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Unequal Retreats: How Racial Segregation Shapes Climate Adaptation

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ABSTRACT

Recent research on climate adaptation points to the need to take flood control seriously as a state-led process that organizes and responds to the racial and environmental spaces of cities. The present study advances that agenda by focusing on the federally funded retreat of homes and residents from flood-prone urban neighborhoods. While officially organized by rational engineering and technocratic calculations, its implementation cannot escape the racialized landscapes of U.S. cities. To illustrate, we review how a century of unequal environmental planning and housing policy has forged today's racialized urban landscapes. Then, we turn to the federal government's entrance into those landscapes via its policy of managed retreat that purchases flood-prone homes and returns them to nature. Here we draw on nationwide data to reveal the policy's increasing urban orientation. We then present evidence from Houston to reveal how the racial composition and turnover of local neighborhoods influence program implementation and subsequent relocation. While not every city may experience the same racialized patterns as Houston, they will exhibit some patterns due to the powerful social and environmental force that race has long exerted in U.S. cities. Failing to account for that force will compromise efforts to adapt effectively to climate change.

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Four months after Hurricane Katrina hit New Orleans, Louisiana, the local newspaper published a map on its front page beneath the headline "PLAN FOR THE FUTURE." In his analysis of that plan, Zachary Lamb (2020) details how despite emerging from a planning process that included early calls for equity and inclusion, the plan ended up placing bright green dots on six flood-prone, predominantly African American areas of the city. Those circles indicated spaces that would be converted to future parkland to help mitigate flooding in the city's inner core. The map triggered many Black New Orleanians' worst fears: that they would lose their homes and the right to return to their neighborhoods. Years later, even after the plan's defeat, Lamb recounts how people still speak of their homes and neighborhoods as having been green dotted. A coffee shop in a public library slated for demolition is now called the Green Dot Café. And to date, the map still serves as a cautionary tale in official discussions of how urban adaptation planning is not simply about local environmental ecologies but also the racial ecologies in which that planning unfolds.

Yet a decade and a half later, government agencies at all levels continue to address the mounting problems of sea-level rise and urban flooding through similar mitigation and adaptation strategies that ignore the racial dynamics of housing and neighborhoods. Our contention is that, like in New Orleans, these strategies amount to *de facto* housing policies. Taking that stance does not simply mean recognizing the 4.6 million U.S. homes now at risk of substantial flooding—70% more than

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designated by the Federal Emergency Management Agency (FEMA)'s official flood maps (First Street Foundation, 2020). Recentering urban climate policies as housing policies also means entering one of the most fraught domains of American life. For more than a century, urban housing development has relied on large-scale, often controversial public investments in hard infrastructure (and, more recently, national insurance programs) to harness and repel the challenges of water. Urban housing has also been *the* space and symbol of racial segregation, which continues to drive enduring inequities in homeownership, wealth, environmental exposure, and neighborhood social conditions (McCabe, 2016; Pattillo, 2007; Sharkey, 2013). These entangled trajectories mean that any climate policy that intervenes into the environmental ecologies of U.S. cities will also and inevitably intervene into racially segregated housing long in the making.

In the present study, we engage these entangled trajectories in a two-step fashion. The first step reviews and synthesizes prior research on urban adaptation, race, and neighborhoods. It spotlights insights that help to contextualize and inform understanding of what has emerged as a major, if implicit, prong of federal climate policy: managed retreat, or the voluntary buyouts of homes in flood-prone urban neighborhoods across the country for demolition and return to nature. The second step then presents and synthesizes our own empirical findings on the policy's implementation in Houston, Texas—by many measures America's flood capital (Erdman & Dolce, 2017). These findings focus specifically on how the racial context of the neighborhoods in which purchased homes are located influences the program's implementation at various points. We start with how White flight increases program participation. Next, we reveal how, upon the purchase and demolition of respective properties, residents of Whiter neighborhoods are able to resettle closer not only to their original homes but also to similarly relocated neighbors, thereby providing a stronger basis for ongoing maintenance and support of their communities. Finally, we show how these racialized differences end up allowing residents to resettle within the same or other flood-prone neighborhoods in ways that do not remove them from rising flood risks so much as maintain and improve the social status of their neighborhoods by insulating them from the city's growing populations of Black and Latinx residents. The overarching conclusion is that despite seemingly rational, color-blind efforts to fund the voluntary removal of people and housing from areas of rising urban flood risk, racism is refracting those efforts into multiple, unequal retreats that require explicit attention to make adaptation successful.

Urban Adaptation, Housing, and Race

Since the building of canals, reservoirs, and levees during the early 19th century, managing the relationship between the geography of water and the geography of housing has been an historical priority for U.S. towns and cities (Colten, 2014; Elliott, 2017; Tarlock, 2012). Subsequent infrastructural investments via the Army Corps of Engineers and later the establishment of the National Flood Insurance Program (founded in 1968) have further subsidized and facilitated that development, including in and along urban floodplains and waterfronts. Now, with properties in those coastal and riverine cities under increasing threat from climate change, newer programs such as FEMA's Hazard Mitigation Grant Program—which funds the voluntary acquisition of residential properties in flood-prone areas across the country—are attempting to undo that earlier development (Loughran, Elliott, & Kennedy, 2019). The goal: to purchase and demolish homes in the way of rising flood risks. These actions and related means of environmental planning are becoming part of a growing societal effort to retreat from harm's way—an idea that has become increasingly prominent among policymakers, scholars, and residents of flood-prone communities (Hino, Field, & Mach, 2017; Koslov, 2016).

On its face, the decision to protect people and property by sliding housing away from rising flood risks seems an unequivocally good idea. By making housing the vehicle for urban adaptation, governments can ensure that people are moved away from chronic flooding; and in theory, that process of relocation and demolition allows previously developed land to return to nature or to host new flood-control infrastructures that will collectively benefit surrounding areas in the future

(Godschalk, Beatley, Berke, Brower, & Kaiser, 1999). Yet by putting housing at the center of urban adaptation, new climate policies also intersect with other policies and programs that have long been central to producing durable racial inequities in access to homeownership, wealth, clean environments, and other resources that have effectively inscribed White privilege into America's urban landscapes (McCabe, 2016; Pattillo, 2007; Sharkey, 2013).

Contesting and protecting that racial privilege has been a guiding principle for political action at various scales for decades (Hunter, 2013; Kruse, 2005; Self, 2003). The last century has seen White privilege threatened at numerous points in time by Black agency and insurgency via social movements such as fair housing campaigns, as well as by more routine forms of placemaking and residential mobility (Goetz, 2018; Hunter, Pattillo, Robinson, & Taylor, 2016). White housing privilege has also been challenged at various times and places by macroeconomic and political forces such as deindustrialization and interurban competition (Kaufmann, 2018; Sugrue, 1996). Each time, though, White power structures and social actors have attempted and largely succeeded in mediating those perceived threats through means such as tax revolts, residential flight, and NIMBY-ism (Not In My Back Yard) (Davis, 1990; Hunt, 2009; Lassiter, 2006).

Today, climate change poses a new existential threat to the accumulated advantages of White housing privilege. But if history is a guide, related policies are likely only to extend, not reverse, the tendency for U.S. policymakers to treat housing primarily as a commodity, not a right, and to allow systemic racism to filter opportunities for and outcomes of participation. That potential is especially ripe in the case of FEMA's Hazard Mitigation Grant Program, which directs mitigation assistance strictly to homeowners—not renters, the homeless, or other socially and economically vulnerable groups, despite historical inequities in access to home-purchasing power and capital. Although carrying none of the overtly racist logic that informed past housing policies such as redlining, this latest effort is nonetheless poised to deliver similarly inequitable results as environmental logics provide cover for pro-market, "colorblind" (Bonilla-Silva, 2003) climate policies that protect homeowners and disproportionately defend the economic power of White communities (Loughran, 2020).

These tendencies occur not because White communities are disproportionately threatened by increasing flood risks but because the residential segregation of cities supported by past housing policies has created stark neighborhood inequalities more generally (Pattillo, 2007; Sharkey, 2013). In some cities, these social and environmental vulnerabilities overlap considerably, with the result being that areas with the highest levels of rising flood risk are also areas of poverty and Black and Latinx settlement (Bullard, 1993; Chakraborty, Collins, Montgomery, & Grineski, 2014). But in other cases, risks can also be fragmented and widely dispersed. Thus, although waterfront locations can be socially marginalized and reflective of the sharpest residues of industrialization and segregation—consider New Orleans' Lower Ninth Ward—they can also be home to corporate downtowns, such as Lower Manhattan, or elite, predominantly White residential districts, such as Charleston's South of Broad neighborhood.

As a result, the same broad commitment to retreat can end up playing out quite differently across various types of racially divided residential spaces. If federally funded retreat continued as it began—as a program targeted largely to farmers and their agricultural lands—the implications might not be so fraught. But our analysis of newly released data on FEMA's Hazard Mitigation Grant Program (displayed in Figure 1) indicates that the opposite is occurring. Over time, more than three quarters of federally funded home buyouts have taken place in the central counties of U.S. metropolitan areas, where environmental planning, housing policies, and racial inequities have long been intertwined.

In a recent analysis of those data (Elliott, Brown, & Loughran, 2020), we found that flood damage is not the only predictor of where FEMA buyouts occur. Local racial composition matters too. It starts with Whiter central counties and relatively Whiter neighborhoods within those counties being more likely to gain access to funding from the program—perhaps because they have more resources and expertise to successfully navigate the highly technical application process. It then proceeds to homeowners in neighborhoods of color being more likely to accept that assistance in larger

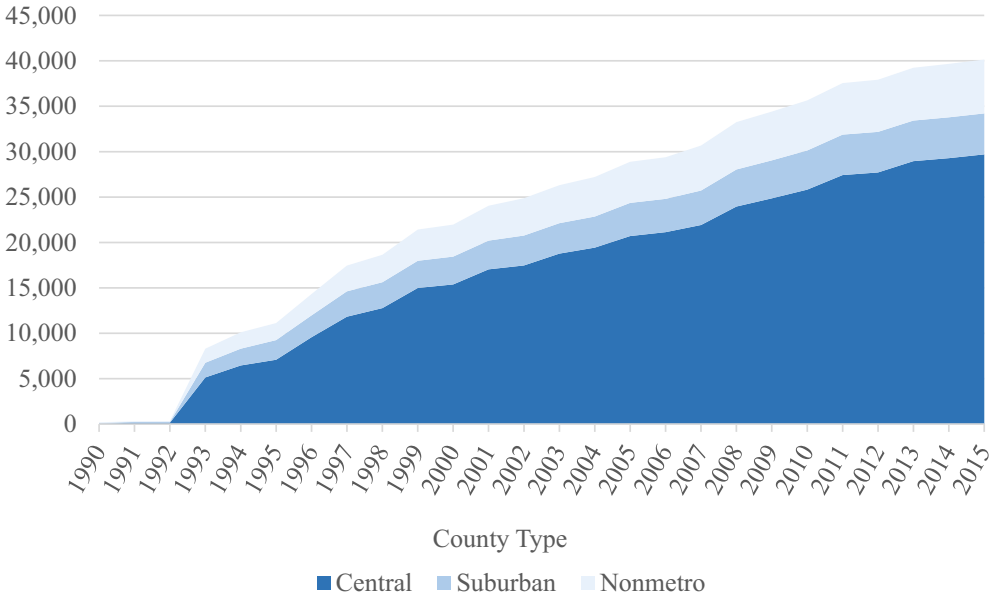


Figure 1. Cumulative number of Federal Emergency Management Agency (FEMA)-funded buyouts in central, suburban, and nonmetropolitan counties of the United States, 1990–2015.
Source. Authors' calculations from a FEMA database of more than 40,000 property acquisitions, or buyouts, funded by the agency from 1989 through 2017. Data may be accessed publicly through a site hosted by National Public Radio (https://www.npr.org/2019/03/05/696995788/search-the-thousands-of-disaster-buyouts-fema-didnt-want-you-to-see).

numbers, making non-White neighborhoods in otherwise White counties the areas of greatest demolition, nationally. Yet buyouts in New York and New Jersey after Superstorm Sandy offer a stark exception to that national pattern, where it has been Whiter neighborhoods that have accepted buyouts in larger numbers. Why might this be so?

One reason is that, as Koslov (2016) has documented, the buyout process played out differently after Superstorm Sandy. The federal buyout program (along with similar state-funded initiatives) became a fountain of collective action in places such as Staten Island and along the Jersey shore, where White working- and middle-class residents organized to lobby for buyouts of entire communities. In those cases, White privilege appears to have helped to secure such assistance while also supporting shared community sentiments that framed the future in terms of two intersecting collective threats: flooding and gentrification. Mass buyouts addressed both concerns by allowing flooded homeowners to hand their community back to nature en masse rather than to wealthy newcomers. Yet around the same time, a very different scenario was unfolding in the historically Black neighborhood of Kashmere Gardens in Houston. There, as Lynn (2017) documents, residents rallied to suppress offers of managed retreat, which community leaders framed as a new type of urban renewal looking to remove Black residents from their neighborhoods.

These trends and cases offer prospective insights into the future of managed retreat as a form of climate adaptation. First, they indicate that the policy is likely to continue to be a predominantly urban one. Central counties of metropolitan areas are simply where the financial savings to government agencies are greatest given the large numbers of federally insured properties at risk. Second, that urban focus means that the policy will continue to interface with housing landscapes long cross-cut by race. To think otherwise is to ignore not only history but government's role in its production. And that production seems to be providing more opportunities to Whiter communities to participate in the latest wave of federal flood mitigation, while leaving neighborhoods of color more likely either

to consent to buyout offers or otherwise face future flood risks. This is how privilege seems to be working in the age of climate change (Norgaard, 2012; Siders, 2019). It brings more options and public resources to those living in more racially advantaged urban spaces, especially if they own property, while leaving those in racially marginalized spaces more reliant on government assistance that is not only less likely to come but less trusted when it does.

These racial dynamics make already complex efforts to adapt to urban flooding even more complicated, especially when they are ignored. To further investigate these dynamics and the myriad ways in which they can unfold in the implementation of managed retreat, we follow Lynn (2017) into one of America's most flood-prone and racially diverse cities—Houston, Texas. There, we conduct a series of empirical analyses, from which types of neighborhoods have participated in managed retreat in the greatest number, to neighborhood variations in where participants move, to the probabilities of resettling in similarly flood-prone neighborhoods.

In these efforts, our empirical intent is less about establishing causality than about assessing from multiple vantage points how racialized housing manifests in the implementation of managed retreat policy within a highly segregated and socially unequal U.S. city. As such, we see the statistical analyses we present below as more diagnostic than causal in orientation. In part, this approach derives from the systemic complexities that emerge from intersecting environmental and racial ecologies. And, in part it reflects the fact that the pursuit of such causal estimation would require detailed individual-level data on the residential histories of buyout as well as nonbuyout households, ideally at the address level and ideally dating back as early as 1990. This is no easy request. Migration data in the United States are sparse and derive mostly from national point-in-time surveys such as the American Community Survey, which aggregate and release data at the level of geographic units with little or no accompanying data on the individuals involved. Consequently, research on environmental migration in the United States typically focuses on the net demographic transformation of places or relies on restricted data from the Internal Revenue Service (IRS) for analyses of intercounty flows. But even those intercounty data have technical issues. DeWaard et al. (2020b, p. 5) report that "what appears to be a systemic problem with the IRS migration data since the IRS took over responsibilities for preparing these data from the U.S. Census Bureau in 2011." They go on to warn that, "With so much on the line, until more is known about the reasons for this apparently systemic problem with the post-2011 IRS migration data, we conclude that these data should not be used."

Houston, We Have a Problem: An Illustrative Case Study of Housing, Race, and Buyouts

Houston is a good case to study because it reflects in high relief the policy challenges faced by U.S. cities, residents, planners, and researchers more generally in the age of climate change. Like many other American cities, contemporary Houston is a place that has experienced rapid urban development and demographic diversification over recent decades, with little in the way of centralized planning (Emerson, Bratter, Howell, Jeanty, & Cline, 2012; Feagin, 1988). That urbanization has not only reproduced stark racial segregation and related inequalities but also relied heavily on a drain-and-reclaim approach to local wetlands in conjunction with massive mitigation projects. One thing that makes contemporary Houston different from other cities, however (as Figure 2 shows), is that its water is widely distributed across a broad network of local bayous and other waterways that have historically served as a resource—one that has allowed, via the creation of the Houston Ship Channel, a city located 40 miles inland to become a major international port.

Now, excess water throughout the city's 2,500-mile network of waterways presents a growing threat. According to NOAA's (National Oceanic and Atmospheric Administration) National Centers for Environmental Information, there were 96 days with at least one notable flood event in Harris County—the city's central county—from 1996 through 2015, equating to four to five flood days per year on average (Erdman, 2017). This regularity, along with four major flood events in recent years—the Memorial Day Flood (2015), the Tax Day Flood (2016), Hurricane Harvey (2017), and Hurricane Imelda

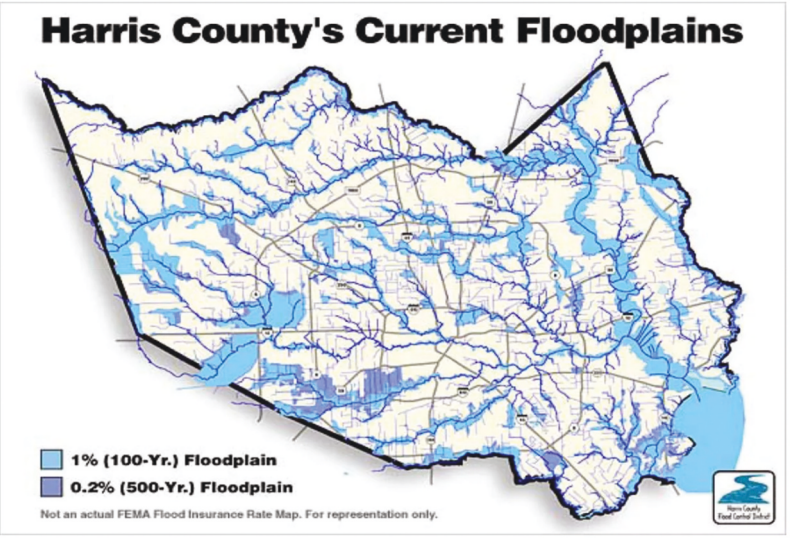


Figure 2. Officially designated floodplains, Harris County, Texas.
Source. Harris County Flood Control District.

(2019)—has led observers in outlets as diverse as *Scientific American* and the *Weather Channel* to dub Houston "Flood Town" and the "Flood Capital" of the United States (Erdman & Dolce, 2017) . The fact that local flooding does not line up neatly along a major coastline or river adds further analytic benefits. By exposing a relatively large number of neighborhoods of varying racial composition and histories to the same rising flood risks and the same federally funded buyout programs, the city offers a strategic research site in which to uncover how such variation can segment urban adaptation efforts as it intersects with local housing.

That segmentation begins with the fact that, as in other cities, the rapid growth and diversification of Houston's population over recent decades has not produced growing numbers of integrated neighborhoods. Instead, the opposite has occurred. As Houston's housing stock has doubled over the past half century, racial clustering has become more common, albeit with some important changes. For White residents, those changes have occurred largely through spatial contraction, concentration, and fortification. As working- and middle-class White households have left for the suburbs, more affluent White households have consolidated their numerical, spatial, and economic control over a shrinking number of inner-city neighborhoods where they have historically clustered and where they continue to concentrate and move into newly built housing units, many with gated access or first-floor doormen. These developments, alongside rising rates of homeownership, provide today's White urban enclaves not only more residential stability than in the past but also greater power over what happens to them locally in the future. That power through ownership, in turn, helps to explain how and why White residents have increasingly concentrated within such spaces over time. Not only do their higher incomes act as a racial filter on in-migration; they also help to maintain a more concentrated White presence within a diversifying urban core—a presence that further elevates housing values, ensures safe, well-funded schools, and affords residents the luxury of expressing tolerance for racial diversity without having to live residentially immersed in it on a daily basis.

For growing populations of Latinxs and African Americans, residential enclaving within Houston's diversifying urban core has taken a different trajectory. Rather than contracting spatially and elevating socioeconomically, respective enclaves have extended outward along and between major transportation and industrial corridors into adjoining neighborhoods with declining White

presence, homeownership rates, and average incomes. Sometimes that geographic expansion has meant moving into areas of high traffic, pollution, and flood risk that conjoin to keep housing prices affordable. But rarely has it meant moving into areas with new housing or stable White populations. In this way, Black and Latinx enclaves in Houston have been steadily extending into neighborhoods of greater risk, where older housing stock is increasingly available to rent, but not for sale. Across this changing and highly racialized housing landscape, we take several empirical cuts at a single overarching question: How do federally funded efforts at managed retreat unfold across these racially segregated neighborhood settings?

The Data

To answer this question we draw on a unique database from the Harris County Flood Control District (HCFCD), the local entity that manages federally funded buyouts in Houston's urban core. As with other state, county, and municipal recipients of federal buyout funds, the HCFCD has received the bulk of its aid from FEMA and then used those funds to conduct voluntary buyouts. The HCFCD decides where and to whom to offer buyouts—and how much to offer, in line with the technocratic cost–benefit assessments that guide this mode of floodplain management more broadly (for more on how federal buyouts are implemented at the local level, see Smith & Vilá, 2020). Harris County, with a residential population of more than 4.5 million, is the central county of the City and Metropolitan Area of Houston. The database contains the address, homeowner name, lot size, price paid, and transaction date for each of the 3,076 federally funded buyouts that occurred in the county between January 1985 and August 2017, just before Hurricane Harvey. To prepare the data for analysis, we took a number of steps (summarized numerically in Appendix Table A1). First, we excluded records in which the property owner was a corporate entity rather than an individual homeowner (n = 157). We then excluded records in which the site had no structure present at the time of the buyout—often the lot was part of a planned subdivision where buyouts occurred before homes were actually built (n = 412).[1] Next, we excluded records with clerical errors that compromised data quality (n = 141). Those errors included mostly duplicate entries and some entries with no property owner names. Collectively, these steps left us with 2,366 valid records with complete information.

To test for bias in this sample, we estimated a simple logistic regression model in which the outcome equals 1 if the record is in our analytic sample, and 0 if it is not. The predictors include whether the buyout participant had a Spanish surname (a proxy for Hispanic identity) as well as the price, acreage, and number of days since the buyout was transacted. We also included measures of the racial (% White) and class (median household income and % of residents who are homeowners) composition of the census tract in which the respective buyout was located, using 2000 decennial census data. Results reported in Appendix Table A2 indicate that our analytic sample disproportionately excludes participants who sold larger, less expensive properties in more rural parts of Harris County. Results also indicate that Spanish surname and the amount of time since the buyout, in addition to the racial, income, and homeownership composition of the tract in which the buyout occurred, do not significantly predict exclusion from our analytic sample. Consequently, if analyses reveal variation along those lines, we can be confident that it is not due to selection bias.

For analyses of where buyouts occur in the largest number, we aggregated the 2,366 buyout addresses to the level of census tracts (n = 149) and then appended demographic data from 1970 and 2014. For all years, data are spatially standardized to 2010 tract boundaries, which means that analyses are conducted for the same, geographically fixed units over time. Those spatially standardized data come from the GeoLytics Neighborhood Change Data Base (NCDB), developed in partnership with the Urban Institute (GeoLytics, 2016). The database draws from the decennial Census of Population and Housing between 1970 and 2010 and from the American Community Survey (5-year sample) for 2014 (U.S. Census Bureau [USCB], 2016).

For analyses of where buyout participants relocate, we took a series of additional steps to search for the destination addresses of respective households. Each search began by looking for the names of buyout participants in the Harris County Appraisal District (HCAD)'s online database for tax year 2018. The HCAD database is searchable by name and includes ownership histories for each property address. If there was an exact match for the participant's name in the HCAD database and the timing of entrance into the newly recorded residence roughly matched the buyout date, then the new address was entered as the buyout destination. Next, to affirm data quality and continue searching for names that did not appear in the HCAD database, we turned to the online database FastPeopleSearch.com, which allows users to conduct a public records search by individual name and then returns all addresses ever affiliated with that person. We then used a second online database, Anywho.com, to further identify and verify each destination address. If an address for a participant could not be reliably located and verified around the observed buyout date, we treated the case as missing (n = 584). That number includes 211 cases in which a buyout participant's name (e.g., Pedro Martinez or Carol Moore) was too common to reliably distinguish them from other movers with the same name relocating around the same time.

These methods produced destination addresses for 1,782 buyout participants, representing 75% of households that accepted a buyout in Harris County prior to August 2017. For analytical purposes we examine only the 1,617 buyout participants in that sample who resettled somewhere within the nine-county Houston Metropolitan Area, consisting of Austin, Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller counties. We invoke this geographic restriction for several reasons. First, the Houston metropolitan area covers more than 10,000 square miles—roughly the size of Massachusetts—allowing for plenty of space to observe both short- and long-distance moves. Second, the reliability of our methods for finding destination addresses likely declines over more extreme distances. Third, the exclusion of extreme outliers in our regression analyses of distances moved improves statistical inference and thus the conclusions drawn. Fourth and finally, most residential moves are in fact short-distance moves. National data indicate that nearly 70% of all moves in the United States occur within the same county, and 98% occur within the same metropolitan area (Marlay & Fields, 2010).

White Flight and Buyout Participation

We begin with where buyouts have occurred in the largest number. For these analyses we estimate a series of negative binomial regression equations predicting the count of buyouts transacted in a tract, conditional on that tract experiencing at least one buyout—our proxy for a neighborhood's participation in the county's buyout program.[2] Results appear in Table 1 and reveal several key findings, all controlling for the population size and density of respective tracts. First, the average price paid for a buyout property in a tract has no significant effect on the number of buyouts that occur there. That is true across all of our models, even after controlling for income per capita, indicating that higher prices do not incentivize more program participation, regardless of the class status of neighborhood residents.

Second, the proportion of White residents present in a tract in 2000—just before the start of widespread program implementation—also exhibits no significant effect on the number of buyouts that occur there. This finding is reflected in the statistically nonsignificant coefficients for that variable in Models (c) and (d) of Table 1.

Finally and most notably, Model (d) adds a variable indicating change in the proportion of White residents in a tract over the preceding three decades, 1970–2000. These dates extend from just after the establishment of the National Flood Insurance Program in 1970 to just before property buyouts emerged as a serious mitigation strategy in Houston. Here, our results show a strong, negative correlation, meaning that the more a tract's White population declined proportionally during the 1970–2000 period, the more buyouts occurred there.[3] To help visualize these results, Figure 3 uses results from Model (d) to plot the estimated number of buyouts in a participating tract by changes in

Table 1. Negative binomial regression results predicting the number of buyouts in tracts with at least one buyout in Harris County, Texas, 2000–2017.

	Model (a)	Model (b)	Model (c)	Model (d)
Economic incentive				
Mean payment per buyout acre in tract ($000)	− 0.001	− 0.001	− 0.001	0.300
Tract traits, 2000				
Population (000)	0.096	0.096	0.097	0.154*
Population density (000)	− 0.047	− 0.053	− 0.054	− 0.088
Income per capita ($000)		− 0.005	− 0.004	0.005
% White			− 0.034	0.414
Tract changes, 1970–2000				
Δ in % White[a]				− 1.543**
Constant	2.747***	2.844***	2.841***	1.475*
Ln(alpha)	0.794	0.794	0.794	0.749
N (Buyout tracts)	149	149	149	149
Log likelihood	− 564.15	− 564.09	− 564.09	− 559.98

Note. [a] Change in % White is measured as % White in 2000 minus % White in 1970. Values range from − 1.00 to 0.19, with a mean of − 0.40, indicating a 40-percentage-point decline, on average (e.g., from 80% White to 40% White). Two-tailed tests were used.

*$p < .05$. **$p < .01$. ***$p < .001$.

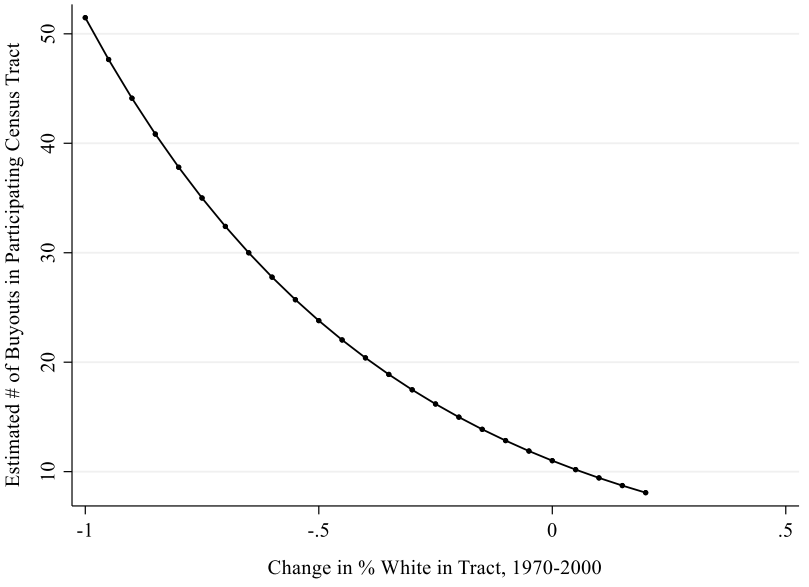


Figure 3. Estimated numbers of buyouts in participating tracts in Harris County, Texas, 2000–2017, by the change in the proportion of White residents during 1970–2000, all else being equal. *Source.* Model (d) of Table 1, with all other variables held constant at the sample means. The x-axis stops at 0.2 (or a 20-percentage-point gain in % White) because that is the highest observed value. As Houston has diversified racially since 1970, few census tracts have gained White residents proportionally.

its proportion of White residents during 1970–2000, holding all other variables in the model constant at their observed means. Here we see, for example, that (all else being equal) the predicted number of buyouts in a tract that experienced near-complete racial turnover from nearly 90% White in 1970 to nearly 0% White in 2000 (which occurred in some tracts) is approximately 48. That compares with just 11 estimated buyouts in a tract that experienced no change in its proportion of White residents. White flight, in other words, appears to strongly correlate with buyout participation—much more so than the prices paid for respective properties.

To probe this finding further, we took a closer look at three buyout areas of Harris County that have experienced particularly large demographic swings from predominantly White to predominantly Latinx residential populations—Pasadena, LaPorte, and Channelview. Of the 125 buyout participants in those areas, 22% had Spanish surnames, a rough proxy for Latinx identity (Rumbaut, 2009, p. 8; see also Loughran & Elliott, 2019, p. 58, footnote 4). That percentage falls far below the roughly two thirds of residents who report Hispanic ethnicity in the encompassing census tracts. This discrepancy suggests that it is disproportionately White homeowners in these areas who accept buyouts, continuing a process of White flight started decades earlier and leaving respective neighborhoods less racially privileged and more subject to razed lots. Those razed lots in turn can end up looking and acting very differently in predominantly White rather than predominantly non-White neighborhoods, as contemporary photographs of bought-out lots in Braeswood Place (a wealthy, White neighborhood) and Kashmere Gardens (a working-class, Black neighborhood) illustrate (see Figure 4).

Divergent Resettlement From Bought-Out Homes and Neighborhoods

When participants accept buyouts and their homes are demolished, where do they move? And to what extent does the answer to that question vary by the racial composition of the neighborhoods in which those buyouts occur? To date, there has been little research on that question. But investigations of residential mobility more generally provide strong evidence that decisions about whether and where to move are deeply tied to attachments to people and places (Dahl & Sorenson, 2010). And those attachments are cross-cut not only by the racial segregation of urban housing and social networks but also by the suppressed power of racial minorities to exercise their full housing choices. To investigate these dynamics empirically, we examine two intersecting dimensions of relocation that spatially approximate attachments to places and people. One dimension focuses on distance moved: Is that distance shorter, suggesting a gradual resettlement that maintains attachments to one's original neighborhood? Or is it over a longer distance, suggesting a more extended relocation and withering of neighborhood attachment? Another dimension is the average distance of one's new home from similarly resettled neighbors: Is that distance relatively short, suggesting collective resettlement? Or is it longer, suggesting more individualistic adaptation?

These questions matter, because recent reporting and case-study research have spotlighted how climate adaptation via residential relocation can proceed in communal fashion when residents are able to band together to secure collective planning and resources. This type of resettlement has occurred not only in Staten Island, New York (Koslov, 2016), but also in the small towns of Valmeyer, Illinois (Knobloch, 2005) and Isle de Jean Charles, Louisiana (Baurick, 2017), among others. But with few municipalities offering such assistance (Loughran & Elliott, 2019; Siders, 2019), the extent to which that type of collective retreat actually occurs—and for whom—remains an open question. Moreover, FEMA's buyout program grounds itself in the notion that homeowners are independent actors, making their own individualistic, rational decisions about whether to accept a buyout as well as where to move thereafter. Such official framing carries with it notions of individual freedom that cohere with FEMA's market-centric implementation of the policy, but research suggests that such individualistic relocation can also be highly disruptive and is typically invoked to explain job-related and retirement moves, not moves from less to more desirable, risk-free housing (Parisi, Lichter, & Taquino, 2019).

To investigate the possibility that less racially privileged neighborhoods are more prone to these more socially disruptive forms of retreat, we turn to the address-to-address relocation data set described above. With these data, we measure *distance moved* as the straight-line distance between a participant's bought-out residence and their subsequent destination.[4] To measure *distance from similarly resettled neighbors*, we started by using local community tabulation areas (CTAs) to define a participant's buyout neighborhood. CTAs were developed by the Kinder Institute for Urban Research (Kinder Institute, n.d.) using social boundaries such as the city's officially designated

(a)

(b)

Figure 4. Current views of buyout lots in predominantly non-White and White neighborhoods. (a) Predominantly non-White neighborhood of Kashmere Gardens. *Source*: 5016 Falls St, Houston, Texas; photograph by the authors, taken September 2017. (b) Predominantly White neighborhood of Braeswood Place. *Source*: 3306 Drummond St, Houston, Texas; Google Street View, retrieved September 2017.

super neighborhoods and small independent municipalities to construct the boundaries of 143 different neighborhoods within Harris County.[5] Of these 143 CTAs, we focus on the 39 that experienced at least five buyouts between 2000 and mid-2017. This restriction reduces our sample

by just 46 participants while helping to ensure more reliable measurement of median distance among similarly resettled participants from the same neighborhood. As with distance moved, median distance among similarly relocated neighbors is measured in straight-line miles. The result is an analytic sample of 1,572 participants who accepted buyouts of their flood-prone homes in Harris County and resettled somewhere in the encompassing metropolitan area between 2000 and 2017.

Results reveal that the mean distance moved from one's bought-out home to the subsequent address is 11.4 miles, and that the average distance of that new home from neighbors from the same CTA who also resettled through the same buyout program is 14.2 miles. To investigate neighborhood variation in these distances, we estimated a series of regression equations predicting each by the proportion of White residents in one's buyout tract in 2000, controlling for the price paid for one's home. Results (available from the authors upon request) indicate a strong, negative correlation ($p < .05$) for both distance measures, controlling for the clustering of individuals within the same buyout tract. Results are graphed in Figure 5(a) for average distance moved and in Figure 5(b) for median distance from similarly resettled neighbors, with the respective coefficients reported below that.

Here we see that as the proportion of White residents in a buyout tract increases, the distance moved and the distance from similarly relocated neighbors both decrease. These patterns indicate that participants from more racially privileged neighborhoods tend to stick relatively close not only to their departed homes but also to each other. Through this collective retreat, climate adapters from these more racially privileged areas are better able than those from communities of color to maintain local ties to place, neighbors, and routines. Whether that means still going to the same stores and meeting at the same restaurants and community events is a matter for further study. But what is certain is that without any top-down planning or apparent bottom-up coordination, this type of resettlement diverges from that found in less racially privileged neighborhoods. In those areas, at-risk homeowners are free to pursue longer, more individualistic relocations but seemingly empowered to do little else.

Taken together, these findings suggest a reversal of how we might think about cases of coordinated resettlement from areas of rising flood risk. Through news stories and studies of exceptional cases, it might be easy to conclude that socially and spatially marginalized communities are the ones prioritizing attachment to place and to each other in the face of imminent flooding. But in cities, it turns out that it is residents of more privileged areas who are prone to such shorter distance, collective retreat (Elliott, Loughran, & Brown, 2021). What sets them apart is that they require little formal planning to carry out such moves. Their social status and resources seem sufficient to do the job. Moreover and at the same time, the lack of overt, formal planning supports the illusion that their resettlement is rational and highly individualistic. Results reported from Houston turn that thinking on its head. Individualistic relocation, it turns out, is what happens when you lack social status, leaving residents of less racially privileged neighborhoods more prone to becoming dispersed and disbanded when they follow public directives to act rationally and leave their flood-prone homes.

Racial Variations in Eventual Destinations

Finally, we turn to the characteristics of the neighborhoods in which buyout participants resettle. Here, we estimate two logistic regression models (with robust standard errors linked to tracts of origin). In the first model, the outcome equals 1 if the buyout participant relocated within the same flood-prone census tract as their bought-out home, and 0 if they relocated elsewhere in the metropolitan area. Results appear in Model (a) of Table 2 and are illustrated in Figure 6(a). Here we see a clear pattern: The only factor that significantly predicts resettlement within the same tract is the tract's racial composition in 2000. Specifically, results indicate that, all else being equal, the predicted probability of doing so increases from approximately 2% in a tract that is just 10% White to approximately 18% in a tract that is 90% White.[6]

Next, we extended our analyses to examine the likelihood of a buyout participant resettling in any buyout tract, not just their own. Because measurement of this outcome is contingent on the

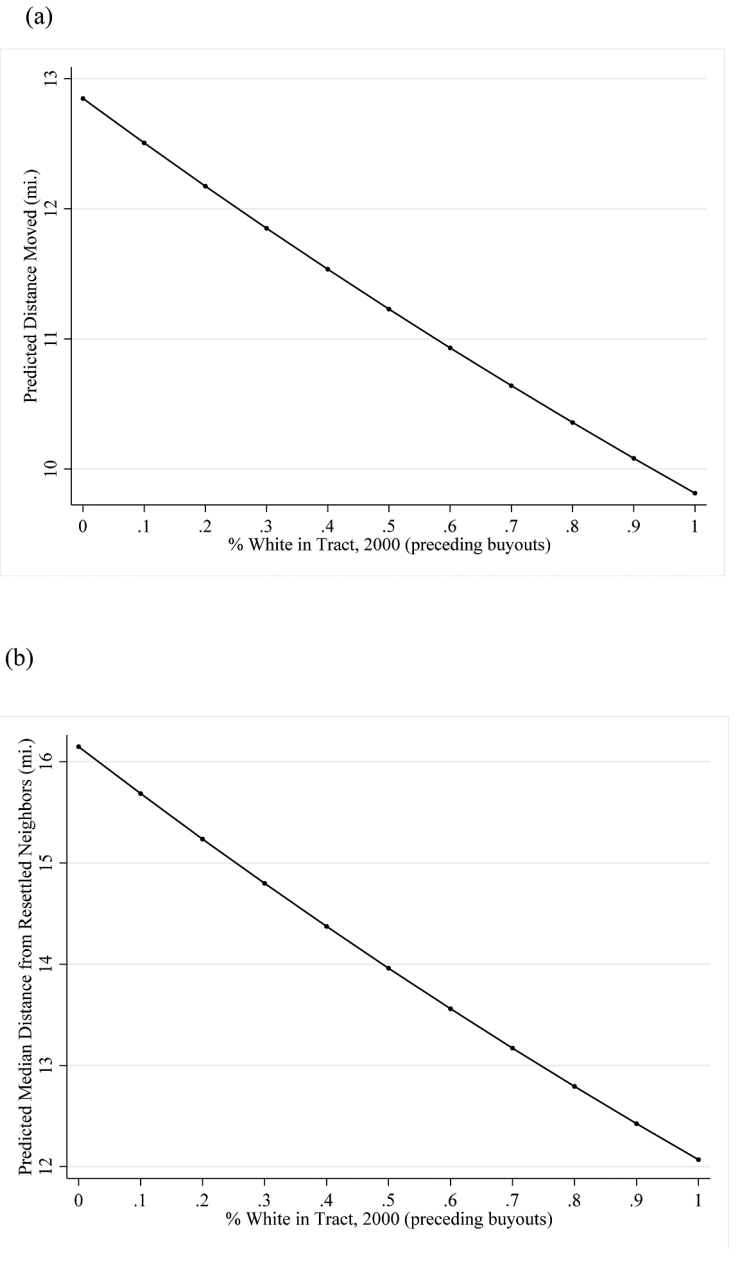


Figure 5. Estimated (a) distance moved and (b) median distance from neighbors who also relocated through the same buyout program, Harris County, Texas, 2000–2017.
Source. Authors' calculations, controlling for the buyout price paid for one's property (adjusted to constant 2017 dollars to control for inflation). Calculations come from a general linear model with a log function and robust standard errors. The estimated coefficient for (a) is − 0.269, $p = .008$; for (b) − 0.291, $p = .000$. Results without controlling for buyout price are even greater in absolute magnitude and statistical significance. Neighbors are defined as those whose buyout properties were located in the same community tabulation area.

buyout participant staying within Harris County (where we have data to reliably identify buyout tracts), we limit analysis here to those participants, who comprise 79% of our analytic sample.

Table 2. Logistic regression results predicting relocation to the same and/or another buyout tract in Harris County, Texas, 2000–2017 (with robust standard errors).

	Model (a) Relocated within the 2 same buyout tract (1 = yes; 0 = no)	Model (b) Relocated to any buyout tract (1 = yes; 0 = no)
Buyout property characteristics		
Buyout price (logged)	− 0.041	− 0.119
	(.087)	(.101)
Days since buyout (000)	0.179	0.148***
	(.099)	(.042)
Buyout tract characteristics, 2000		
% White	2.991**	1.291*
	(1.000)	(.440)
Income per capita (logged)	− 1.381*	− 0.914**
	(.590)	(.292)
Constant	8.898*	8.473**
	(5.341)	(2.625)
n (buyout participants relocating within Harris County)	1,466	1,526
Wald chi-square (df)	12.67 (4)	28.41 (4)

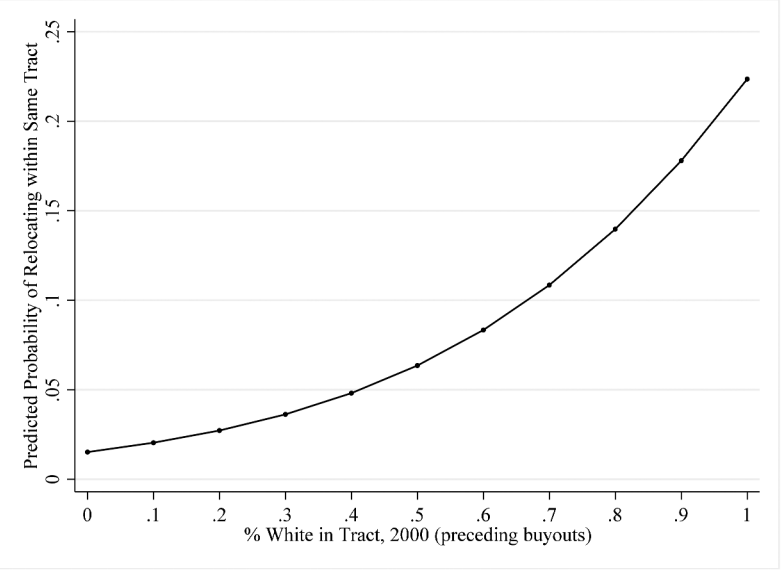
Note. Two-tailed tests were used.
*$p < .05$. **$p < .01$. ***$p < .001$.

Results appear in Model (b) of Table 2 and are illustrated in Figure 6(b). Here we see that buyout participants from Whiter neighborhoods are not only more likely to stay in their same flood-prone tracts, as indicated above; they are also more likely to resettle in buyout tracts more generally, wherever those tracts are located. For example, results indicate that, all else being equal, the predicted probability of doing so increases from approximately 26% in a tract that is just 10% White to approximately 48% in a tract that is 90% White. In other words, the more racially advantaged the buyout neighborhood, the more likely participants are to resettle in areas officially designated as ones of rising flood risk.

Why would residents of Whiter urban neighborhoods engage in such behavior? One incentive might be the social rather than environmental status of the neighborhoods involved. To probe that possibility, we compared socioeconomic indicators in tracts of origin and destination for all participants who relocated somewhere within the metropolitan area. Results (available from the authors upon request) reveal a clear pattern. Regardless of whether the indicator is income per capita, median home value, percentage homeownership, or percentage of residences above the poverty line, the amount of money paid for one's property has little influence on changes in the socioeconomic status of participants' neighborhood from origin to destination. Instead, what matters is the relative racial composition of one's destination tract.

Specifically, the Whiter one's buyout tract, the more likely one is to downgrade in neighborhood socioeconomic status at destination, *unless* one is able to resettle in a tract of equal or greater White composition. For residents of environmentally risky neighborhoods that are already predominantly White, that reality means a greater likelihood of relocating within the same flood-prone tract or moving to another one nearby that shares the same publicly identified flood risks in addition to a high proportion of White residents. In other words, what appears to be driving environmental mobility in and from more racially privileged urban spaces is less the environmental push of imminent flood risk than the social pull of maintaining and even upgrading the socioeconomic status of one's neighborhood and, by extension, its White composition. Under such conditions, more racially privileged neighborhoods are likely to continue drawing disproportionately from federal insurance programs that are already woefully in debt, whereas less racially privileged neighborhoods are likely to lose more and more homeowners—and their residential tax dollars—as buyout properties are demolished and returned to nature for mitigation purposes.

(a)



(b)

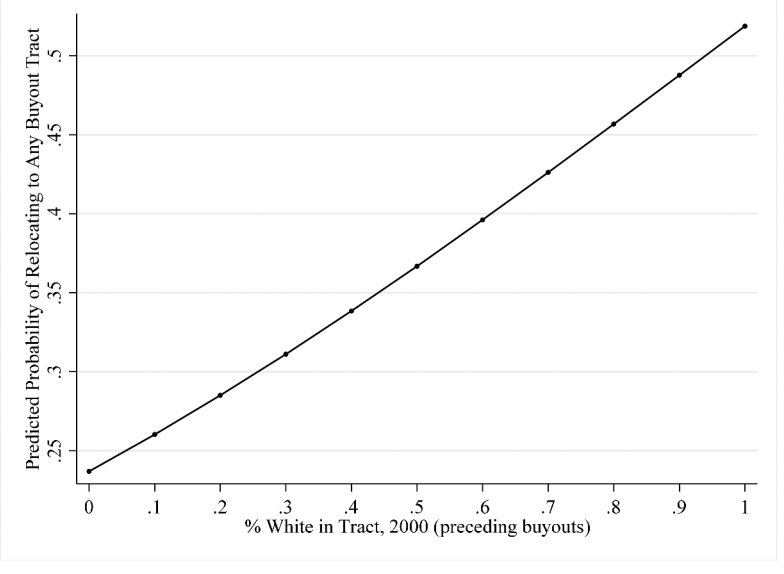


Figure 6. Predicted probabilities of relocating within (a) the same buyout tract or (b) any buyout tract after accepting a buyout. *Source.* Models (a) and (b), respectively, from Table 2 with all other variables held constant at their mean values.

Conclusion

The green dots that forewarned displacement for Black communities in post-Katrina New Orleans are taking hold across the United States. Rather than removing entire neighborhoods all at once, however, current adaptation programs are entering cities at the level of individual homes and homeowners. As they do, these de facto housing policies encounter racially segregated

neighborhoods that shape how implementation unfolds, with White communities seemingly benefiting disproportionately at successive stages. After reviewing evidence of these dynamics nationally and in the illustrative case of Houston, several broad concluding thoughts stand out.

First, housing is likely to continue becoming increasingly central to climate policy in the years ahead. Although there are many ways that the federal government could attempt to slow global warming—by curbing emissions, investing in renewable energy, etc.—the focus on housing, when funneled through the individualistic, market-based framework currently in place, seems politically safe because it does little to threaten the racial and economic status quo. It also does little to alter the broad trajectory of the climate crisis. Far from offering widespread opportunity for environmentally vulnerable urbanites to move from local floodplains, the federal policy of managed retreat as currently implemented appears mainly to serve persistent White advantages while doing little to meaningfully curb the negative impacts of flooding. No new zoning rules or restrictions on development must accompany buyouts beyond the purchased sites themselves. And in Houston, at least, it is common to see newly built, expensive housing constructed just down the street from a buyout site, with perhaps a few extra feet of elevation serving as the only indicator that the home is at significant risk of chronic flooding.

Second, and at the same time, these policy interventions are likely to continue growing even stronger in urban centers because of the relatively high densities of existing residents and property at increased risk of flooding. Buyouts might prove cost-effective in such contexts, given the magnitude of federally insured development in local floodplains, and managed retreat seems to offer opportunities for environmentally vulnerable communities to relocate within the same city, allowing for the continuation of community ties. But top-down urban renewal programs have had a devastating history in the United States, and marginalized communities rightfully distrust that federal and local governments have their best interests at heart, as the cases of Kashmere Gardens in Houston (Lynn, 2017) and the green dots of New Orleans (Lamb, 2020) vividly illustrate. These concerns, coupled with growing evidence of the sort provided in the present study, call into question how broadly and fairly managed retreat policy can be implemented.

Third and relatedly, although government agencies formally frame buyouts in rational, color-blind terms, actual program implementation appears to strongly segment along racial lines. Although we do not expect that segmentation to be news to scholars studying postdisaster recoveries, it does point to how segregated urban neighborhoods forged from prior housing policies and environmental planning are playing as strong a role in the implementation of new climate adaptation policies as the environmental risks they seek to reduce. This conclusion is not to argue that the racial ecologies of housing are the same in all American cities. Local histories and geographies matter. But it is to argue that those racial ecologies must be taken just as seriously as local hydrology if current adaptation efforts are to be successfully extended beyond the privileged few.

Notes

1. Many of these cases were identified by addresses that begin with 0 (e.g., 0 Little Fox, Lot 18) and verified using Google Earth's historical imagery.
2. For more details on these and related analyses, see Loughran et al. (2019).
3. Supplemental analyses indicate that flood-prone neighborhoods in Houston with high levels of racially stable areas tend to have fewer buyouts, regardless of which racial group predominates.
4. We use straight-line, or Euclidean, distance because it is easy to calculate and highly reliable. Prior research in other metropolitan areas indicates that the mean ratio between driving distance and straight-line distance ranges from approximately 1.3 (Boehm, 2013) to 1.6 (Blind et al., 2018); and, nationally, each trip-mile takes an average of 1.9 minutes to complete (U.S. Department of Transportation, 2020).
5. Super neighborhoods are geographically designated areas delineated and recognized by the City of Houston. As officially described, they are areas in which residents, civic organizations, institutions, and businesses work together through an elected council to identify, plan, and address the needs and concerns of their community. The boundaries of each super neighborhood are delineated on the basis of key physical features (e.g., bayous, freeways, railroads, and major roads) as well as shared physical characteristics, identity, and infrastructure. To facilitate the standardization of super neighborhoods and small, neighborhood-like municipalities within Harris

County (e.g., West University Place and Pasadena) with 2010 census tract boundaries, the Kinder Institute for Urban Research created the CTAs.

6. For more details, results and discussion, see Loughran and Elliott (2019).

Disclosure Statement

No potential conflict of interest was reported by the authors.

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Appendix.

Table A1. Counts and analytic samples of federally funded buyouts in Harris County, Texas, 2000–2017.

	Count	% of (sub)total
Total number of buyout records[a]	3,076	100.0
Minus undeveloped sites with no housing structures (n = 412)	2,664	86.6
Minus corporate owners (n = 157)	2,507	81.5
Number of developed, noncorporate buyout sites	2,507	100.0
Minus records with clerical errors (n = 141)	2,366	94.4
(Number of census tracts with at least 1 buyout)	(149)	
Number of developed, noncorporate buyout sites with valid data	2,366	100.0
Minus unlocated owners, post buyout (n = 584)	1,782	75.3
Number of located buyout participants	1,782	100.0
Minus those who resettled outside the metro area (n = 175)[b]	1,617	90.7
Number of located buyout participants still in metro area	1,617	100.0
Minus those in community tabulation areas with ≤ 4 buyouts (n = 45)	1,572	97.2
(Number of community tabulation areas with buyouts)	(39)	
(Number of census tracts with buyouts)	(92)	
Number of located buyout participants still in Harris County	1,466	
(Number of census tracts with at least 1 buyout)	(115)	

NOTE. [a] Before Hurricane Harvey: August 2017.
[b]Metro counties include Austin, Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, Waller. Data from the Harris County Flood Control District Records.
Source. Harris County Flood Control District (2020)

Table A2. Logistic regression results predicting inclusion in our analytic sample (Yes/No) with robust standard errors in parentheses.

Buyout property characteristics	
Last owner has a Spanish surname	.136
	(.145)
Buyout price ($, logged)	.386a
	(.162)
Buyout acreage (logged)	− .342a
	(.162)
Days from buyout (logged)	− .085
	(.150)
Buyout tract characteristics in 2000	
% Black	− .073
	(.645)
% Hispanic	.191
	(.883)
% Asian	5.536
	(5.579)
Income per capita (logged)	.162
	(.625)
% Owner occupied	1.361
	(.691)
Constant	− 5.972
	(6.430)
N (buyout sites)	2,366
Wald chi-square	12.29

Source. Analytic sample of developed, noncorporate buyout sites with valid data.