Received 29 January 2016
Revised 18 March 2016
Accepted 19 March 2016

Land use change on U.S. floodplain buyout sites, 1990-2000

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Abstract

Purpose – The Federal Emergency Management Agency provides guidelines for the management of open space created through property acquisition (buyouts); however, land use decisions are primarily left to local governments manifesting in a variety of uses. The purpose of this paper is to provide a land use assessment of buyout sites, to describe the changes in those uses that have occurred during a ten-year period from 1990 to 2000, and to offer an assessment of management approaches employed across these sites.

Design/methodology/approach – Using a mixed-methods approach consisting of a land use classification survey and a semi-structured questionnaire of floodplain managers, this study explores the land use trends at buyout sites, diverse approaches local governments take in managing the open spaces created through floodplain buyout programs, and the successes and challenges communities face in open space management.

Findings – Results indicate strong support from floodplain managers for property acquisition and several cases emerged where communities put their newly acquired public land to creative uses. However, the opportunity to leverage these properties for greater public values is largely being missed, primarily because of limited funding.

Practical implications – The analysis indicates strong support among floodplain managers for the buyout approach; however, additional resource-sharing and funding opportunities are needed to increase the utility of buyout properties.

Originality/value – By evaluating the long-term management strategies floodplain managers utilize on buyout sites, this study adds to an underrepresented area of scholarship and is of value to practitioners, government officials, and academics.

Keywords Land use, Buyout, Disaster mitigation, Floodplain management

Paper type Research paper

Introduction

Floodplain property acquisitions, or buyouts, are a type of non-structural mitigation that utilize a cost-share approach to reduce repetitive-flood loss. This voluntary program removes people and structures from the floodplain by paying homeowners the pre-flood value of their damaged properties; these properties are then converted to open space. Federal, state, and local governments often share the cost of purchasing these flood-damaged properties. Communities participating in the National Flood Insurance Program (NFIP) are eligible to receive federal funding through the Hazard Mitigation Grant Program (HMGP) as distributed by the Federal Emergency Management Agency (FEMA). FEMA contributes up to 75 percent of the buyout funding, leaving local communities and/or state governments responsible for the remaining 25 percent.

Disaster Prevention and Management
Vol. 25 No. 3, 2016
pp. 360-374

0965-3562
DOI 10.1108/DPM-01-2016-0021

These local municipalities assume the ownership and responsibility to maintain the open space in perpetuity. In addition to these federally assisted HMGP-funded buyouts, some communities elect to acquire floodplain properties using only local resources as capital projects. Since these capital projects are not subject to the same FEMA regulations, local governments are solely responsible for land use decisions.

Although FEMA provides communities with guidance on open space development, specific open space land uses are at the discretion of the local community. Local governments are encouraged by FEMA to develop the acquired properties in a manner that is "compatible with open space, recreational, or wetlands management practices, and consistent with conservation of natural floodplain functions" (FEMA, 2009, p. 39). FEMA suggests open space development will increase adjacent property values thus increasing the tax base for the community and helping offset the loss created through property acquisition. To help municipalities develop high-utility open spaces such as community gardens, athletic fields, and wetlands, FEMA published a community handbook for guidance that includes land use regulations (FEMA, 1998). However, recent research indicates that only a minority of residents living in buyout neighborhoods attribute their property values to the appearance of the open space; that minority consisted of residents adjacent to high-utility open spaces (Zavar, 2015). Not all open spaces generated from buyout programs are high-utility as the FEMA (1998) community handbook provides development restrictions on buyout properties yet allows communities to develop open space land uses that reflect local needs and budgets. Local governments therefore interpret open space development within these regulations, resulting in a myriad of land uses at buyout sites that vary in their utility to the community. Given the range of open space land uses, this study asks:

(1) At present day buyout sites, what trends in land use exist on sites that experienced flooding during the 1990-2000 time period? What similarities and differences exist between land uses at HMGP-funded vs capital project buyouts sites?

(2) In communities where buyouts have occurred, how do local floodplain managers perceive the results of the program and how do they tend to approach and enable management of the buyout sites?

Most geographic research on land use/landscape changes following disasters draws inspiration from the landmark work *Reconstruction Following Disaster* (Haas *et al.*, 1977). Three spatial patterns of spatial change were derived from this analysis of urban disaster events. First, most reconstructed landscapes exhibited an aerial expansion resulting from rapid reconstruction of the built environment. Second, landscapes tended to undergo a homogenization of use, especially in areas where commercial districts intermingled with residential. Lastly, land development trends in place before the disaster tended to be accelerated rather than substantively altered. More recent research has observed similar patterns in post-disaster land development (Rosen, 1986; Pais and Elliott, 2008; Hagelman *et al.*, 2012). This study posits that floodplain buyout sites represent distinct, sequestered parcels within the reconstruction landscape upon which these post-disaster processes play out. Despite the limitations and prescriptions tied to federal funding of these sites, recent research indicates that local development trends can have a strong influence on the land use outcomes of floodplain buyouts parcels (Zavar, 2015). This study offers a baseline analysis of a large sample of these sites in order to better understand the land uses that emerge and to enable future research on the role these sites play in reconstruction development patterns.

History of the flood buyout program

US floodplain development increased substantially throughout the twentieth century (Walker, 1990). This increase was financed by local, state, and federal government agencies and enabled by structural engineering projects such as retention dams, levee construction, and river channelization (White, 1958; Montz and Gruntfest, 1986; Burby *et al.*, 1988). Federal decision makers embraced non-structural mitigation approaches following a period of intense and wide-spread flood damages in the 1960s, resulting in the passage of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973 (Platt, 1999). The NFIP was established through this legislation as a means to reduce flood-related losses by instituting financial disincentives for floodplain development. Rather than inhibit floodplain development, the NFIP spread the cost of local flood events across a federally financed risk-pool and further enabled floodplain development in many US communities. However, catastrophic flooding in 1993 initiated a change in US flood management culture and subsequent legislation reflected a shift toward non-structural mitigation techniques meant to inhibit floodplain development (Godschalk *et al.*, 1999; Burby, 2001). Many communities adopted non-structural mitigation techniques such as stricter flood insurance requirements, zoning, and education outreach. Property acquisition is one of those non-structural mitigation techniques that gained popularity following the Midwestern floods of 1993.

Despite empirical evidence demonstrating the effectiveness of open space as a flood mitigation tool (Brody and Highfield, 2013) and that over 20,000 flood-prone properties have been acquired in the USA since the 1980s (Conrad *et al.*, 1998), floodplain property acquisition has received sparse scholarly attention. The majority of the literature on floodplain buyouts is aimed at exploring the financial and environmental benefits of property acquisition as well as homeowners' experiences with the program. The economic benefit includes estimates of the amount of money buyouts saved homeowners and governments in rebuilding costs following repetitive-flood events (Hanson and Lemanski, 1995; White, 2011). The environmental reports highlight the ecological services that can be gained through property acquisition, particularly wetland restoration and increased storage for storm water (Conrad *et al.*, 1998; Harter, 2007). In addition to the studies that establish the financial and environmental effectiveness of property acquisition as a mitigation tool, the literature also evaluates the social dynamic of buyouts including various accounts of homeowners' experience with property acquisition (Lyons, 2010) and factors that influence homeowner participation in a buyout program (Tobin, 1992; Fraser *et al.*, 2003; Kick *et al.*, 2011; de Vries and Fraser, 2012; Zavar *et al.*, 2012). Furthermore, issues of inequity and residential displacement arise in the literature as some buyout programs "targeted the most socially vulnerable neighborhoods" (Tate *et al.*, 2016, p. 2071). Although these aspects of property acquisition are vital to effective community reconstruction, additional work is needed to better understand the outcomes of this emergent federal/local cost-sharing approach to flood mitigation. This study investigates how a sample of communities utilize buyout sites, their reintegrated into public management, and how local managers address the open space created through post-disaster property acquisitions.

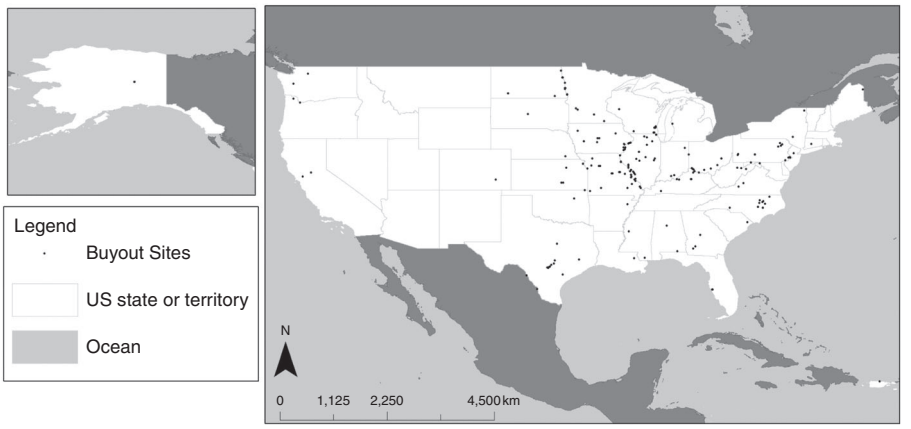
In addition to the HMGP cost-share approach to property acquisitions, many state and local governments fund buyout properties without federal assistance as capital projects. Although many of these programs reflect the same ideals and goals of the HMGP-funded buyouts, the use of these properties is completely at the discretion of

the state or local government. The majority of the research on locally funded buyouts predates the present HMGP (Tobin, 1992) or details the experiences of other countries with floodplain property acquisition (Bennett and Mitchell, 1983; Handmer, 1985). By analyzing the similarities and differences in open space management between federally assisted HMGP buyouts and local capital projects, this study contributes to an area of underrepresented scholarship.

Methods

To understand how communities manage open space created through the buyout program, a two-phase mixed-methods approach was implemented that included a qualitative land use classification survey of floodplain properties as well as a semi-structured questionnaire of floodplain managers. A search to identify buyout properties was conducted through communication with state and local governments, FEMA records, as well as FEMA and state mitigation best practices publications. Additionally, searches were performed in ProQuest News and Newspaper database using the key word "flood" in conjunction with "property acquisition" or "buyout." The search results were then limited by timeframe (1990-2000); yielding a total of 10,133 acquired properties. Both the HMGP- and locally funded buyout sites analyzed in this study represent a convenience sample with a shared temporal characteristic. This selected timeframe allowed sufficient time for property acquisition, structural demolition, open space development, and observations on land management trends. This study is classified as an examination of long-term buyout land management trends, defined as ten or more years, which is consistent with disaster reconstruction literature (Haas *et al.*, 1977).

This study includes buyouts from 37 states and Puerto Rico (Figure 1). Many of the sites are located within the Mississippi River Valley and were inundated by riverine flooding during the 1990s. Also included are sites that experienced coastal flooding due to hurricanes and tropical storms; these sites are primarily located along the Atlantic Coast. Approximately 20,000 properties across 36 states and one territory were acquired prior to 1998, with the majority occurring after the great Midwest flood of 1993 due to amendments to the Stafford Act (Conrad *et al.*, 1998). The number of buyout



Source: ESRI

Figure 1.
Map of floodplain buyout study sites

properties analyzed in this study (10,133 acquired parcels) and their geographic distribution offer a representative sample of the total buyouts conducted between 1990 and 2000.

Instead of analyzing the land uses at each of the 10,133 acquired parcels, this study identifies the land uses at each buyout site- a group of parcels acquired in the same neighborhood or local which experienced catastrophic flooding at the same time. The 10,133 acquired parcels of this study are distributed across 186 buyout sites, where municipalities acquired between one to 900 properties; although the mode is 6 and mean is 54 acquired properties. The communities hosting the buyouts ranged in size and population to include rural agricultural towns of two hundred people to metropolitan areas with over 1.3 million people. Given the diversity of communities participating in flood buyout programs, this study compared the observed land uses by year of acquisition, population, and scale of buyout (i.e. number of properties acquired) through descriptive statistics.

The majority of the properties in this study, 9,321 from 166 buyout sites, were acquired through the federal HMGP or a predecessor. In addition to these cost-share acquisitions, the study includes 812 properties from 20 buyout sites that were acquired as local capital projects without assistance or land use regulations from federal agencies. The present day land uses at the HMGP- and locally funded sites were initially identified through communications with local government officials, FEMA and government publications (FEMA, 2011), as well as historical satellite imagery from Google Earth (Google Inc., 2010). The land uses were then verified through site visits conducted during the summers of 2010 and 2011.

Present day land uses were identified by buyout site, not individual parcels, since some land uses spanned parcel boundaries (e.g. parks, hiking trails, etc.). The land uses were counted individually, as some communities implemented multiple land uses at a single buyout site; for example, a park with athletic fields. This study used the seven land uses recommended by FEMA (1998) as the initial categories for the survey and then expanded the categories based on observations. *The FEMA Property Acquisition Handbook for Communities Phase IV Open Space Management* identified the following as appropriate open space uses for buyout land: wetland restoration, greenway, athletic fields, camp grounds, gardens, bird sanctuary, wildlife refuge, and ecological education center (FEMA, 1998). The observed land uses were compared against these FEMA recommended land uses on open space management (FEMA, 1998) using descriptive statistics.

In addition to identifying land uses at buyout sites, the second phase of this study examined the successes and challenges associated with managing the acquired properties as reported by local floodplain managers. To address this question, a semi-structured questionnaire was conducted online in Google Drive (Google Inc., 2010). Using a modification of Dillman's (1978) survey approach, the questionnaire was e-mailed to local government employees; floodplain and emergency managers were the primary survey targets, but if these positions were unavailable, officials in city or county management were contacted. Participants were e-mailed follow up reminders two weeks after the initial e-mail. Of the 142 municipalities surveyed, 25 participated (some municipalities, especially counties, manage multiple buyout sites), yielding a 16.8 percent response rate. The survey participants are from 15 states/territories, include ten county and 14 local employees (one no response), and represent communities that acquired between five to 500 properties (mode of 300 and median of 122). The survey rendered both quantitative values from multiple-choice

questions that were analyzed using descriptive statistics as well as qualitative information from open-ended questions that were coded for patterns and themes (Creswell, 2008).

Findings

Fieldwork revealed that although some of the local governments instituted creative land uses beyond FEMA's suggestions, the majority of buyout sites in this study were vacant lots, defined as areas of mowed grass or bare soil (Table I). Vacant lots were the most common land use at both HMGP-funded (34.2 percent) and capital project (27.0 percent) sites. The vacant buyout properties tended to represent a patchwork pattern with buyout parcels interspersed among privately owned homes. This patchwork pattern limits the opportunity for open space development; however, some communities found ways to increase the utility of these lots by implementing recreational land uses such as Frisbee disc golf courses. This recreational land use is a resourceful solution to increasing the utility of buyout properties scattered throughout a neighborhood and meets the recreational goals of FEMA open space management. Another high-utility open space land use that still maintains the function of the

Buyout land use classification	Frequency of land use at HMGP-funded site (%)	FEMA suggested use	Frequency of land use at Capital Project site (%)
Vacant lot	34.2		27.0
Park	14.4		13.5
Athletics	9.0	X	5.4
Hike/Bike trail	7.5		10.8
Playground	7.5		2.7
Wetland restoration	6.9	X	13.5
Parking lot	5.7		2.7
Garden/Farm	5.1	X	10.8
Water recreation	2.7		5.4
Memorial	0.9		2.7
Levee	0.9		2.7
Detention basin	0.6		2.7
Stage/Amphitheater	0.6		0
Camp grounds	0.6		0
Waste dump	0.6		0
Native vegetation restoration (non-wetland)	0.6		0
Labyrinth	0.3		0
Horse arena	0.3		0
Dog park	0.3		0
Shed	0.3		0
Flagpole	0.3		0
Squatter settlement[b]	0.3		0
First responder training facility	0.3		0

Notes: [a]The total number of land uses at HMGP-funded sites were 333 and the total number of land uses at Capital Project sites were 37; [b]the Walter Cronkite School of Journalism and Mass Communication at Arizona State University documented the squatter settlement in Toa Baja, Puerto Rico through their Borderlands Initiative (Khan, 2012)

Table I. Land uses at selected buyout sites[a]

floodplain and is recommended by FEMA is athletic facilities. The land use survey identified athletic facilities as a popular open space land use particularly at HMGP-funded sites (HMGP-funded site = 9.0 percent and Capital Project site = 5.4 percent). Athletic land uses included, but were not limited to, skateboard parks, basketball courts, and soccer fields; generally, these occurred within or adjacent to community parks.

Parks were frequently observed as a high-utility recreational land use on buyout open space and they often occurred with hike/bike trails, water recreation, parking lots, and playgrounds. For communities that acquired properties adjacent to preexisting parks, the buyout properties were often incorporated into the park to expand the available recreational opportunities. This incorporation of buyout properties into existing park land is in part why parks are the second most common land use at buyout sites (HMGP-funded site = 14.4 percent and Capital Project site = 13.5 percent). For example, following flooding in 1997 and 1998 the community of Wauwatosa, Wisconsin acquired over 80 properties in the Menomonee River floodplain through both the HMGP and local funding provided by the Milwaukee Metropolitan Sewage District (FEMA Best Practices Library, 2014). These acquired properties doubled the size of the existing Hart Park and added additional athletic fields as well as a stage for community use. Plans are underway that include the addition of a skateboard park, rain garden, and multi-use play area to further expand the services of Hart Park.

In addition to these recreational services, buyout properties also provided communities the opportunity to restore wetlands. Wetlands can serve communities by storing excess storm water, improving water quality, and providing natural habitats for native flora and fauna. Restoration of wetlands is a FEMA suggested land use and emphasized in the goals of open space management. For this land use survey wetlands are defined as water-saturated land with riparian or wetland vegetation that is not mowed or landscaped. For communities that participated in the HMGP, wetland restoration comprised 6.9 percent of the observed land uses; however, in comparison, capitally funded buyout sites implemented wetland restoration at a much higher frequency, 13.5 percent of observed land uses. One possible explanation is local governments that solely fund buyouts tend to value the ecological services these acquired properties provide and perhaps acquire floodplain land with the targeted goal of wetland restoration more often than HMGP-funded sites. It may also attest to the financial constraints on communities implementing capital project buyouts; it is more cost effective to allow native riparian grasses to return to the floodplain, which reduces mowing and landscaping costs. Significant expense may also be the reason levees (0.9 percent) and detention basins (0.6 percent) were observed at federally assisted buyout sites more often than capital buyout sites.

One relatively low cost FEMA recommended land use popular at both HMGP-funded and capital project sites was gardens or small-scale farm plots (HMGP-funded site = 5.1 percent and Capital Project-funded site = 10.8 percent). These ranged from community gardens that offered residents access to fresh vegetables as in Cincinnati, Ohio to ornate Master Gardens in Jefferson City, Missouri (formerly Cedar City). Despite the relatively low cost associated with this land use, these gardens require interest and knowledge from the community as well as commitment to plant and care for them. Previous research indicates that the most successful gardens are initiated and cared for by the gardeners through a bottom-up approach (Abi-Nader *et al.*, 2001). Without this stakeholder investment and/or assistance from non-governmental organizations, local governments may lack the resources to maintain gardens at buyout sites.

Comparatively, HMGP-funded buyout sites implemented a wider-range of land uses than the capital project buyouts sites. Several communities like Piedmont, Missouri, developed camp grounds offering river views and water access on the buyout properties. Others encouraged the reestablishment of native plants like prairie grasses and forests; this study categorizes non-wetland vegetation restoration separately from wetland restoration as the wetlands provide additional flood storage services. One creative land use observed at both HMGP-funded (0.9 percent) and capital-funded sites (2.7 percent) was memorials. In Oquawka, IL, the acquired properties house commemorative statues dedicated to Presidents Lincoln and Obama, and veterans are honored in Falmouth, KY. Many of the creative land uses at HMGP-funded buyout sites are unique to individual locations including a dog park, labyrinth, and a first responder training facility. All of these land uses are within the prescriptions for open space management yet reflect the needs and values of the local community.

Notably, there is less variety of land uses among the locally funded acquired properties. This could reflect the smaller relative sample size of locally funded buyouts; however, the expense of acquiring properties and developing high-utility open space likely deters many communities from implementing these projects. The amount of money required for a local government to purchase and demolish flood-prone properties diminishes financial resources leaving many local governments unable to finance the development of post-buyout land uses beyond basic maintenance needs. Despite this financial burden, 12 different open space land uses, in addition to vacant lots, were observed at these capital project sites (Table I).

Given the multitude of land uses and open space management techniques at both HMGP – and capital project buyout sites, it is plausible that as the buyout program became more popular and with the publication of the *Community Handbook on Open Space Management* (FEMA, 1998) that higher-utility land uses would emerge. However, when the observed land uses were sorted by flood year, the number of vacant lots at buyout sites is comparable across the decade: from 1990 to 1993, 12.7 percent of the buyout sites were vacant lots; from 1994 to 1996, 7.8 percent of the buyout sites were vacant lots, and from 1997 to 2000, 13.0 percent of the buyout sites were vacant lots (Table II). There is no distinct temporal pattern of land use in this study sample, furthering the argument that local communities manage open space to suit local needs and values rather than adopting a la carte options suggested by federal planners. This management strategy is further evident when observed buyout land uses were compared against the population size of the community and the number of properties purchased, again there were no distinct patterns. Vacant lots remain the most frequent land use regardless of number of properties acquired or the size of the community. These patterns raise several questions regarding access to information and resources. Do local governments share their buyout experiences with other governments? What information sources do communities utilize to manage open space? Is the relatively high volume of vacant lots on buyout sites the result of lack of funding, information, or a combination of both?

To address these questions and learn more about the challenges and successes of managing open space as identified by local governments, municipal floodplain managers from 142 buyout communities were surveyed. Survey participants identified that the most common educational resources they used to guide open space management decisions included: communication with a FEMA representative (34.1 percent); the *FEMA Property Acquisition Handbook for Communities IV: Open Space Management* (19.5 percent); and communication with other communities that

Buyout land use Classification	Flood year 1990-1993	1994-1996	1997-2000
Vacant lot	12.7	7.8	13.0
Park	5.4	3.5	5.4
Athletics	4.9	1.1	2.7
Hike/Bike trail	2.7	2.7	2.4
Playground	2.7	2.2	2.2
Wetland restoration	4.1	1.6	1.9
Parking lot	1.9	1.6	1.9
Garden/Farm	3.0	2.7	0.0
Water recreation	1.4	0.3	1.4
Memorial	0.3	0.3	0.5
Levee	0.3	0.3	0.5
Detention basin	0.3	0.0	0.5
Stage/Amphitheater	0.5	0.0	0.0
Camp grounds	0.3	0.0	0.3
Waste dump	0.3	0.0	0.3
Native vegetation restoration (non-wetland)	0.0	0.5	0.0
Labyrinth	0.0	0.0	0.3
Horse arena	0.3	0.0	0.0
Dog park	0.0	0.0	0.3
Shed	0.0	0.0	0.3
Flagpole	0.0	0.3	0.0
Squatter settlement	0.0	0.0	0.3
First responder training facility	0.0	0.0	0.3

Table II. Observed land uses, recorded as percent of total uses at capital and HMGP-funded buyout sites, organized by flood year

Notes: 1990-1993 includes 69 buyout sites and 151 observed land uses; 1994-1996 includes 45 buyout sites and 92 observed land uses; and 1997-2000 includes 72 buyout sites and 127 observed land uses

implemented a buyout program (19.5 percent; Table III). Although 34.1 percent of the survey participants indicated that their community used multiple educational resources to guide open space management, it seems their strategy for open space management developed over time. Only 12.0 percent of the participants indicated that their community had an open space management plan in place prior to implementing the acquisition of properties, while 56.0 percent responded that they did not have a plan in place, 28.0 percent were unsure, and 4.0 percent had no response. The high frequency of vacant lots resulting from the buyout programs are likely linked to the ad hoc approach to open space management. Based on the survey responses and observations

Reference material used by local governments	%
Communication with a FEMA representative	34.1
FEMA Property Acquisition Handbook	19.5
Communication with other communities that implemented a buyout program	19.5
FEMA Best Practices publication/website	14.6
State Best Practices publication	4.9
State Office	2.4
Local resources	2.4
No response	2.4

Table III. Types of resources local governments utilized for information on open space management[a]

Note: [a]Some communities recorded multiple resources

of buyout land uses, it seems communities would benefit from increased guidance on creating open space management plans prior to property acquisition.

Related to the minimal guidance, participants in the survey identified several other challenges related to open space management; the most frequent issues included maintaining the acquired properties (40.0 percent) and the associated expenses (32 percent; Table IV). Floodplain managers noted that local governments incur additional maintenance expenses due to periodic flooding of the open space. The cost associated with minimal open space maintenance could easily drain the financial resources of a community, particularly one that lost a large percentage of its tax base through property acquisition. Considering that the Lexington-Fayette Urban County Government in Kentucky spends nearly $45,000 annually to mow approximately 120 properties acquired through buyout programs, the financial aspect of open space management represents a real challenge for many communities (Zavar, 2014). One survey respondent highlighted that the "flat revenue streams [do] not [keep] up with increased costs" of open space maintenance. The majority of survey participants, 60.7 percent, indicated that their community relies on money from the general community fund or budget to finance the open space (Table V). Property taxes contribute to general funds and with the acquisition of flood-prone properties, the available tax base is lowered, thus creating a cycle of financial loss for local governments. Conceptually, these are financial costs that were previously borne by private landowners and their insurance policies. With limited public funds to go beyond acquisition and structure removal, buyout properties remain a drag on municipal budgets rather than a boon to local tax bases.

FEMA (1998) asserts that communities should increase the utility of the open space by developing land uses like parks to increase the real estate value of homes remaining in the community thus increasing the tax base. However, this may not be a realistic option for communities without external grants or other funding sources. To minimize some of

Challenges in maintaining open space	%
Maintain the space	40.0
Expense (as related to maintenance, development, and repetitive flooding)	32.0
Adjacent property owners trying to implement uses beyond open space regulation	4.0
Illegal dumping	4.0
Public perception of natural vegetation	4.0
Unauthorized users	4.0
Vandalism	4.0
None	4.0
No response	4.0

Table IV. Greatest challenges local governments face in maintaining open space

Funding sources for open space management	%
General fund/Budget	60.7
Sales tax	10.7
Private (including adjacent landowners)	7.1
None	10.7
Road fund	3.6
State inmates	3.6

Table V. Sources of funding local governments used to finance open space management

the local expenditures on open space management, some communities implemented leasing programs where adjacent neighbors use the open space for a nominal fee or in exchange for regularly mowing the properties. Property owners participating in these leasing programs still must adhere to open space regulations; for instance, they cannot fence in the leased property. Although this reduces the financial burden on local governments, the privatization of open space management does not increase the utility of land, nor the tax base, for the community as recommended by FEMA.

Despite these challenges, floodplain managers pointed out the many successes associated with the flood buyout program, namely, the reduction of flood loss. One floodplain manager recommended for "communities trying to reduce flooding, improve water quality and provide recreation, START WITH A FLOODPLAIN BUYOUT PROGRAM!" This emphatic support was echoed by other managers that attested "the flood buyout program is well received by the local community. It has been a benefit to our community." Both of these communities implemented high-utility open space land uses including a public park and trail system. In the survey, floodplain managers highlighted the development of open space land uses as their primary success. When asked to describe their greatest success in regards to maintaining buyout open space, one survey participant noted that the acquired properties have "become a very attractive refuge for wildlife," and others highlighted the reduction of loss to floods. These comments indicate that the buyout open space generates valued ecological services in these communities.

Overall, the survey of floodplain managers indicates two general trends. First, floodplain managers working in communities that embraced the buyout approach tend to believe that the acquisition of properties reduces overall losses to the community. This finding is important, as federal funds may be available for property acquisition, but local support is needed to prompt the community to spend their money on acquisitions rather than environmental engineering or ignoring the problem altogether. The second trend indicates that despite federal financial support for the acquisition and FEMA planning advice, decisions regarding land use on floodplain buyouts tend to be made in a local context. Adjacent land uses, managerial capacity, and pre- and post-disaster development trends all seem to play a role in the land use outcomes for the sampled communities. The fact that only three of the 25 land uses identified in this study match FEMA's suggested uses, support this observation (Table I). In terms of land use, the frequency of vacant lots among the study sites is of particular interest. Certainly individual homeowners who avoid repetitive-flood loss benefit from buyouts and, presumably, federal taxpayers benefit as they no longer contribute to the repairs of flood-damaged properties. However, if the local community does not see a useful, community-wide, outcome to property acquisitions, then local support for post-buyout land use development or even future buyouts may wane. This diminishing public support is even more realistic given the extended period required for most communities to generate funding for post-buyout development.

For locally funded capital projects, which do not have federal requirements associated with land use development, low-utility open space may give way to floodplain redevelopment as experienced in Fort Wayne, Indiana. Following flooding in 1982, 17 homes along Fairmount Place were purchased by the city of Fort Wayne as part of a local buyout program (Warner, 2009). The buyout was financed through a federal Community Development Block Grant that cost taxpayers $350,000 and placed no restrictions on long-term land use. By 2002, the ownership of the vacant buyout property was transferred to a private individual who sold the land for a profit with the

intended goal of redevelopment. Today, a 78-bed facility offering shelter to women and their children occupies the former buyout site thus reintroducing a vulnerable population to a high-risk landscape. Had residents and local officials viewed the open space as a high-utility land use that serves the greater public good, redevelopment of the buyout lot might have been prevented. As public memory of flood events fade and pressure for economic opportunities increase, the potential for low-utility open space redevelopment of capitally funded buyouts exists. To prevent the reintroduction of people to high-risk landscapes as well as the waste of resources associated with the arduous buyout process, floodplain managers must work with local residents to identify high-utility land uses for buyout open space, otherwise the repetitive-flood cycle continues. As the survey of floodplain managers indicates, public will is not enough to support flood-friendly land use redevelopment, financial resources must be available to fund these projects.

Conclusions and future work

The land use survey identified a variety of open space uses at buyout sites across the USA. Despite this variety, the majority of the communities in this study did not develop high-utility land uses as encouraged by FEMA resulting in a high percentage of vacant lots at buyout sites. Floodplain managers' survey responses indicated that these vacant lots are likely the result of limited resources; both in terms of budgets as well as access to information on open space planning. Highlighting this lack of information, many survey respondents commented that they did not have an open space management plan in place prior to floodplain property acquisition. Technical assistance with the creation and implementation of a management plan during the initial stages of floodplain property acquisition would likely increase the number of high-utility land uses at buyout sites. For many communities, budgetary constraints prevented the development of high-utility open space land uses as opposed to lack of planning or technical assistance. Although FEMA (1998) advocates for open space development as a means to increase the tax base, the initial cost of developing a high-utility land use is often unrealistic for communities recovering from a flood and property acquisition.

Communities implementing property acquisition for the first time can learn from these experiences especially that for many communities, the prospect of open space development is not financially realistic following a buyout and land uses may take decades to finance and implement. In addition, the economic climate under which the buyouts in this study were conducted is a consideration; all of the participants of this study implemented buyouts during the 1990s, a relatively strong decade financially for the USA and all prior to the great recession of the late 2000s. If these communities struggled to finance open space development in prosperous times, the burden seems even more significant for communities implementing buyouts in a period of economic decline. As public funding diminishes, the question looms, what is the future for these open spaces? Do local governments have the programming and funding necessary to maintain open space in perpetuity considering financial fluctuations? Although this study does not question the social and economic value of removing repetitive loss properties from the floodplain, this study suggests that more public debate is warranted on the ability of local governments to finance vacant, open space and resist lucrative private redevelopment on sites where zoning does not entirely prohibit future development.

Increased communication and informational resource sharing among municipalities that instituted floodplain buyouts would help alleviate some of these challenges;

particularly, the establishment of a network of resources for communities to share information on land use ideas and financial resources for open space management. Additionally, local municipalities need to seek more partnerships with federal, state, and non-governmental agencies to minimize the cost burden on local governments and in turn, policy-makers need to increase alternative funding opportunities, such as grants, for open space development. For example, at the state level, the Illinois Department of Natural Resources maintains an Open Space Lands Acquisition and Development Program and the Federal National Park Service offers the Land and Water Conservation Fund to assist local communities in developing public open space (Illinois Department of Natural Resources, 2014). Finally, the academic community must be engaged in research related to floodplain management, particularly property acquisition, to better assist government entities and stakeholders in the development and management of high-utility open spaces.

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