administrative costs due to buyout-related reductions in applications for disaster recovery programs run through municipalities. Key informants from all eight communities reported that multiple staff members -- often planners, engineers, county managers and clerks, along with hired consultant groups -- spent 6 months - 1.5 years working nearly full time on flood recovery after Hurricane Matthew, but were unable to estimate what proportion of that time may have been spent on the buyout program alone. One community described that, while they they have had to pay out of pocket for a consulting group to a prepare necessary paperwork and documentation while waiting for a grant agreement for federal programs to be established, they have also been employing the consultants for recovery or general community planning work (as the town does not have its own planning staff) for almost 2 years prior to Matthew's impacts.

Along with buyout-related reductions to workload and staff time devoted to administering the buyout program, past buyouts also translate to a reduced emotional toll on staff who, in many

cases, described the painfully long process of updating anxious residents about the buyout program's status over the course of a year or more.

One community described the potential for buyout-related cost savings having experienced two events that inflicted significant localized flooding, but did not warrant a Presidential Disaster Declaration. These events led to the municipality incurring 25% of the costs normally covered by the state and federal government.

### **Avoided infrastructure costs**

Since 7 out of 8 of the studied communities had incomplete buyouts, which resulted in spatially inefficient patterns, it is rare that road, water, or sewer infrastructure was permanently removed. In Kinston, a large-scale, highly spatially efficient buyout rendered ~5% of the municipally-owned roads no longer publicly accessible (and eliminated maintenance), with barricades placed alongside signs stating, "no dumping." The "larger buyout" scenario described below, which assumes that 5% of a municipality's infrastructure is removed, can provide significant savings in the long run. All other scenarios assume 1% of the municipality's infrastructure is removed as a result of a buyout and provide minimal fiscal benefits. Key informants in Greenville echoed what we heard in a few other communities describing that,

"...there weren't any areas that we could magically cordon off, and go I'll tap the sewer on the end of that and we're just going to walk away. No. We still had that checkerboard pattern, a little bit here, a little bit there."

More detailed conversations with a local water and sewer utility staff suggested that quantifying these savings or costs is extremely case specific, and that infrastructure removal could lead to a number of unintended consequences that incur costs. Several interviewees mentioned possible negative outcomes, such as having to relocate sewers to maintain operations that could compromise grade-related operations and lead to more frequent cleaning, or having to account for lateral blockage issues, mainline blockages, or storm sewer overflows in the area during removal. In addition, one interviewee argued that abandoning the water infrastructure and "creating a dead end system could also lead to water quality issues and diminished fire protection."

### **Buyout site maintenance costs**

Both the total area of buyout land maintained by municipalities, and the annual cost per acre to maintain it, varied substantially across our communities (with several lacking detailed information that would allow for accurate estimation). Many municipalities were responsible for maintaining 100% of the buyout properties, while others leased a fraction of the vacant lots to neighboring residents, who use the space for agreed-upon, low-impact uses such as parking or gardening.

To reduce site maintenance costs and offer potential benefits to remaining residents, one community was able to lease as much as one third (~90 total lots) of the buyout properties to adjacent residents or organizations. In multiple cases, a single individual now helps maintain -- through mowing and even cleaning of ditches -- several properties along a street. One

community leased a portion of a buyout property to a nearby church that now uses the space for overflow parking, which the town considered the highest and best use.

A majority of municipally-owned lots are vacant patches of grass that are mowed several times year by public works or parks and recreation departments, incurring costs for staff, equipment, and fuel that total anywhere from \$192/acre to \$1,398/acre annually, depending on frequency of mowing and available equipment. These per-acre cost were inferred using data from municipal public works or parks and recreation interviewees regarding the acreage maintained, frequency of maintenance, and costs. In one of the smallest of our case study communities -- the Town of Seven Springs -- buyout maintenance became a significant stressor for the part-time town clerk, who was additionally tasked with mowing several acres of buyout property multiple times a month during each summer using old and/or or inefficient equipment.

Along with maintaining vacant lots, several municipalities have also used buyout properties to create new parks or green space/greenways that may also connect with or supplement existing park space. These included a 9-hole disc golf course in Windsor, a disc golf course and dog park in Rocky Mount, and community gardens in Charlotte (Figure 6).

**Figure 6:** A disc golf course (left) and dog park (right) were created by the City of Rocky Mount, NC on lands purchased as part of a floodplain buyout



While difficult to estimate the exact financial benefits, interviewees in Windsor noted that the amenity value of the disc golf course has served as an economic driver, attracting large groups or teams that participate in tournaments, leading to a small economic boost for local restaurants and shops. Town officials also acknowledged that having the amenity in close proximity to remaining residents likely has a negligible effect on their property values, given their location in a flood-prone area. With additional buyouts in the same neighborhood approved for Hurricane Matthew, the disc-golf course may be expanded, adding more recreational tourism to the municipality. Similarly, key informants in Lumberton used the proximity to 1) existing schools

and 2) parks where green space could be expanded, as criteria for prioritizing and targeting certain areas for their Hurricane Matthew buyout program.

When estimating the annual fiscal impact of buyout property site maintenance using our model, the associated annual costs range from \$774.50 to > \$8,600 depending on a number of factors, such as the percentage of land leased to a third party, the relative cost per acre, and the total area of buyout property.

**Property tax impacts**

Among our interviewees, the potential loss of municipal property tax revenue was certainly the greatest worry from a fiscal impact standpoint when a community is considering or implementing a buyout program. Interviewees noted that some buyout participants relocate outside of the municipality due to a lack of available affordable housing, delays in receiving or inadequate amount of financial aid, or ties to family or friends elsewhere. However, based on the responses from our key informants, the percentage of participants that relocate within a municipality was almost universally unknown or undocumented.

In some cases, however, this percentage was associated with policies that stipulate where participants can locate in order to be eligible for additional financial incentives offered through the N.C. State Acquisition and Relocation Fund (SARF). For communities who had an established policy like this, they estimated as much as 90-95% of participants stayed within the municipality, at least for the first few years following the buyout.

**Table 2.** Estimated property tax revenue lost and recovered due to buyouts in NC communities

Municipality	Buyout years	Hypothetical revenue loss (% participants remaining in municipality)				Estimated actual revenue loss*	Percent actually remaining	2017 Total Revenue
		0% remain	25% remain	50% remain	75% remain			
Charlotte	2001, 2002, 2008	\$1,920,000	\$1,440,000	\$960,000	\$480,000	ND	ND	2,283,848,000
Greenville	2001, 2002	\$1,051,729	\$788,797	\$525,864	\$262,932	\$788,797	25%	\$357,642,139
Kinston	1997-2003	\$2,796,432	\$2,097,324	\$1,398,216	\$699,108	\$83,893	97%	\$93,221,536
Lumberton	2001, 2004, 2005	\$54,080	\$40,560	\$27,040	\$13,520	\$43,264	20%	\$72,538,103
Raleigh	1999, 2011	\$599,150	\$449,362	\$299,575	\$149,787	ND	ND	\$941,691,637
Rocky Mount	2000, 2001, 2003, 2003	\$3,137,786	\$2,353,340	\$1,568,893	\$784,447	\$313,779	90%	\$239,044,797
Seven Springs	2001-2003	\$47,033	\$35,275	\$23,516	\$11,758	\$47,033	0%	\$473,236
Windsor	2001-2002, 2011	\$35,276	\$26,457	\$17,638	\$8,819	ND	ND	\$8,876,031



Notes: ND = no data available. Total municipal revenue data for 2017 is from the NC Department of State Treasurer. Buyout years are estimates based on available NCDEM data.

Table 2 shows estimates for the hypothetical revenue lost based on what percent of participants remain inside the municipality. For example, if 50% of participants in Charlotte were retained, the city would have failed to collect just under \$1 million in total tax revenue in the years since the buyouts occurred. For Kinston, where the actual estimated percentage of residents remaining is nearly 100%, the estimated revenue loss is minimal (\$84,000) when compared to the case where 0% remain in the municipality (\$2.79 million). Seven Springs estimated that nearly all participants from past buyouts relocated out of the town, which resulted in an estimated \$47,000 loss in total tax revenue over time, which is roughly equal to the entire Town's annual budget (\$48,000).

### **Scenario analysis for the City of Lumberton**

To demonstrate the relative importance of different controllable and uncontrollable variables on the net fiscal impact of a buyout project, we conducted a sensitivity analysis resulting in eight scenarios, including a base or "business-as-usual" case. The seven scenarios show how changes in buyout implementation can affect net fiscal impacts. The alternate values used for each of the scenarios represented either what is considered a more positive outcome or simply the most likely alternative based on what was observed in other communities, including one scenario that represents the 'best case' or combination of more favorable variables. Figure 6 shows how each factor impacts the net fiscal impact as it relates to the business as usual case.

We chose the City of Lumberton for scenario analysis because it had the most complete data set available. Anecdotally, Lumberton also appeared to represent a fairly typical instance among our case studies as it was not a complete buyout, officials did not remove any infrastructure as a result of the buyout, and the buyout properties remain as vacant lots, which was typical among our case studies.

#### *1. "Business-as-usual"*

The 'business as usual' scenario (pattern shown in Figure 3D) estimates the net fiscal impact from 1996 to 2017 due to the City of Lumberton's 21-parcel buyout, which occurred following Hurricane Fran (1996). In this instance, the average buyout property price was \$16,180; distributed across 2001, 2004, and 2005 buyout years) and the per-acre cost to maintain the buyout properties is \$1,400 (100 percent of original buyout properties is now maintained by the city). We estimate that 100 percent of disaster response and recovery costs have been reimbursed to the city. We also estimate that 10 percent of buyout participants have relocated within the municipality. In the business-as-usual case, we assume that 1 percent of neighborhood infrastructure was removed as a result of the buyout.

Given these assumptions, for our business-as-usual scenario, we estimate a total fiscal loss to the City of Lumberton of ~\$60,945 over the course of 19 years (1999-2017). This net negative impact is not surprising when considering the difficulty in retaining residents and their tax contributions, the accruing cost to maintain now-vacant property, and the negligible avoided losses that are not fully reimbursed following a Presidentially Declared Disasters or PDD.

## *2. Relocation policy*

In this scenario, we simulate Lumberton offering additional financial incentives to buyout participants, but with a stipulation that they relocate within the municipal boundaries as a way to minimize property tax revenue loss, a policy implemented in a number of the communities studied including Kinston and Rocky Mount. If Lumberton did this effectively and retained 95% of buyout participants, the net negative fiscal impact over time would be reduced by nearly 88 percent, to just over \$7,000.

## *3. Buyout property leasing and partnerships*

*If we assume that*, instead of 100% of the buyout properties needing to be maintained by the City, 50% of the land was leased to nearby residents or other organizations, who then take over responsibility for maintenance (at little to no municipal cost). Reducing annual site maintenance costs by half reduces the overall fiscal impact by about 7% (\$4,337).

## *4. No Presidentially Declared Disasters*

When there is a more localized flood event that impacts a municipality, but is not associated with a PDD, the local government is often only reimbursed for 75% of the response and recovery costs. The other 25% could be (partially) avoided through a buyout program.

However, in the case of Lumberton, where the buyout project covered only about 5% of the total area impacted by Hurricane Matthew, we calculated the avoided costs at ~\$357, reducing the net negative fiscal impact to ~\$60,589. Overall, these newly avoided costs are not particularly significant, saving less than 1% when compared to the business-as-usual case (where 100% of those costs are reimbursed). This avoided cost may seem insignificant, but if the buyout neighborhood consisted of a larger percentage of the total impacted area, or if no state disaster declarations are made (leading to less or no reimbursement; because costs will not be reimbursed unless a state or presidential disaster is declared), the benefits could be much greater.

## *5. Reduced site maintenance costs*

Because there was some variation in the amount that communities spend per acre on property maintenance, one option would be to use a less expensive annual rate of \$250 per acre, a figure based on the average of rates found Greenville and Charlotte. This reduced rate produced a net fiscal impact that saved the municipality 12% (\$7,125), relative to the business- as-usual case, yielding a total net negative impact of \$53,820.

## *6. Increased buyout extent*

The Hurricane Fran buyout in Lumberton purchased 21 properties. While not insignificant, this is a relatively small buyout project when compared to some of the more ambitious programs found in North Carolina following Hurricane Floyd (1999) where some municipalities such as

Kinston or Greenville purchased hundreds of properties. If we estimate using the same average home value, lot size, participant departure rate, and site maintenance costs as the business-as-usual case, but increase the infrastructure removal from 1% to 5%, and the number of homes bought out from 21 to 200, the net negative fiscal impact is increased by nearly 550%, from ~\$60,945 to ~\$398,319. This demonstrates how influential the size of a buyout project can be on property tax revenue loss and total annual buyout site maintenance costs.

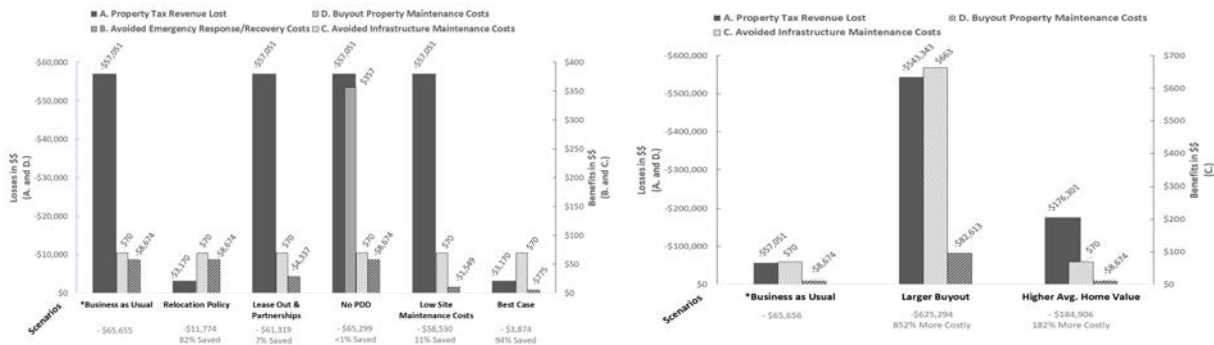
### 7. Higher average home value

Knowing that the average value of the properties bought out in Lumberton was low (\$16,180 [1999 USD]; \$23,806 [2017 USD]), this scenario reflects the same small-sized buyout, but placed in a more moderately priced neighborhood where the FMV might average \$50,000 per property (which is about twice the value of properties bought out in Lumberton). This effect nearly triples the net negative fiscal impact up to ~\$180,000. In some NC communities, buyout properties have been purchased for over \$200,000, which can multiply the effect of lost property tax revenue loss, assuming the household relocates outside the municipality.

### 8. Best case scenario

Finally, a more idealized scenario that combines the preferred implementation options of the other scenarios (high relocation rate, percent of property leased, low site maintenance costs) results in a small, but nonetheless positive net fiscal impact of \$836. While difficult to achieve, this scenario highlights the extent to which negative fiscal consequences can be significantly mitigated.

**Figure 7.** Net fiscal impact scenarios for City of Lumberton buyout



## Discussion

By testing the range of scenarios using our model, we are able to explore the relative impact of different factors--related to characteristics of the community and design of buyout program--on the net fiscal impact to the municipality over time. Figure 7 displays two sets of scenarios (represented by a cluster of bars), where each bar represents individual estimates for each of our four cost categories. Each scenario's net fiscal impact is compared to the *business-as-usual*, with percentage cost differences varying from a 94% reduction (8. *Best Case*) to an 852% increase (5. *Larger Buyout*).

When state or local government offer to provide participants with additional, non-FEMA financial assistance during a buyout (e.g., NC's post-Hurricane Floyd SARF program), they can also stipulate that participants must relocate within the municipal boundary or extraterritorial jurisdiction. If the municipality possesses a sufficient stock of housing (as we learned was the case for Rocky Mount, Kinston, and Greenville), then this strategy may help retain residents and the associated property tax base. Our analysis reveals that -- at least in areas where property taxes are a significant form of municipal revenue -- this type of "relocation policy" may have the single greatest influence on the net fiscal impact of buyouts on a municipality, reducing the total negative impact by nearly 88%.

However, many complicating factors can limit the feasibility of this policy option, including multi-year delays in buyout implementation that force residents to secure housing elsewhere. In some areas, there may be a lack of safe, affordable housing within municipality. In Rocky Mount, the city council denied a buyout participant the supplemental relocation funds since the homeowner bought a home outside city limits.

In terms of reducing buyout site maintenance costs, we simulated the actions of several communities - including Windsor, Rocky Mount, Greenville, and Seven Springs -- in finding willing residents and commercial property owners to take responsibility for maintaining buyout properties. Leasing out buyout properties to a third party can significantly reduce costs to the municipality. For the large percentage of communities that experience an inefficient patterns (e.g., "checkerboarding"), successfully implementing this action can make a real financial difference. Furthermore, this opens the possibility for involving interested organizations (i.e., watershed advocacy groups, community land trusts, or other park systems) to improve ecosystem or recreational services of buyout areas that are contiguous.

In the event of a hyper-local flood (affecting a single municipality only), a municipality can incur non-reimbursable costs related to disaster response and recovery. Officials in Windsor acknowledged that they likely avoided some of these costs since past buyouts have reduced the number of homes in flood zones that would have been affected by two hyper-local floods. Likewise, key informants in Raleigh acknowledged that many of their buyouts in recent past were completed not because of a major storm, but because more localized events have repeatedly flooded some properties, making them eligible for buyout through the National Flood Insurance Program Repetitive Flood Claims Grant (FEMA, 2018c).

Different communities have varying resources and capabilities to effectively manage an increased amount of vacant land created as a result of a flood buyout program. One scenario (5. *Reduced site maintenance costs*) estimates how reduced per-acre costs to maintain buyout properties affect buyout fiscal impacts. Some community officials recognized that checkerboard pattern of buyout properties could add to maintenance costs due to having to move between each of the randomly scattered lots, as opposed to mowing several contiguous parcels of land all at once. Since there was not a clear relationship gathered during our interviews between a community's characteristics and the annual per-acre property maintenance, municipalities should consider other ways of reducing maintenance costs, including using more fuel efficient equipment or allowing land to return to its original function as a natural floodplain.

Using a combination of each of these factors, the idealized *Best Case* scenario demonstrated that a combination of policies can minimize costs and maximize savings, creating a significantly more favorable fiscal impact. Based on collected data and interviews with key informants, no single community was able to achieve this idealized situation.

Two of the final scenarios (6. *Increased buyout extent* and 7. *Higher average home value*) were modeled to show the multiplier effect that a significantly larger (or more expensive) buyout could have on property tax revenue lost, site maintenance costs and avoided infrastructure maintenance costs. These scenarios mimic the buyout experiences of other communities, such as Kinston and Seven Springs (large buyouts) and Raleigh and Charlotte (more valuable homes). With a greater number of more expensive homes bought out, a municipality's ability to influence these factors becomes increasingly important to achieve a favorable fiscal result.

A summary of the factors explored in the scenarios and how they relate to the range of experiences seen in our study's communities is shown in Table 3. Populated using available quantitative and qualitative data from interviews, we were able to observe how each municipality's unique situation produced a set of outcomes that influenced buyout effectiveness and fiscal impact. During our interviews, we asked informants whether they thought buyouts were generally favorable for their municipality; the consolidated response is summarized in the last column of Table 3 and illustrates that most view buyouts as positive programs overall (despite some drawbacks<sup>9</sup>), primarily because they permanently reduce flood risks and create opportunities for new or enhanced amenities (e.g., parks, greenways, etc.).

In searching for what made buyouts successful from a fiscal standpoint, interviews with nearly every informant revealed several reasons why the program was challenging as a municipality to implement successfully and as a resident to participate in. Perhaps the biggest question or influencing factor is related to the number and location of residents who voluntarily apply for and choose to participate in the buyout. Reasons we heard that residents chose not to participate include: a strong sentimental attachment to or family history associated with the home; the inability to afford a new home of same quality nearby and outside the floodplain, especially if on a fixed income; the unwillingness to abandon a home that has been paid off; the inability to wait multiple years for the program to find permanent residence in a new location. For Hurricane Matthew, interviewees in Greenville and Rocky Mount noted that there were plenty of interested participants, but when compared to past storms, there wasn't enough money appropriated by Congress to acquire all the homes. An official in Greenville stated "This one [Matthew] was more frustrating... and Congress only gave us 1% of what the whole state asked for. In Floyd, we got plenty of money... We weren't turning people away because we didn't have the money. There's people being turned away now because we don't have the money.

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<sup>9</sup> The relatively special case of Seven Springs, whose extremely small size (population 110 before Matthew; estimated at 50-55 as of Spring 2018) and relatively large buyout ( $n= 10$  homes) has magnified the negative effects of property tax loss and site maintenance. Since Matthew struck in 2016 the Town has considered becoming unincorporated due to population loss as a result of Hurricanes Floyd and Matthew.

ND = No data

**Table 3.** Summary of factors influencing buyout effectiveness

	Buyout efficiency (Efficient/inefficient)	Buyout size	Current buyout land uses	% properties leased to 3 <sup>rd</sup> party	% participants relocated within municipality	% costs reimbursed	Municipal perspective on program outcome (Positive/negative)
<b>Charlotte</b>	Efficient	Small	Amenity (Park)	ND	ND	ND	Positive
<b>Raleigh</b>	Efficient	Small	Amenity (Park), Vacant	ND	ND	ND	Positive
<b>Greenville</b>	Both	Medium	Amenity (Dog Park, Greenway), Vacant lots	30	25	~ 100	Positive
<b>Rocky Mount</b>	Both	Medium	Amenity (Park), Parking, Vacant, lots, Reforested Area	<10	90	~ 100	TBD
<b>Lumberton</b>	Both	Medium	Amenity (Park) Vacant	0	20	~ 100	TBD
<b>Kinston</b>	Efficient	Large	Returned to Nature, Vacant	ND	97	ND	Positive
<b>Windsor</b>	Both	Medium	Amenity (Frisbee Golf), Vacant lots	<5	ND	> 80	Positive
<b>Seven Springs</b>	Inefficient	Large	Amenity (Park), Vacant lots	<10	0	~ 100	Negative

Convincing residents to participate is the first step and finding ways to encourage or incentivize them to relocate within town is yet another challenge. Interviewees in Seven Springs and Windsor noted that buyout participants had no choice but to relocate outside of the municipality to find affordable housing. After Hurricane Floyd, Rocky Mount managed to take advantage of state infrastructure grants that helped fund the development of new affordable housing within the city. The new units were meant to house buyout participants, but by the time the units were constructed and available almost 2-3 years later, most participants had settled into permanent housing elsewhere.

### Buyout efficiency

In light of our analysis, it is important to think about buyout “efficiency” in more rigorous way, and in terms of both 1) the opportunities for post-buyout land uses and 2) relative infrastructure cost savings. In the former case, we can consider efficiency as the clustering of buyout properties that facilitate environmental improvements (e.g., bottomland forest restoration,

streambank restoration) or passive public uses like parks. For example, in the case of a random (checkerboard) buyout pattern (Figure 1, Panel A), it is difficult to build a greenway or park if even a few homes remain in in-opportune locations.

In the infrastructure cost savings case, we can define a global measure of a buyout’s spatial efficiency ( $E_s$ ) as the ratio of houses *remaining* in a buyout area ( $h_f$ ) to the infrastructure operations and maintenance costs ( $C_f$ ) that will be required to support those remaining houses; essentially, this is the number houses per dollar of required ongoing infrastructure maintenance costs (the inverse, dollars per house, would give the relative “inefficiency”).

$$E_s = \frac{h_f}{C_f}$$

This calculation is related to the efficiency of the buyout itself ( $E_b$ ) which we define as the ratio of infrastructure maintenance cost savings from the buyout (initial costs ( $C_i$ ) - final costs [ $C_f$ ]) and the houses purchased (initial houses [ $h_i$ ] - final houses [ $h_f$ ]):

$$E_b = \frac{C_i - C_f}{h_i - h_f}$$

These efficiencies differ in that a high buyout efficiency  $E_b$  may include significant cost savings, but may still leave an enormous final cost ( $C_f$ ) for remaining residents ( $h_f$ ). While a buyout may remove a number of houses at a major cost savings, we can imagine the result being a street with nearly all the homes removed, except for one or two houses at the end (a high buyout efficiency  $E_b$  and a low spatial efficiency  $E_s$ ). Infrastructure and utility service provision to the few remaining homes after this type of buyout could become difficult to justify (an issue has been described in work on “shrinking cities” across the US; Ryan 2012; Hollander et al. 2009). This would yield a high buyout efficiency  $E_b$  and a low  $E_s$ . Examples of high and low buyout spatial efficiencies  $E_s$  are shown in Figures 1D and 1E, respectively.

Using these metrics, we can also consider a situation, shown in Figure 1E, in which a “more than full” buyout takes place, whereby a city opportunistically purchases houses beyond the flooded area in order to create a contiguous zone at a scale that is relevant for ecological restoration or for certain recreational activities, such as a community-scale park that is large enough to include ball fields. By coupling spatial and buyout efficiency considerations, future research could consider the spillover land value impacts of alternative post-buyout land uses.

## Conclusions

Over the past 25 years or so, communities have turned to buyouts to reduce permanently their vulnerability to future floods. Huge buyouts are underway in North Carolina, Texas and Florida in the aftermath of Hurricanes Matthew, Irma and Harvey, respectively.

By moving people and property from harm’s way, buyouts can help reduce the emotional and financial toll of future flooding. In addition, buyouts can also reduce disaster-related costs for evacuation, sheltering and debris removal, while creating green space - parks, community

gardens or even wetlands - that can absorb and hold floodwaters, potentially reducing flooding downstream. Several studies have demonstrated that the value of avoided costs from buyouts far outweighs the value of immediate costs (Freudenberg, et al., 2016:39). However, while the benefits to the federal treasury are clear, the fiscal impacts of buyouts on local government are less well understood.

In this paper we sought to answer a simple question: what is the fiscal impact of buyouts on municipalities, or, put another way: are municipalities better or worse off financially for participating in a buyout program? The answer is dependent on at least three key factors: 1) the spatial layout of the acquired properties, 2) whether buyout participants relocate within the community, and 3) how the acquired properties are managed or maintained.

*Spatial layout* – As we have discussed in this paper, floodplain buyouts can result in a number of different spatial patterns for the homes that remain, however, the most common pattern is random (i.e., checkerboarding). The spatial distribution of the acquired properties largely determines how the properties can be used afterwards, e.g., as a park or as scattered, vacant lots. If the acquired properties are sufficiently clustered or contiguous, the municipality could create an amenity, such as a park or greenway, that could add value to surrounding properties, thus boosting the tax base. If however, the pattern is random, a community's options for using the acquired properties are limited.

*Relocation* – One of the main fiscal impacts of a buyout is the loss of tax revenues from homes that are acquired and demolished. Those tax revenues will be lost if homeowners that sell their homes move outside the municipality. There has been little literature on where buyout participants relocate after they sell their home. Recognizing the potential loss of population, community connectedness, and taxable income, some communities have offered financial incentives to encourage buyout participants to relocate within the same municipality.

*Management* - As shown by Zavar and Hagelman (2016), most buyouts end up as vacant, mowed lots, not parks or greenways. Either way, the local municipality ends up paying to maintain the land to support recreation or minimize unsightly vegetation growth. The costs for maintenance can be substantial, particularly for smaller communities. As mentioned previously, some communities (e.g., Greenville, Rocky Mount, Seven Springs, and Windsor) simply lease the vacant lots to adjacent property owners, in some cases for \$1 per year, thus transferring the cost of maintenance directly to members of the community.

One of the factors that skews the analysis of the fiscal impact of buyouts on municipalities is that many of the avoided costs never enter into the cost calculations, since typically they are covered by the federal, rather than local, government. For example, one of the benefits of buyouts is that they can reduce the damages or costs of future floods. If, however, the costs of search and rescue, sheltering, or for debris removal are reimbursed by FEMA, then those avoided costs accrue to the federal government, not the municipality.

Still, buyouts provide value beyond just the avoided losses. Buyouts can provide much-needed open space. For example, city staff in Greenville acknowledged that they essentially got a park for free: “[we] did gain some park areas that the city didn’t physically have to go out and



purchase...” and “...so they (federal government) essentially paid for the dirt, .. “ The Town of Windsor has also found that after administering multiple rounds of buyout programs over the past 18 years, it has essentially purchased all the homes in flood-prone areas, aside from a single residence or two in certain locations that weren’t eligible or didn’t participate in previous buyout programs. This means that future floods are likely to cause much less damage.

Our estimates do not account for the potential long-term added value of post-buyout land uses, whether they are community gardens, parks, or restored wetlands that provide flood retention benefits. This type of analysis is ripe for further research. Cities could benefit greatly from guidance on post-buyout land value capture, which involves assessments of how different land uses create spillover effects on the value of neighboring parcels (e.g., improved subway service can partly be funded from the increased tax revenue that new subway stops create when they boost neighborhood land values (Medda, 2012). As part of this, additional research should focus on better understanding the relationship between the spatial pattern of buyouts and the resulting efficiency of future uses and reduction in infrastructure costs.

The various scenarios used to assess the estimated fiscal impact of a buyout program in Lumberton could and have occurred in some combination or form in other communities that implemented a buyout. Using the spreadsheet model we created, (see Supplementary Material 2) municipal governments can generate estimates of a range of possible outcomes to help plan and make decisions about the most effective strategies or policies in implementing a buyout program. In addition to providing a resource for local governments, this type of assessment can help state policymakers make better decisions about how to allocate federal grants for mitigation. Currently, many of the calculations involve some assumptions and degree of uncertainty. However, with better data and recordkeeping, municipalities can create more accurate estimates of the fiscal impacts of buyouts. Thus, the spreadsheet model serves as a potentially powerful tool to help local governments evaluate the likely impacts of a buyout.

## **Recommendations**

Based on our analysis, we offer the following recommendations to minimize the costs and maximize the benefits of buyouts.

For local governments - Communities should design and implement buyouts that adhere to the following principles:

*Acquire a sufficient number of contiguous properties to create a public amenity.* A buyout that results in a collection of vacant lots scattered throughout the community is a missed opportunity to create an amenity, such as a park or greenway. Planning for buyouts should occur in consultation with agencies or departments, such as parks and recreation.

*Look for opportunities to connect to existing open space, such as a park or greenway.* Buyouts should not occur in isolation. To get the most out of a buyout, communities should seek to acquire homes that could add to or augment existing open spaces, including ballfields, parks, and greenways.

*Create incentives and strategies for homeowners to participate in a buyout and relocate within the community.* For a variety of reasons, (strong ties to the community, cost of replacement housing, length of the buyout process), some eligible homeowners choose not to participate in a buyout. These holdouts, as they are often called, limit what can be done with the acquired lands. Just one holdout, for example, can ruin city plans for a greenway. Working with the state, local governments should create sufficient incentives to increase the number of participants. Incentives could include, for example, assistance with relocation costs, finding replacement housing, and providing gap funding to cover the additional cost of acquiring a replacement house. Local governments could also develop strategies and incentives to encourage homeowners to relocate within the community. Strategies could include, for example, expediting the buyout process and providing a financial bonus for staying within the city.

*Partner with third parties such as land trusts, conservation groups, land banks, or regional/state park systems to manage lands acquired as part of a buyout.* FEMA grants for buyouts do not cover the cost of long-term maintenance. These costs add up. Local governments should seek partnerships with third parties to help shoulder the financial burden of site maintenance.

*Identify and prioritize buyout areas in advance.* Prioritization could be based on criteria such as frequency of flooding, location adjacent to existing protected areas, e.g., a park, and the willingness of homeowners to sell. Such prioritization could help expedite a buyout when it occurs and help a community get the most of the buyout.

*Create list of homeowners who are willing to sell their home the next time it floods.* Cities could prepare in advance, and update regularly, a list of willing sellers. This could speed up the buyout process and increase the number of homeowners who participate. It would also help the city prioritize which areas to focus their buyout dollars.

*Incorporate plans for a buyout into local hazard mitigation plans.* Most communities have adopted a hazard mitigation plan. Such plans identify hazard-prone areas and include potential mitigation actions. Buyouts should not occur in isolation - a buyout could create synergy with other mitigation programs or projects to reduce a community's vulnerability to flooding.

#### For state government

*Develop incentives for a more complete or efficient buyout.* For example, the state could provide supplemental funds for relocation, as it has in the past (e.g., through SARF), to fill in the gap between the price paid for the home being bought out and the cost of a replacement house. In addition, the state could prioritize the awarding of grants to communities that have achieved the greatest participation among those who are eligible to take part in a buyout.

*Provide funds for long-term maintenance and management of buyout lands.* Local governments are often saddled with maintaining properties acquired through a buyout. This acts as a disincentive for local government participation. The state could ease the burden, and thus encourage local government support of a buyout, by providing funding for maintenance. The amount of funding could be tied to the completeness or efficiency of the buyout, with less funding provided for scattered or checkerboard buyout patterns.

*Create incentives for buyout participants to relocate within the same community.* Local governments often are concerned about the loss of tax base as a result of a buyout. There is little research on where buyout participants relocate. Still, the state could create incentives, such as a 5% bonus on the price paid for a buyout home, to encourage or reward buyout participants for relocating within the same municipality. This occurred in Kinston after Hurricane Floyd.

*Work with local governments to identify relocation areas in advance.* Flooding can limit the supply of housing, at least in the short term, thus making it even more challenging for buyout participants to find a replacement house within the same community. Some communities have sought to avoid this dilemma by building homes for disaster victims, including buyout participants. Unfortunately, it can take two-three years to find a suitable location, obtain funding, secure permits, install infrastructure, and build the homes. By the time the new homes are available, buyout participants often have relocated outside the community. By identifying and perhaps even purchasing vacant land in advance, a community can speed up the process of providing replacement housing, thus retaining its tax base.

*Coordinate with local governments to collect data on the costs and benefits of buyouts, including avoided losses due to subsequent flooding.* This data could help communities make better decisions about the full fiscal impacts of a buyout and help the state decide where to target its mitigation funding.

*Look for opportunities to coordinate planning and funding for buyouts across state agencies and programs, such as the Division of Emergency Management, the Department of Parks and Recreation and the Clean Water Management Trust Fund.* For example, different agencies in Charlotte-Mecklenburg have combined resources and planning to implement buyouts in a way that helps both agencies meet their goals, e.g., stormwater management, water supply and flood mitigation.

## **Limitations**

The main limitation to our work is the limited availability of data for our analysis, e.g., costs to maintain acquired properties, response and recovery costs, and relocation of buyout participants). For the most part, this data was not available from either the communities in our study or from the state or federal governments. Also, many of the people who had administered buyouts after Hurricanes Fran (1996) and Floyd (1999) have retired or moved on to another position. Thus, it was difficult to get answers to many of our questions about the fiscal impact of buyouts. Similarly, many holdouts – people who were eligible to participate in a buyout, but chose not to – also had moved on and were difficult to contact. Instead of meeting with holdouts themselves, we asked key informants to identify the main factors influencing homeowner’s decisions about whether or not to participate in a buyout.

Our estimates do not account for the potential long-term added value of post-buyout land uses, whether they are community gardens or restored riparian wetlands that provide flood retention benefits. This type of analysis is ripe for further research; municipalities could benefit greatly from guidance on post-buyout “land value capture,” which involves assessments of how different municipal investments create spillover effects on the land values of neighboring parcels (e.g., improved subway service can partly be funded from the growing tax revenue that new subway

stops create when they increase neighborhood land values; Medda 2012). As part of this, future research should consider the spillover land value impacts of alternative post-buyout land uses. Additional research should also focus on better understanding the relationship between the spatial patterns of buyouts and the resulting efficiency for future uses and reduction in infrastructure costs.

The various scenarios we used to assess the estimated fiscal impact of a buyout program in Lumberton could have occurred in some combination or form in other communities that implemented a buyout. Using the spreadsheet model we created (see Supplementary Material 2), municipal governments can generate estimates of a range of possible outcomes to help plan and make decisions about the most effective strategies or policies in implementing a buyout program. In addition to providing a resource for local governments, this type of assessment can help state policymakers make better decisions about how to allocate federal grants for mitigation. Currently, many of the calculations involve some assumptions and degree of uncertainty. However, with better data and recordkeeping, municipalities can create more accurate estimates of the fiscal impacts of buyouts. Thus, this spreadsheet model represents a potentially powerful tool to help local governments evaluate the likely impacts of a buyout.

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## Supplementary material 1: List of interviewees

<b>Affiliation</b>	<b>Name</b>	<b>Position</b>
HMDRRI	Gavin Smith	Project Lead for HMDRRI
HMDRRI	Link Walther	Lead Contractor in Seven Springs & Lumberton
NCEM	Chris Crew	State Hazard Mitigation Officer (SHMO)
City of Lumberton	Brandon Love	City Planning Director
City of Lumberton	Teresa Johnson	Community Development Administrator
City of Lumberton	Rob Armstrong	Director of Public Works
City of Lumberton	Alicia Thompson	Director of Finance
City of Lumberton	Timothy Taylor	Director of Parks and Recreation/Internal Service
Town of Seven Springs	Stephen Potter	Mayor
Town of Seven Springs	Rhonda Hughes	Town Commissioner
Town of Seven Springs	Lisa Cash	Town Clerk
City of Kinston	Adam Short	Planning Director
Wayne County	Chip Crumpler	Assistant County Administrator/Planning Director
City of Rocky Mount	Charles Penny	Former City Manager
City of Rocky Mount	Jim Martin	Attorney formerly under contract with city
City of Rocky Mount	Donnie Daniels	Division Chief of Life Safety & Training
City of Greenville	Gloria Kesler	Acting Housing Division Administrator
City of Greenville	Billy Merrill	Surveyor/Floodplain Coordinator
City of Greenville	Karen Gilkey	Planner in CDBG Program Division
City of Greenville	Chantae Gooby	Planner
City of Greenville	Kevin Heifferon	Public Works - Buildings & Grounds Superintendent
Town of Windsor	Allen Castelloe	Town Administrator
City of Charlotte	David Love	Storm Water Services Manager
City of Raleigh	Benjamin Brown	Stormwater Administrator