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Rethinking the Relationship Between Floodplain Protections and Affordable Housing: Insights from Local Decision-Makers in New York State

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Abstract:
Floodplain protections are an important strategy for reducing flood risk yet are often perceived as conflicting with efforts to address affordable housing shortages. Despite the policy relevance of this tension, empirical evidence explaining how floodplain protections influence affordable housing remains limited and contradictory. This study explores how local decision-makers conceptualize the relationship between floodplain protections and affordable housing. Specifically, we investigate how local leaders perceive the factors shaping this relationship and how these perspectives can inform future research and practice. Using a mental modeling approach, we conducted semi-structured interviews with local decision-makers in a county within the Catskills region of New York. Participants broadly perceived floodplain protections as likely to influence affordable housing but described this relationship as highly context dependent. Six interconnected themes emerged: adaptation actions, flood risk characteristics, community characteristics, land use characteristics, regulatory tools, and knowledge and information. Mental model diagrams revealed multiple bidirectional relationships and feedback loops, suggesting that floodplain protections and housing affordability are embedded within a broader governance and land-use system. Notably, adaptation actions emerged as a central pathway, while knowledge and information were perceived to have comparatively indirect influence. These findings challenge simplified narratives about trade-offs between floodplain protections and affordable housing and highlight the need for systems-oriented research and practice. The results are translated into future research priorities as well as guidelines for conversations between climate adaptation practitioners and local leaders. More nuanced, context-sensitive approaches are needed to support local leaders navigating concurrent climate adaptation and housing challenges.

Key words: Floodplains, Affordable Housing, Environmental Governance, Adaptation, Land Use Local Decision-Makers

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1. Introduction

Across the United States, local leaders face growing pressure to reduce flood risk while addressing severe shortages of affordable housing. Land use regulations that prevent floodplain development effectively reduce future flood risk (Highfield & Brody, 2013; Peck et al., 2022), but such restrictions can become politically contentious in communities also struggling to expand housing access. Flooding costs the United States between $179.8 and $496.0 billion annually (US Congress Joint Economic Committee, 2024), while the country faces a shortage of more than seven million affordable homes (NLIHC, 2025). The magnitude and immediacy of the housing crisis may therefore complicate the political feasibility of stronger floodplain protections.

Housing markets and land use regulations are complex, and little scholarship offers empirical evidence on whether or how floodplain protections influence affordable housing availability. Despite this gap, local leaders regularly work at the intersection of floodplain management and housing. They attempt to balance development, climate resilience, and equity goals, while navigating limited empirical evidence (Hino et al., 2024), policy-shaping public perceptions (Burstein, 2003), and substantial regulatory consequences (Hadden & Prakash, 2025). Understanding how these leaders perceive the relationship between floodplain protections and housing affordability is therefore critical for informing both research and practice. Given their expertise and influence, this study uses a participatory mental modeling approach to investigate how community decision-makers conceptualize this relationship, drawing on their place-based experience to identify research priorities and explore the nuanced ties between floodplain protections and housing challenges.

1.1 Floodplain protections: Using nature to reduce flood risk

Traditional flood risk reduction relies on hardening strategies such as levees, bulkheads, and retaining walls (Klein et al., 2001). Though still common, these strategies draw criticism for their short-sightedness, cost, and unintended social and ecological consequences (Siders & Keenan, 2020; Thomsen et al., 2012). Protecting and restoring floodplain ecosystems offers an alternative, providing flood-risk reduction alongside ecological and recreational benefits (Peck et al., 2022). Floodplains can loosely be defined as land adjacent to bodies of water at risk of recurring inundation (Tarlock & Albrecht, 2018). Preventing floodplain development substantially reduces risk; in some cases, purchasing vacant floodplain land costs less than one-fifth of potential flood damage (Johnson et al., 2020). However, floodplain protection efforts tend to require significant land and strong buy-in from local landowners and stakeholders (Christopher et al., 2024).

In practice, federal, state, and local land regulations and planning efforts enact floodplain protections by preventing or minimizing development in flood-prone areas (Siders et al., 2024). The National Flood Insurance Program provides a federal example, which requires new or modified residential buildings to be elevated above base flood levels (FEMA, 2026). Locally, zoning regulations and comprehensive planning policies can dissuade floodplain development

(Tullos, 2018). These efforts often target the 100-year floodplain — land with a 1% annual chance of flooding (FEMA, 2024) — and research suggests local governments play a critical role in protecting floodplains from development (Siders et al., 2024).

Efforts to enact land use regulations, including floodplain regulations, face significant political and economic barriers (Adler, 2008).Floodplain protections in particular often conflict with other community priorities, such as economic development or affordable housing shortages (Christopher et al., 2024; Wells et al., 2020). For example, recent plans to expand New Jersey's coastal floodplains and require buildings to be elevated five feet above FEMA's base flood elevations were scaled back after pushback from developers, businesses, and local elected leaders — notably, the revised regulations exempt affordable housing projects that meet certain safety standards (Biryukov, 2026; New Jersey Department of Environmental Protection, 2026).

1.2 The affordable housing and floodplain nexus

Affordable housing is generally defined as housing in which a household pays no more than 30% of its income toward housing costs, including utilities (Dacquisto & Rodda, 2006). Yet nearly half of all renting households in the U.S. spend more than 30% of their income on housing (Airgood-Obrycki et al., 2022). This crisis is so widespread that "in no state, metropolitan area, or county—can a full-time minimum-wage worker afford a modest two-bedroom rental home at fair market rent" (NLHIC, 2025, p 13). Climate change complicates housing solutions further: its impacts must be considered in developing affordable housing to avoid placing a community's most vulnerable residents in high-risk areas (Ruíz & Mack-Vergara, 2023; Sullivan et al., 2022) . As such, the intersection between affordable housing and floodplain protections is inherently an issue of social equity.

Despite the clear need for affordable housing that is safe and resilient to climate hazards, the spatial relationship between affordable housing and floodplains is not straightforward. Research shows that in some communities, wealthier residents — less vulnerable to both housing markets and flooding — are disproportionately located in the floodplain, while in others, socially vulnerable neighborhoods are disproportionately located there instead (Lee & Jung, 2014; Mazumder et al., 2022; Montgomery & Chakraborty, 2013). These contradictory patterns often coexist within the same city or region: in Miami, residents of color are significantly overrepresented in inland flood zones but underrepresented in coastal flood zones (Collins et al., 2018). This suggests the spatial relationship between floodplains and affordable housing is non-linear and variable. Samoray et al. describe a "bifurcation" in floodplain housing development, "one where floodplain housing is relatively affordable and more likely to include mobile homes, and another where floodplain housing is relatively expensive and more likely to be comprised of single-family homes," often differing between coastal and inland floodplains (2024, p. 5). It is unsurprising, then, that little is known about the relationship between floodplain protections — and environmental regulations more broadly — and housing development patterns (Hino et al., 2024).

Limited scientific understanding of the floodplain protection and affordable housing nexus also stems from the methodological difficulty of attributing changes in affordable housing outcomes to any single regulation or program (Laquatra & Potter, 2000). Several studies associate land use regulations with reduced new housing construction and increased housing prices (Mayer & Somerville, 2000; Quigley & Rosenthal, 2005). However, much of this literature addresses broad environmental regulations rather than floodplain protections specifically, and the few floodplain-focused studies offer contradictory evidence. Sims and Scheutz (2009) found that local wetlands and land use regulations did not significantly affect housing prices within a community, but prices did rise if a neighboring community enacted regulations — indicating a need for regional-scale analysis. Kiel (2005) similarly concluded that regulating undeveloped land increased demand for nearby unrestricted land. By contrast, a study of wetlands regulations as a flood management tool in several New York counties found that such regulations "are more likely to limit the ability of property owners to install a second garage, clear cut part of their yard, or build a new tennis court than to limit affordable housing" (Siders et al., 2021, p. 21) and may even encourage denser development outside regulatory buffer zones. Glaeser and Ward (2009) found no significant impact of wetlands regulations alone on annual housing permits in eastern Massachusetts, and concluded that land use regulations were associated with higher home prices only when density and demographic trends went uncontrolled. Collectively, these findings underscore the inconsistent, context-dependent nature of the evidence on floodplain protection's housing implications.

While the relationship between land use regulations and housing affordability is complex and lacks clear causality, the two are often perceived as strongly linked, particularly within the real estate industry (Quigley & Rosenthal, 2005). Laquatra and Potter (2000) conclude that demographic shifts bear greater responsibility for housing affordability issues than environmental regulations, noting: "it is puzzling how many individuals and organizations have been able to so confidently make the sweeping generalization that environmental regulations have had profoundly negative effects on housing affordability. Clear, specific, and reliable scientific data supporting this conclusion simply do not exist" (pg. 8). More recent research confirms that the narrative linking land use regulation to constrained housing supply remains among the most frequently cited drivers of rising housing prices (Lee et al., 2022). Broader literature on housing affordability notes that land use regulations share influence with other factors, including shifts from public to private investment in affordable housing (Acolin & Reina, 2022; Dewilde, 2017), demographic and cultural shifts (Anthony, 2018), racial discrimination (Reina et al., 2021), and income inequality (Dong, 2018) — pointing to a need for a broader set of factors when contextualizing the relationship between floodplain protection and affordable housing.

The existing literature on how floodplain protection affects affordable housing is contradictory, sparse, and in some cases outdated. Meanwhile, the political narratives challenging floodplain protections remain compelling. Many communities face both flooding and housing pressures, but the salience of flooding — outside the immediate aftermath of a disaster — is likely less immediate than ongoing housing challenges. Local decision-makers need more robust evidence to navigate this nuance as they work to provide safe, affordable housing to their most

vulnerable residents. For this evidence to be useful, it must be grounded in community experience and guided by the perceptions of local decision-makers, whose context-specific knowledge can help researchers identify priorities that fill this scholarship gap. Such insight can also benefit conservation and climate adaptation professionals, who must address community concerns in their floodplain management efforts.

This study explores the conceptual models held by local decision-makers (e.g., elected leaders, municipal planners, floodplain managers) regarding how floodplain protections influence affordable housing. More specifically, the study is guided by the research question: How do local decision-makers conceptualize the relationship between floodplain protections and housing affordability? We synthesize these conceptual models to discuss implications for how researchers and practitioners can support local decision-makers navigating these contentious, critical issues.

2. Methods

2.1 Case Study: The Catskills & New York State

Communities in Upstate New York offer a useful context for examining our research questions. Local leaders across the state are simultaneously navigating increasing flood risks, housing affordability and availability challenges, and the ways these pressures intersect. Since 2015, rent prices in New York City have risen by approximately 30%, while areas outside the city have seen increases of 40–60%, with some rural communities seeing home prices climb by as much as 80% (New York State, 2023).

Flood-related risks and impacts have also increased across both coastal and inland areas of New York State (Lamie et al., 2024) which has experienced several major flood events in recent decades, including Hurricane Irene (2011), Superstorm Sandy (2012), and Hurricane Ida (2021). In New York City, flood levels once considered a 500-year event in the preindustrial era now approximate a 25-year event and are projected to approach a 5-year frequency by 2050 (Garner et al., 2017). Inland flooding is similarly expected to increase statewide, with much of eastern New York projected to see greater damages under moderate warming scenarios (Lamie et al., 2024).

This study focuses on a county within the Catskills region of New York State, well suited for examining the intersection of floodplain protections and housing dynamics. The Catskills' proximity to New York City (approximately 100 miles) and strong recreation-based economy make the region a frequent destination for visitors and second-home buyers—patterns that shape local housing markets and intensified during the pandemic. Parts of the Catskills also experience both riverine flooding, driven by steep mountainous terrain, and coastal flooding associated with storm surge along the Hudson River. Ongoing regional efforts to enhance flood resilience include updates to floodplain regulations, property buyout programs, and large-scale infrastructure investments.

Our study focuses on a single county in the Catskills region (the county name is withheld to protect participant anonymity), with data collection focused on several municipalities within it: a small city (Community A, ~3,200 people per square mile), one rural township (Community B & C, ~25 people per square mile), and two semi-urban towns (Community D, ~300–500 people per square mile) (see Table 1).

Table 1. Socio-demographic data for case study communities from U.S. Census Bureau

	Community A	Community B	Community C	Community D
Density (people per square mile)	~3,200	~25	~300	~475
Non white percent of population (%)	36.3	15.6	14.3	19.9
Median household Income (USD)	$68,186	$66,031	$78,721	$79,769
Poverty level (%)	17.6	19.9	9.8	11.6
Median Gross Rent Cost (USD)	$1469	$1191	$1208	$1351

2.2 Mental Model Methodology

Mental models are defined as "a concentrated, personally constructed, internal conception of external phenomena or experience that affects how a person acts" (Rook, 2013, p. 45). Mental model interviewing enables researchers to describe how individuals interpret complex issues by identifying key components and mapping the perceived relationships among them (Johnson-Laird, 1983). Because they surface how people believe change occurs, mental models are frequently used to elicit an individual's implicit "theory of change" regarding how a phenomenon or scenario operates (Carley & Palmquist, 1992; Jones et al., 2011). Within environmental social science, this approach has been widely applied to better understand complex social–ecological systems and their interdependencies (e.g. Biggs et al., 2011; Steger et al., 2021).

There are multiple approaches to eliciting or constructing mental models. Many studies rely on in-depth interview protocols designed to prompt participants to reflect on a topic and articulate connections among variables or constructs of interest (Moon et al., 2019). In some cases, researchers and participants co-create a visual diagram during the interview (e.g. Johnson et al.,

2026); in others, researchers synthesize interview data into a diagram afterward and share it with participants for feedback and validation (e.g. Morgan, 2002).

2.3 Data Collection

For this study, we conducted semi-structured interviews, constructed mental model diagrams based on these interviews, and had participants edit the diagrams. Participants were invited to reflect on whether they perceived a connection between housing affordability and floodplain regulations, describe the nature of that relationship, and identify factors that shape it, drawing on examples from their local context (see Appendix A for interview guide). Fifteen interviews were conducted between November 2022 and January 2023, including five elected officials, two planning professionals, four housing specialists, and four environmental specialists. All interviews were audio recorded.

We used a combination of purposive and snowball sampling to identify participants, who held professional roles related to local decision-making on flooding and housing. An initial pool of potential participants was developed collaboratively with key informants and through a review of municipal websites. At the end of each interview, participants were asked to suggest additional individuals meeting the study criteria. Invitations were sent via email, and interviews were conducted virtually. Written informed consent was obtained prior to each interview (protocol #21-0497).

2.4 Data Analysis

Interviews were transcribed using Otter AI (Otter.ai, Inc., 2022) and manually checked and edited for accuracy. A team of two researchers constructed individual diagrams representing each interview, using the same diagram template throughout. The researchers co-constructed diagrams for three initial interviews to ensure consistency. For the remaining interviews, one researcher constructed each diagram while the second checked it against the transcript, making any additions or edits. Each diagram was then sent to the participant, who had the option to return a revised version.

The primary author then conducted a thematic analysis of the components identified across all 15 mental model diagrams, using Braun and Clark's guidelines (2006) to inductively open code mental model components and combine them into broader themes. The resulting theme organization was shown to two additional research team members, who provided feedback and helped finalize the themes.

Two researchers then deductively coded the interview transcripts for the identified themes, writing research memos for each. This iterative process of moving between raw transcripts and constructed diagrams allowed for a thicker description of the themes and grounded our results in both verbal and visual data.

Finally, the primary researcher coded the mental model diagrams for connections between themes and created synthesis diagrams showing each theme's connections to others. Given the novelty of the approach, our team relied heavily on a collaborative analysis process to ensure validity and clarity in decision-making (Cascio et al., 2019). Quotes are presented verbatim, except for removal of repeated or filler words to improve readability.

3. Results

We interviewed 15 local experts and constructed mental model diagrams from their interviews. These interviews and diagrams sought to understand local leader perspectives on the relationship between efforts to increase floodplain protections and affordable housing concerns in their communities.

When asked whether they thought efforts to protect floodplains would affect affordable housing in their community, participants broadly answered "likely," but highlighted multiple factors influencing the strength and direction of the relationship. We now describe a set of themes representing these factors. Table 2 provides a high-level summary, followed by a detailed description of each theme. Finally, we present synthesis diagrams that combine participants' mental models into a "collective mental model."

Table 2. Summary of Themes

Theme/Factor	Description	Examples	Participants who mentioned theme (#)	Theme coding frequency (#)
Adaptation Actions	Actions aimed at reducing flood impact	Altering existing buildings or infrastructure, buyouts etc.,	13/15	103
Flood Risk Characteristics	Factors that shape how flooding occurs	Topography, climate change, riverine vs coastal flooding etc..	11/15	50
Community Characteristics	Socio-economic factors that shape a community	Wealth, migration patterns, housing stock, racial diversity etc.	15/15	158
Land Use Characteristics	Patterns in how a community uses land	Historical floodplain use, market value of floodplains, water and sewer availability	15/15	164

Regulation Tools	Rules and requirements about land use & development	Local zoning codes, building codes, compressive plans, flood insurance requirements, etc.	14/15	120
Knowledge and Information	Knowledge and information about flood risk, and mitigation strategies	Flood expertise of local leaders and administrators, community education	14/15	66

3.1 Theme 1: Adaptation Actions

We use "adaptation" to refer to actions aimed at reducing flooding's impacts, such as altering existing buildings to be more flood-resilient, buyout programs that remove people and infrastructure from at-risk areas, and large-scale grey infrastructure projects—bridges, riverbanks, roadways—that influence flood levels. Funding programs for these projects are also included in this theme.

Participants discussed adaptation actions in two direct but somewhat contradictory ways. First, they often assumed that increased floodplain protections would require more residential buildings and properties to undertake adaptation actions. When these actions fall to housing developers (e.g., elevating homes, flood-proofing ground levels, grading or drainage work), the added costs will likely be passed to consumers as higher housing prices, or will limit land desirable for development. One participant explained this in reference to regulations requiring elevation of floodplain homes and buildings:

> *"Yes, I think that automatically, we are going to have a hard time attracting developers without very large financial incentives to do the type of floodplain development we want them to do.... we're telling them that they need to build like three feet higher based on our 2050 and 2100 projections. And so that's going to add cost."*

In contrast, participants noted that adaptation efforts led by public officials and governments (e.g., modified infrastructure, bulkheads, riverbank restoration) can reduce flood risk and shrink the amount of land within the floodplain—potentially reducing risk to existing housing, maintaining or increasing developable land, and lowering broader housing costs by easing market pressure. These contradictory pathways highlight a tension over who is responsible for funding and implementing adaptation actions: when cost and responsibility fall solely on developers, adaptation actions may strengthen the link between floodplain protections and affordable housing challenges, but when shared with local or state government, they may have the opposite effect.

3.1.1 Connection to other themes

The role of adaptation actions is discussed further in the following theme sections, as this theme was perceived to connect directly to almost all other themes.

3.2 Theme 2: Flood Risk Characteristics

Flood risk characteristics are factors that shape a community's level of flood risk, including topography, how climate change affects precipitation patterns, and flooding type (riverine, coastal, or combined). Participants explained that these characteristics drive the size and scale of floodplain protections needed, so a significant amount of land would need to be at risk for increased protections to influence housing affordability

3.2.1 Connection to other themes

Flood risk characteristics intersect with several other themes. They influence land use characteristics, since topography determines how land can be used and whether it can be developed for housing. One participant described the effect recent flooding has had on developer interest:

> *"There was that housing development... in the floodplain. And they had started doing site work, right, and excavating. And then we had Hurricane Irene... it washed away the backhoes and the bulldozers. And the developers walked away. And so, they're continuing to try to market the property".*

Flood characteristics also intersect with community characteristics—past flood events can shape community culture, including risk perceptions and priorities around regulation and adaptation. Relatedly, they influence regulation tools: participants explained that communities with historically higher flood risk likely already have mitigation regulations in place, making future regulations more politically acceptable.

3.3 Theme 3: Community Characteristics

This theme reflects the broad set of characteristics shaping a community's social and economic fabric—migration patterns, vacancy rates, financial resources (e.g., property taxes), racial and economic diversity, poverty rates, and community values and perceptions. These are distinct from how a community uses or regulates land, or the information it shares about flood risk, but participants noted that a wide range of cultural, social, and economic conditions shape those realities.

Participants connected this theme to the floodplain–housing tension largely through market pressures and housing stock. Communities with limited housing stock and high market pressure—for example, from COVID-19–induced migration from New York City—may have little affordable housing available, leaving little room to lose potential housing to floodplain protections and intensifying the likelihood that protections affect housing availability and affordability. A community's financial resources also directly shape its ability to address insufficient affordable housing, likely increasing its vulnerability to added pressures like

floodplain protections. Finally, a community's socioeconomic composition directly influences the likelihood that affordable housing projects and floodplain protections occur in the same area, as communities with more vulnerable populations may have greater affordable housing needs.

3.3.1 Connection to other themes

Participants connected community characteristics to other themes in several ways. Financial resources often shaped a community's ability to engage in adaptation action. One participant highlighted their municipality's inability to fund adaptation efforts that would make floodplain land developable for housing: "*if we had $30 million, we, the city government, would probably fix the bulkhead. We don't have that funding. But we have been actively seeking funding...we want to develop it".* High costs of living may also limit household resources available for adaptation or for purchasing adapted housing. Culturally, values and attitudes around climate change, perceived flood risk, racism, and NIMBYism may influence a community's willingness to pursue adaptation. One participant explained the difficulty of funding climate-safe, affordable housing in their community:

> *"Well, racism. You know... people in single family neighborhoods not wanting to have that affordable NIMBYism, 'I don't want to have those people living next door to me. I don't have a six-unit apartment building next to my single-family house with my little white picket fence'. Yeah, the history of redlining, you know, just the whole history of, of keeping people out of certain neighborhoods".*

This theme also intersects with regulation tools, as community values around conservation, land use, racism, and NIMBYism influence willingness to support regulations—such as housing density—that directly affect floodplain protections.

Community characteristics also interact with land use characteristics: local economic growth and financial resources influence how developable land is used and valued, sufficient resources for sewer and water infrastructure must exist to support new development, and local growth patterns can pressure officials to develop land in flood-prone areas. Cultural values around living near or developing waterfront areas further shape land use dynamics. Finally, community characteristics connect to knowledge and information, as cultures of collaboration and resource sharing may lead to partnerships between housing and flood experts pursuing integrated solutions.

3.4 Theme 4: Land Use Characteristics

This theme refers to how communities use land—historical floodplain use, land availability, financial value of floodplain land, housing density, and water/sewer infrastructure availability.

Participants expressed several assumptions about how land use characteristics affect the floodplain–housing relationship. Some hypothesized that if historical use of waterfront property and floodplains produced high property values, changes to development patterns in

these high-value areas could raise land values elsewhere, with spillover effects extending to locations where affordable housing might otherwise be built—particularly in communities with limited developable land. One participant stressed the contextual nature of land availability and value in the floodplain:

> *"... if we were to say, 'okay, because this area is subject to flooding, we shouldn't build in there at all. 'Well, great, but now we've lost 20% of and that could be developed. Right? You know, we're an old built-out city. And so in some ways, this is the prime land for development that we have in the City of X. And so yes, it has to be done right".*

Participants also noted historical spatial housing patterns: where affordable housing and low-income communities have traditionally sat in floodplains, restricting development there would directly affect affordable housing. Conversely, some argued that floodplain land with high market value is unlikely to be viable for affordable housing. Others noted the relationship depends on whether floodplain land interests developers at all:

> *"...Not everything that's in the floodplain is going to be as attractive as this area that we've been talking about, right. So that in those cases, the extra effort by developer might not be worth it, because the return on investment just isn't there".*

3.4.1 Connection to other themes

Participants connected land use characteristics to several other themes. The historical use and financial value of land influence the acceptability of managed retreat strategies like buyout programs (adaptation actions). Land use characteristics also intersect with regulation tools, as historical land use and ownership patterns shape which regulations receive public support, and with infrastructure, since water/sewer availability makes denser development more feasible.

Finally, land use characteristics intersect with community characteristics: historical land use patterns shape people's connection to place, which in turn influences future land use decisions (e.g., developing green space or preserving cultural landmarks). The amount of developable land also affects housing costs and market pressure on existing stock, and existing dams or levees may create a false sense of safety that reduces support for additional flood protections.

3.5 Theme 5: Regulation Tools

This theme refers to the rules and requirements local governments create and enforce to determine who can develop land, how, and where—broader than floodplain regulations alone, including zoning codes, building codes, land use codes, flood insurance requirements, and comprehensive plans.

Regulation tools were perceived to strengthen floodplain protections' influence on housing when zoning codes favor single-unit housing, when regulations impose blanket requirements

lacking nuance or innovation, and when flood insurance costs make existing floodplain housing unaffordable. One participant reflected on potential flood insurance implications:

> *"I mean, you get flood insurance applied to more places [when you increase floodplain protections]. And in many cases... there's some places where some homes that probably exists within the 500-year floodplain are owned by people who couldn't afford that. So... I mean, affordability goes down for those people... you're probably risking them not being able to afford to stay in that. But you have to weigh that against the risk of them suffering catastrophic damage..."*

Conversely, several regulatory tools were seen as weakening this influence: comprehensive planning that proactively identifies where housing should occur, and regulations allowing denser development, both reduce pressure to build in the floodplain. State or federal programs that reward communities for avoiding floodplain development were also cited, along with restrictions on short-term rentals, affordable housing requirements in development plans, and flexible redevelopment policies outside the floodplain. Notably, unenforced regulations were seen as having little impact on the relationship.

3.5.1 Connection to other themes

Regulation tools also indirectly shape the floodplain–housing relationship through other themes. Regulations influence whether adaptation actions—flood-resilient development, buyout programs—are implemented, and shape land use characteristics by raising development costs or preventing certain development types; over time, they may also influence how floodplain and waterfront land was historically used.

Finally, regulation tools connect to community characteristics: historical housing policies and zoning rules shape development patterns and determine where different populations settle, influencing where vulnerable populations most often reside. Market pressures and limited tenant protections can intensify housing crises, and historical density-related zoning decisions may shape community attitudes toward denser development and "smart growth."

3.6 Theme 6: Knowledge and Information

This theme refers to a community's collective knowledge about flooding and flood mitigation strategies, including both community knowledge and strategies for influencing it—resident education, municipal expertise on the National Flood Insurance Program, and elected officials' understanding of mitigation strategies and funding programs.

Participants did not directly link knowledge and information to the floodplain–housing relationship but noted that communities use it to weigh the costs and benefits of floodplain protection against affordable housing. Several emphasized the importance of updated, accurate floodplain maps incorporating climate projections. One participant described how projection-based flood maps pushed community members to prioritize floodplain protections over other concerns:

> *"We were doing climate-informed flood risk modelling... we were essentially saying, 'here's what your floodplain is going to look like in 2070. And here's how much land, more land it's going to take up'. And that, in an interesting way, kind of stoked the fires of the environmentalists who were like, we need to protect the floodplain at all costs".*

Others expressed frustration that even with sufficient knowledge, economic priorities and political pressures often take precedence. Notably, participants spoke almost exclusively about flooding-related knowledge rather than housing.

3.6.1 Connection to other themes

Participants connected this theme to regulation tools, land use characteristics, and community characteristics. A community's knowledge about flooding and mitigation influences the design and effectiveness of regulations—accurate flood maps may inform zoning governing density and development type—while communities with little historical flood experience may have few local regulations addressing flood risk.

Regarding land use, community knowledge about flooding may shape how land is developed and valued: increased education could alter risk perceptions tied to certain locations, in turn affecting property values.

Finally, knowledge and information intersect with community characteristics: past experience with flooding shapes collective awareness and concern about risk. Participants suggested communities with extensive flood knowledge and experience may show greater acceptance of floodplain planning and protections, while communities with limited experience may view the housing crisis as more immediate—leading residents and leaders to see floodplain protections that constrain housing development as unacceptable

3.7 Mental Model Diagrams

To illustrate local decision-makers' collective mental models of the relationship between floodplain protections and affordable housing, Figures 1, 2, and 3 present a diagrammatic synthesis of the connections among themes. Figure 1 illustrates the complete collective model, including all themes. Notably, this diagram highlights the systems nature of local leaders' perceptions of the relationship between floodplain protections and affordable housing. For example, the themes of land use characteristics, community characteristics, regulatory tools, and knowledge and information are all connected through bidirectional relationships and a feedback loop, indicating the potential for cascading and reinforcing effects when changes occur within any of these themes. Additionally, the comprehensive diagram visualizes which themes are perceived to directly influence the relationship between floodplain protections and affordable housing, and which are only perceived to be related indirectly. Strikingly, adaptation actions occupy a central position, as they are perceived to both strengthen and weaken the potential for floodplain protections exacerbate affordable housing concerns (see Theme 1 description) while also serving as a conduit through which other themes exert influence. Furthermore, knowledge and information is the only theme that indirectly connects to the

floodplain protection–housing relationship solely through its connections with other themes. Finally, community characteristics emerge as particularly influential, as this theme is connected to every other theme in the model.

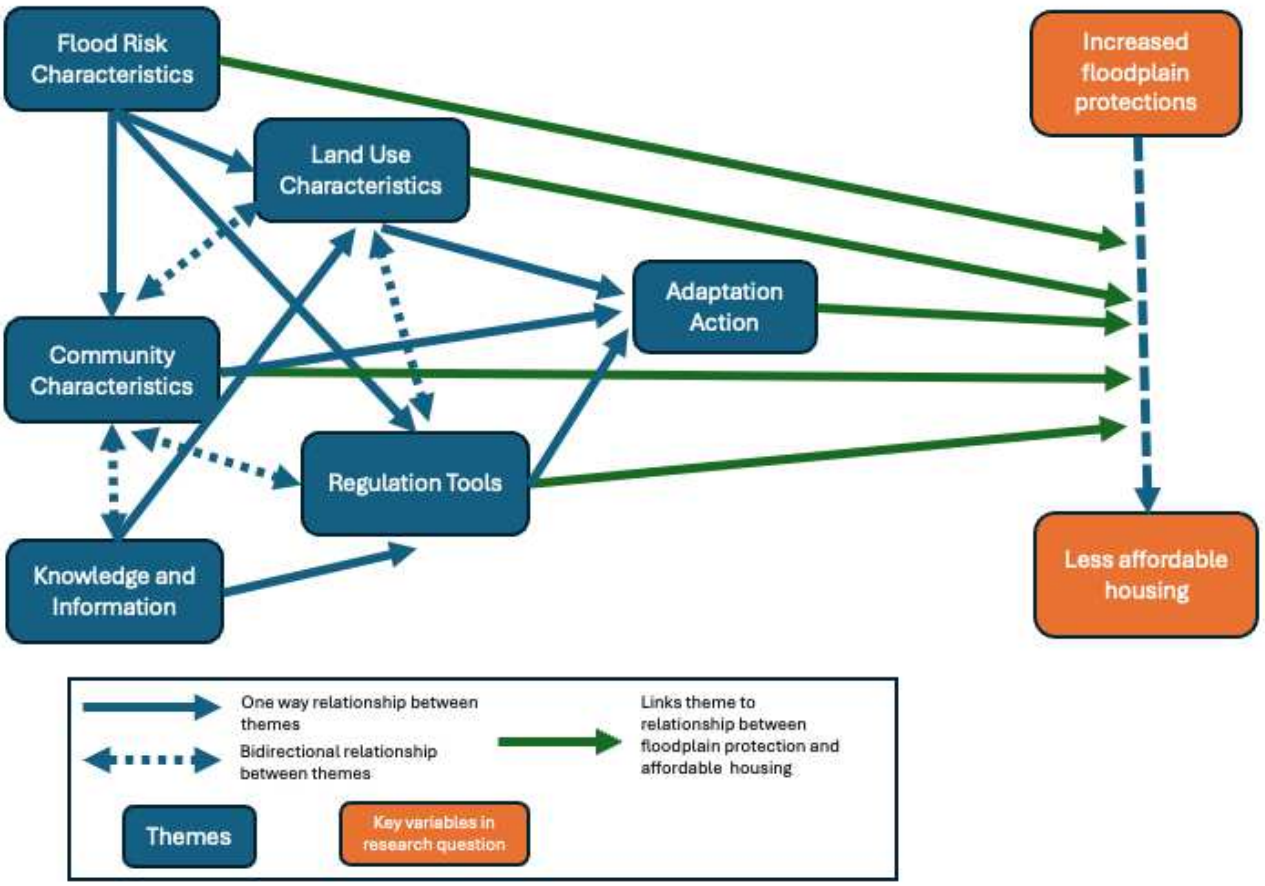


Figure 1. *Synthesis diagram showing directional relationship between all themes, and how participants perceive these themes may influence whether increasing floodplain protections exacerbate affordable housing. Orange boxes are main variables key to our research question and blue boxes are themes coded from mental model interviews. Green arrows represent direct relationships between and theme and the floodplain protections/affordable housing relationship. Blue lines represent an indirect relationship, from one theme to another. Dotted lines represent a bidirectional relationship between themes*.

While Figure 1 presents a high-level synthesis of all themes, Figures 2 and 3 each present a subset of themes. The most salient explanations for the connections between themes are also included in these diagrams. Figure 2 focuses on adaptation actions, regulatory tools, and knowledge and information. In this diagram, the multiple yet more indirect and distanced pathways through which knowledge and information are perceived to influence the floodplain–housing relationship become even more apparent.

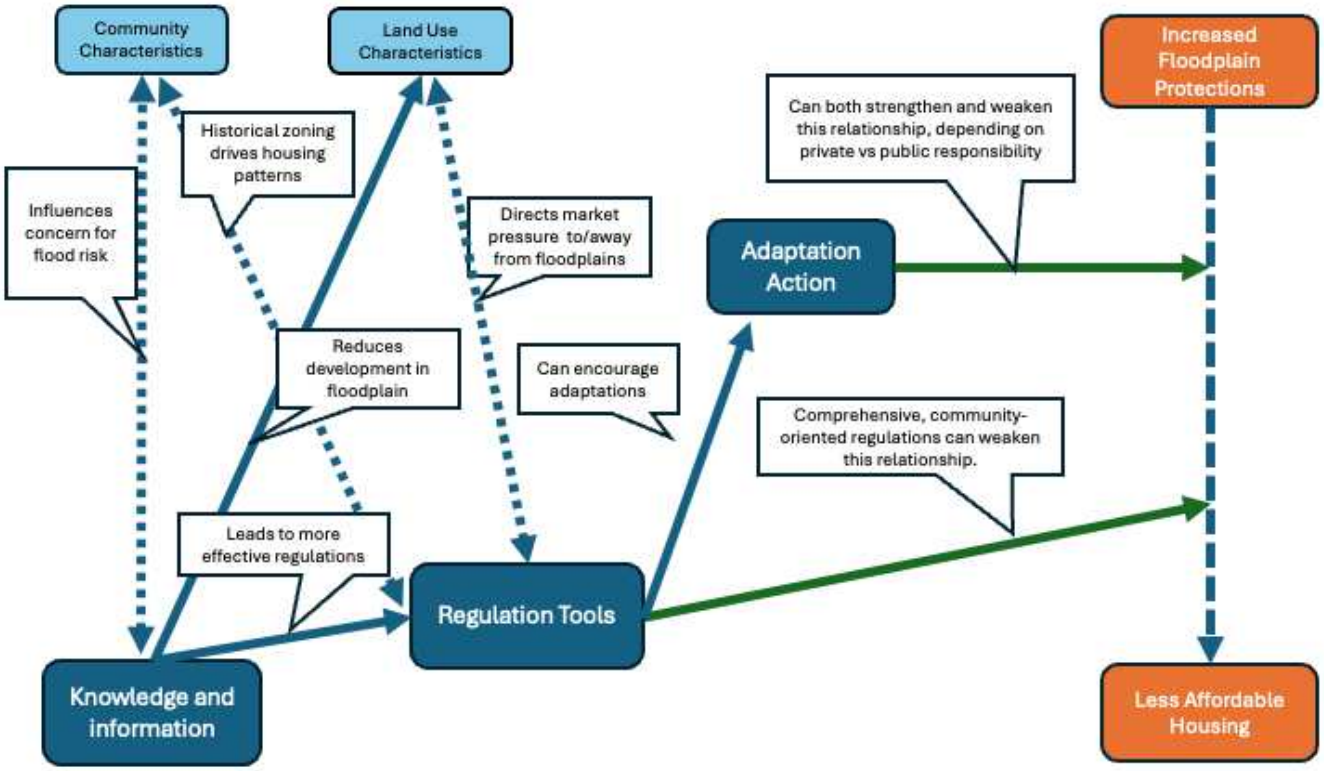


Figure 2. *Synthesis diagram that focuses on themes of adaptation action, regulation tools, and knowledge and information (dark blue boxes). Orange boxes are main variables key to our research question, while light blue boxes represent other themes. Green arrows represent direct relationships between and theme and the floodplain protections/affordable housing relationship. Blue lines represent an indirect relationship, from one theme to another. Dotted lines represent a bidirectional relationship between themes*.

Figure 3 focuses on flood risk, community characteristics, and land-use characteristics. Notably, this diagram highlights the central role of community and land-use characteristics within the collective mental model. Both themes influence four of the five other themes while also maintaining a direct connection to the relationship between floodplain protections and affordable housing.

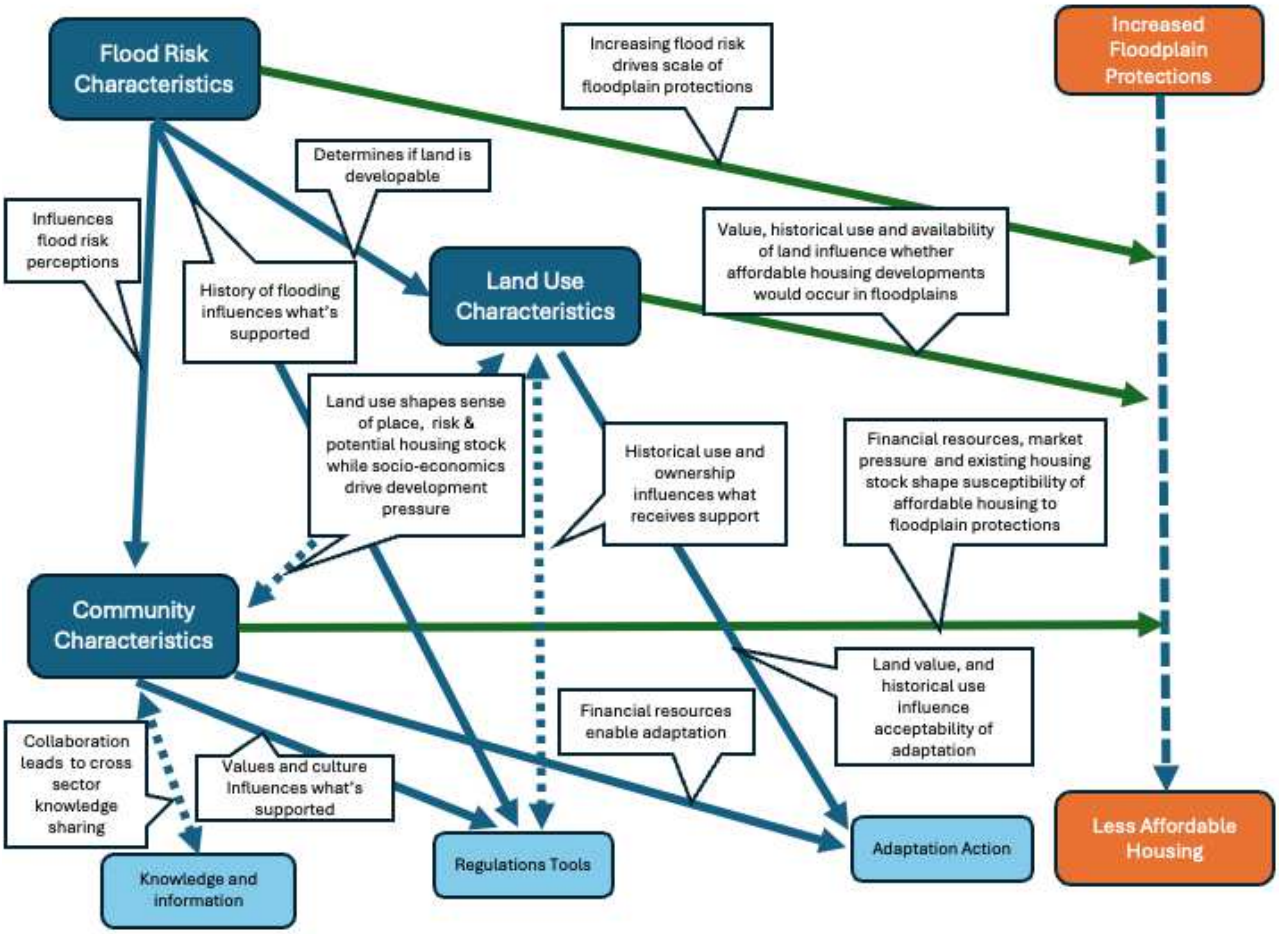


Figure 3. *Synthesis diagram that focuses on themes of flood risk, land use and community characteristics (dark blue boxes). Orange boxes are main variables key to our research question, while light blue boxes represent other themes. Green arrows represent direct relationships between and theme and the floodplain protections/affordable housing relationship. Blue lines represent an indirect relationship, from one theme to another. Dotted lines represent a bidirectional relationship between themes*.

4. Discussion

Participants' mental models suggest that the relationship between floodplain protections and affordable housing is widely perceived but highly dependent on broader community dynamics. Rather than a simple causal pathway, participants described a system in which floodplain protections interact with affordable housing through six interconnected factors: adaptation actions, flood risk characteristics, community characteristics, land use characteristics, regulation tools, and knowledge and information. Adaptation actions emerged as the most direct point of interaction, with participants distinguishing between developer-funded measures that may increase housing costs and publicly funded efforts that may reduce flood risk and maintain developable land. Other themes shaped the relationship more indirectly through local socioeconomic conditions, development patterns, and regulatory contexts. Together, these findings suggest local leaders view floodplain protections and housing affordability as embedded within a broader governance and land-use system, highlighting the need for research and practice that address these interconnected dynamics when designing and communicating flood adaptation strategies. Our results also suggest a need to move away from a singular or linear narrative of this relationship.

4.1 Rethinking the Floodplain–Housing Relationship as a Complex System

Previous literature on the relationship between floodplain protections and affordable housing is complex, contradictory, and limited—likely due to the challenge of identifying causal relationships within such a complex system (Hino et al., 2024; Samoray et al., 2024). While our study does not empirically measure this relationship, our data offer insight into how local leaders perceive it, which can help guide future efforts to untangle these dynamics. Several themes from participants' mental model interviews have also been noted in empirical research. Prior studies highlight the role of zoning and regulatory frameworks in shaping floodplain development and housing outcomes (Kiel, 2005; Quigley & Rosenthal, 2005; Sims & Schuetz, 2009), often examining whether floodplain regulations increase housing costs. Our participants, however, emphasized the potential for zoning and floodplain-related regulations to support affordable housing. They noted that when zoning laws limit denser or mixed-use development, communities have fewer options to offset housing constraints created by floodplain protections—while regulations grounded in comprehensive planning could reduce development pressure in flood-prone areas by encouraging denser development elsewhere. This more nuanced view suggests a need to examine the multiple roles regulatory tools may play within complex housing and floodplain systems. Our themes also highlight gaps in the literature, most notably the role adaptation actions may play in shaping this relationship. More broadly, our findings caution against relying on broad indicators when assessing causal relationships between floodplain protections and affordable housing, and suggest including more nuanced measures of the factors that may shape this relationship.

Our mental model synthesis diagrams also illustrate several bidirectional relationships, with community characteristics often at the center of this complexity. This is striking for two

reasons. First, it challenges the common framing of demographic, social, and economic characteristics as simply explanatory variables in land-use change and housing literature, instead showing that these characteristics both influence and are influenced by land use and housing changes. Second, the presence of bidirectional relationships—and even feedback loops—between themes suggests systems thinking and social-ecological modeling may be more appropriate approaches for exploring the impacts of floodplain regulations on housing. Planning and hazard mitigation scholars have similarly emphasized that relationships among flood risk management, land-use regulation, and housing outcomes are shaped by interacting regulatory, environmental, and market forces, rather than linear cause-and-effect dynamics (Brody et al., 2009; Burby, 2006; Siders, 2019) . Future research should empirically explore floodplain–housing dynamics within this broader social-ecological system, and the themes highlighted in our participants' interviews provide useful starting points. Table 3 translates local decision-makers' perceptions into guiding questions for future research aimed at unpacking the empirical relationship between floodplain protections and affordable housing.

Table 3. Questions to guide future research on the relationship between floodplain protections and affordable housing.

Guiding Questions for Future Research

• How are adaptation costs for floodplain protections currently split among developers, homeowners, and government?
  ○ Does who bears the cost predict changes in affordable housing?
  ○ Is there a cost threshold where developers abandon affordable housing projects?
• How do unexpected shifts in community characteristics (e.g., COVID-19-driven population surges) alter trade-offs between floodplain protections and affordable housing stock?
• In what contexts are floodplain regulations used for exclusionary zoning (NIMBYism) or to block affordable housing?
• How many affordable housing units are affected by expanding 100-year to 500-year floodplain protections, and how does this differ between riverine and coastal floodplains?
• How does water/sewer infrastructure availability in non-flood-prone areas affect a municipality's ability to prioritize affordable housing away from hazard areas?
• How does floodplain regulation enforcement differ across federal, state, and local actors in its impact on affordable housing?
• What public knowledge drives support for floodplain protections, and how does it relate to past flood experience?

- What local technical knowledge leads to more effective floodplain and housing regulations?
- How do community characteristics shape support for different floodplain protections (e.g., adaptation requirements, development restrictions)?

4.2 Beyond knowledge and information deficits

One of the most striking findings was the distanced, indirect relationship between the knowledge and information theme and the floodplain protections–affordable housing relationship. This was the only theme not directly connected to that relationship—linked only indirectly, via other themes—and it was also discussed in far less detail than the others. This is notable given that prior research has emphasized the importance of knowledge and information, such as flood maps, awareness of federal regulations and funding programs, and flood risk mitigation expertise (Christopher et al., 2024; Pasquier et al., 2020). Because our data reflect the perspectives of local leaders rather than an investigation of actual system dynamics, we caution against generalizing these results in ways that diminish the importance of improving local communities' knowledge of and access to flood information. Rather, our findings highlight the risk of overstating the role of knowledge and information at the expense of other interacting factors in the system. Practically, this suggests a need for flood risk mitigation and capacity-building interventions that extend beyond knowledge and information alone.

4.3 Implications for practice

The most practical value of our findings lies in the insight they offer into how practitioners can engage with local decision-makers about floodplain protections. This study originated in conversations with floodplain specialists and conservation professionals who described the difficulty of addressing floodplain protection needs during a housing crisis. Local leaders' mental models show how these conversations can better reflect the complex perceptions of floodplain protections' potential to exacerbate affordable housing issues. Based on these results, we developed the questions in Table 3 as guidelines for more holistic, nuanced conversations with local leaders balancing competing community priorities—and to help those leaders interrogate their own community's version of this system.

Table 3. Guiding questions for having affordable housing and floodplain conversations with local leaders

15 Practical questions for having nuanced and context specific conversations about the influence floodplain protection on affordable housing
Adaptation Questions 1. What types of adaptations would increasing floodplain protections require? How would the costs of those adaptations be distributed across developers, homeowners, and government?

2. Which adaptation strategies in your community tend to *increase* housing costs, and which might help stabilize or reduce them?

Flood Risk Questions

3. How much land would be affected by an increase in floodplain protections? How much of it is developable?
4. How might future flood risk (not just current maps) change today's housing decisions?

Community Characteristics Questions

5. What are the biggest drivers of housing pressure in your community right now (e.g., migration, second homes, short-term rentals)?
6. How do local values—around growth, conservation, or property rights—shape how people might react to propositions for increased floodplain protections?

Land Use Questions

7. Are floodplain areas currently seen as desirable, developable, or constrained land?
8. If development pressure shifts away from floodplains, where would it go?
9. Are there existing spatial patterns where lower-income housing is concentrated in higher-risk areas?

Regulation Tool Questions

10. Which current regulations have the most influence on housing development in flood-prone areas?
11. What regulatory tools (e.g., density allowances, incentives, STR limits) could support affordable housing? What tools could limit development in the floodplain. Is there are overlap?

Knowledge and information Questions

12. What information does your community currently rely on when thinking about flood risk and housing?
13. Where are the biggest gaps in knowledge and information—about flooding, housing, or how they interact? How would you use that information if you had it?

Synthesis Questions

14. What would need to be true for both flood risk reduction and housing goals to be achieved at the same time?
15. What assumptions are you making about trade-offs that might not always exist?

4.4 Conclusion

The relationship between floodplain protections and affordable housing cannot be understood as a simple trade-off, but as a context-dependent outcome shaped by interacting social, ecological, and governance dynamics. Our results show that local decision-makers perceive this relationship not as linear, but as embedded within a complex, multi-factor system characterized by feedback loops and bidirectional relationships. Future research should adopt systems thinking as a lens for empirically investigating this relationship, and practitioners need to

engage local leaders using approaches that reflect this complexity. Our findings provide a foundation for more nuanced, context-sensitive conversations about floodplain protections during housing crises. Recognizing and engaging with this complexity is essential for developing flood adaptation strategies that are both effective and equitable amid growing climate and housing pressures.

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5. References

Acolin, A., & Reina, V. (2022). Housing cost burden and life satisfaction. *Journal of Housing and the Built Environment*, *37*(4), 1789–1815. https://doi.org/10.1007/s10901-021-09921-1

Adler, J. H. (2008). Money or Nothing: The Adverse Environmental Consequences of Uncompensated Land Use Controls. *Boston College Law Review*, *49*(2), 301–366.

Airgood-Obrycki, W., Hermann, A., & Wedeen, S. (2022). "The Rent Eats First": Rental Housing Unaffordability in the United States. *Housing Policy Debate*, *0*(0), 1–21. https://doi.org/10.1080/10511482.2021.2020866

Anthony, J. (2018). Economic Prosperity and Housing Affordability in the United States: Lessons from the Booming 1990s. *Housing Policy Debate*, *28*(3), 325–341. https://doi.org/10.1080/10511482.2017.1393689

Biggs, D., Abel, N., Knight, A. T., Leitch, A., Langston, A., & Ban, N. C. (2011). The implementation crisis in conservation planning: Could "mental models" help? *Conservation Letters*, *4*(3), 169–183.

Biryukov, N. (2026, January 22). New Jersey regulators approve controversial new flood rules • New Jersey Monitor. *New Jersey Monitor*. https://newjerseymonitor.com/2026/01/22/nj-new-flood-rules/

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Brody, S. D., Zahran, S., Highfield, W. E., Bernhardt, S. P., & Vedlitz, A. (2009). Policy Learning for Flood Mitigation: A Longitudinal Assessment of the Community Rating System in Florida. *Risk Analysis*, *29*(6), 912–929. https://doi.org/10.1111/j.1539-6924.2009.01210.x

Burby, R. J. (2006). Hurricane Katrina and the Paradoxes of Government Disaster Policy: Bringing About Wise Governmental Decisions for Hazardous Areas. *The ANNALS of the American Academy of Political and Social Science*, *604*(1), 171–191. https://doi.org/10.1177/0002716205284676

Burstein, P. (2003). The Impact of Public Opinion on Public Policy: A Review and an Agenda. *Political Research Quarterly*, *56*(1), 29–40. https://doi.org/10.1177/106591290305600103

Carley, K., & Palmquist, M. (1992). Extracting, representing, and analyzing mental models. *Social Forces*, *70*(3), 601–636.

Cascio, M. A., Lee, E., Vaudrin, N., & Freedman, D. A. (2019). A Team-based Approach to Open Coding: Considerations for Creating Intercoder Consensus. *Field Methods*, *31*(2), 116–130. https://doi.org/10.1177/1525822X19838237

Christopher, N., Vachette, A., Horne, A., & Kosovac, A. (2024). Enhancing river floodplain management with nature-based solutions: Overcoming barriers and harnessing enablers. *WIREs Water*, *11*(4), e1723. https://doi.org/10.1002/wat2.1723

Collins, T. W., Grineski, S. E., & Chakraborty, J. (2018). Environmental injustice and flood risk: A conceptual model and case comparison of metropolitan Miami and Houston, USA. *Regional Environmental Change*, *18*(2), 311–323. https://doi.org/10.1007/s10113-017-1121-9

Dacquisto, D. J., & Rodda, D. T. (2006). *Housing impact analysis*. US Department of Housing and Urban Development, Office of Policy Development ….

Dewilde, C. (2017). Do housing regimes matter? Assessing the concept of housing regimes through configurations of housing outcomes. *International Journal of Social Welfare*, *26*(4), 384–404. https://doi.org/10.1111/ijsw.12261

Dong, H. (2018). The impact of income inequality on rental affordability: An empirical study in large American metropolitan areas. *Urban Studies*, *55*(10), 2106–2122. https://doi.org/10.1177/0042098017710380

Federal Emergency Management Agency. (2024). *Federal Flood Risk Management Standard (FFRMS) policy, FEMA Policy 206-24-005.* U.S. Department of Homeland Security.

Garner, A. J., Mann, M. E., Emanuel, K. A., Kopp, R. E., Lin, N., Alley, R. B., Horton, B. P., DeConto, R. M., Donnelly, J. P., & Pollard, D. (2017). Impact of climate change on New York City's coastal flood hazard: Increasing flood heights from the preindustrial to 2300 CE. *Proceedings of the National Academy of Sciences*, *114*(45), 11861–11866. https://doi.org/10.1073/pnas.1703568114

Glaeser, E. L., & Ward, B. A. (2009). The causes and consequences of land use regulation: Evidence from Greater Boston. *Journal of Urban Economics*, *65*(3), 265–278. https://doi.org/10.1016/j.jue.2008.06.003

Hadden, J., & Prakash, A. (2025). Unpacking the tradeoff between equity and climate resilience in U.S. housing policy. *Npj Climate Action*, *4*(1), 86. https://doi.org/10.1038/s44168-025-00292-9

Highfield, W. E., & Brody, S. D. (2013). Evaluating the Effectiveness of Local Mitigation Activities in Reducing Flood Losses. *Natural Hazards Review*, *14*(4), 229–236. https://doi.org/10.1061/(ASCE)NH.1527-6996.0000114

Hino, M., BenDor, T. K., Branham, J., Kaza, N., Sebastian, A., & Sweeney, S. (2024). Growing Safely or Building Risk?: Floodplain Management in North Carolina. *Journal of the American Planning Association*, *90*(1), 50–62. https://doi.org/10.1080/01944363.2022.2141821

New York State. (2023). *Achieving the New York Dream: State of the State*. https://www.governor.ny.gov/sites/default/files/2023-01/2023SOTSBook.pdf?utm_source=chatgpt.com

Johnson, K. A., Wing, O. E. J., Bates, P. D., Fargione, J., Kroeger, T., Larson, W. D., Sampson, C. C., & Smith, A. M. (2020). A benefit–cost analysis of floodplain land acquisition for US flood damage reduction. *Nature Sustainability*, *3*(1), 56–62. https://doi.org/10.1038/s41893-019-0437-5

Johnson, S., Walker, S. E., Goulding, C. J., LoTemplio, S., & Zarestky, J. (2026). "Nature from My Perspective": Leveraging Participatory Mental Modeling to Understand the Well-Being Impacts of Outdoor Retreats for Black Men. *Ecopsychology*, *18*(1), 56–72. https://doi.org/10.1177/19429347251407579

Johnson-Laird, P. N. (1983). *Mental Models: Towards a Cognitive Science of Language, Inference, and Consciousness*. Harvard University Press.

Jones, N. A., Ross, H., Lynam, T., Perez, P., & Leitch, A. (2011). Mental Models: An Interdisciplinary Synthesis of Theory and Methods. *Ecology and Society*, *16*(1). https://www.jstor.org/stable/26268859

Kiel, K. A. (2005). Environmental Regulations and the Housing Market: A Review of the Literature. *Cityscape*, *8*(1), 187–207.

Lamie, C., Bader, D., Graziano, K., Horton, R., John, K., O'Hern, N., Spungin, S., & Stevens, A. (2024). New York State Climate Impacts Assessment Chapter 02: New York State's Changing Climate. *Annals of the New York Academy of Sciences*, *1542*(1), 91–145. https://doi.org/10.1111/nyas.15240

Laquatra, J., & Potter, G. L. (2000). Building a Balance: Housing Affordability and Environmental Protection in the USA. *Electronic Green Journal*, *1*(12). https://doi.org/10.5070/G311210376

Lee, D., & Jung, J. (2014). The growth of low-income population in floodplains: A case study of Austin, TX. *KSCE Journal of Civil Engineering*, *18*(2), 683–693. https://doi.org/10.1007/s12205-014-0205-z

Lee, Y., Kemp, P. A., & Reina, V. J. (2022). Drivers of housing (un)affordability in the advanced economies: A review and new evidence. *Housing Studies*, *37*(10), 1739–1752. https://doi.org/10.1080/02673037.2022.2123623

Mayer, C. J., & Somerville, C. T. (2000). Land use regulation and new construction. *Regional Science and Urban Economics*, *30*(6), 639–662. https://doi.org/10.1016/S0166-0462(00)00055-7

Mazumder, L. T., Landry, S., & Alsharif, K. (2022). Coastal cities in the Southern US floodplains: An evaluation of environmental equity of flood hazards and social vulnerabilities. *Applied Geography*, *138*, 102627. https://doi.org/10.1016/j.apgeog.2021.102627

Montgomery, M. C., & Chakraborty, J. (2013). Social Vulnerability to Coastal and Inland Flood Hazards: A Comparison of GIS-Based Spatial Interpolation Methods. *International Journal of Applied Geospatial Research (IJAGR)*, *4*(3), 58–79. https://doi.org/10.4018/jagr.2013070104

Moon, K., Guerrero, A. M., Adams, V. M., Biggs, D., Blackman, D. A., Craven, L., Dickinson, H., & Ross, H. (2019). Mental models for conservation research and practice. *Conservation Letters*, *12*(3), e12642.

Morgan, M. G. (2002). *Risk Communication: A Mental Models Approach*. Cambridge University Press.

National Low Income Housing Coalition. (2025). *The gap: A shortage of affordable homes*. https://nlihc.org/gap.

New Jersey Department of Environmental Protection| Resilient Environments and Landscapes | Overview. (n.d.). *Resilient Environments and Landscapes*. Retrieved August 28, 2026, from https://dep.nj.gov/njreal/overview/

Otter.ai, Inc. (2026). *Otter.ai* [Computer software]. https://otter.ai/

Pasquier, U., Few, R., Goulden, M. C., Hooton, S., He, Y., & Hiscock, K. M. (2020). "We can't do it on our own!"—Integrating stakeholder and scientific knowledge of future flood risk to inform climate change adaptation planning in a coastal region. *Environmental Science & Policy*, *103*, 50–57. https://doi.org/10.1016/j.envsci.2019.10.016

Peck, A. J., Adams, S. L., Armstrong, A., Bartlett, A. K., Bortman, M. L., Branco, A. B., Brown, M. L., Donohue, J. L., Kodis, M., McCann, M. J., & Smith, E. (2022). A new framework for flood adaptation: Introducing the Flood Adaptation Hierarchy. *Ecology and Society*, *27*(4). https://doi.org/10.5751/ES-13544-270405

Quigley, J. M., & Rosenthal, L. A. (2005). The Effects of Land Use Regulation on the Price of Housing: What Do We Know? What Can We Learn? *Cityscape*, *8*(1), 69–137.

Reina, V. J., Pritchett, W. E., & Wachter, S. M. (2021). *Perspectives on fair housing*. University of Pennsylvania Press.

Rook, L. (2013). Mental models: A robust definition. *The Learning Organization*, *20*(1), 38–47.

Ruíz, M. A., & Mack-Vergara, Y. L. (2023). Resilient and Sustainable Housing Models against Climate Change: A Review. *Sustainability*, *15*(18), 13544. https://doi.org/10.3390/su151813544

Samoray, C., Hino, M., Siders, A. R., Agopian, A., & Mach, K. J. (2024). Housing amenity and affordability shape floodplain development. *Land Use Policy*, *144*, 107216. https://doi.org/10.1016/j.landusepol.2024.107216

Siders, A. R. (2019). Managed Retreat in the United States. *One Earth*, *1*(2), 216–225. https://doi.org/10.1016/j.oneear.2019.09.008

Siders, A. R., Gerber-Chavez, L., Adams, S., Richardson, D., & Reece, K. (2021). *Local Wetlands and Watercourse Regulations, Potential Tools for Floodplain Management: Lessons from Three New York Towns*. University of Delaware Disaster Research Center and The Nature Conservancy of New York. https://udspace.udel.edu/handle/19716/30100

Siders, A. R., & Keenan, J. M. (2020). Variables shaping coastal adaptation decisions to armor, nourish, and retreat in North Carolina. *Ocean & Coastal Management*, *183*, 105023. (pub.1122199400). https://doi.org/10.1016/j.ocecoaman.2019.105023

Siders, A. R., Niemann-Morris, J., Hino, M., Shields, E., Cano Pecharroman, L., Doeffinger, T., Gerber-Chavez, L., Huang, J.-C., Lafferty, A., Tamima, S., Williams, C., Agopian, A., Samoray, C., & Mach, K. J. (2024). How local governments avoid floodplain development through consistent implementation of routine municipal ordinances, plans, and programs. *Oxford Open Climate Change*, *4*(1), kgae017. https://doi.org/10.1093/oxfclm/kgae017

Sims, K. R. E., & Schuetz, J. (2009). Local regulation and land-use change: The effects of wetlands bylaws in Massachusetts. *Regional Science and Urban Economics*, *39*(4), 409–421. https://doi.org/10.1016/j.regsciurbeco.2008.12.004

Steger, C., Klein, J. A., Reid, R. S., Lavorel, S., Tucker, C., Hopping, K. A., Marchant, R., Teel, T., Cuni-Sanchez, A., Dorji, T., Greenwood, G., Huber, R., Kassam, K.-A., Kreuer, D., Nolin, A., Russell, A., Sharp, J. L., Šmid Hribar, M., Thorn, J. P. R., … Waiswa, D. (2021). Science with society: Evidence-based guidance for best practices in environmental transdisciplinary work. *Global Environmental Change*, *68*, 102240. https://doi.org/10.1016/j.gloenvcha.2021.102240

Sullivan, E., Makarewicz, C., & Rumbach, A. (2022). Affordable but Marginalized: A Sociospatial and Regulatory Analysis of Mobile Home Parks in the Houston Metropolitan Area. *Journal of the American Planning Association*, *88*(2), 232–244. https://doi.org/10.1080/01944363.2021.1952477

Tarlock, D., & Albrecht, J. (2018). Potential constitutional constraints on the regulation of flood plain development: Three case studies. *Journal of Flood Risk Management*, *11*(1), 48–55. https://doi.org/10.1111/jfr3.12274

Thomsen, D. C., Smith, T. F., & Keys, N. (2012). Adaptation or Manipulation? Unpacking Climate Change Response Strategies. *Ecology and Society*, *17*(3). https://www.jstor.org/stable/26269087

US Congress Joint Economic Committee. (2024). Flooding costs the US between $179.8 and $496.0 billion each year. *Washington, DC: JEC*.

Wells, J., Labadz, J. C., Smith, A., & Islam, Md. M. (2020). Barriers to the uptake and implementation of natural flood management: A social-ecological analysis. *Journal of Flood Risk Management*, *13*(S1), e12561. https://doi.org/10.1111/jfr3.12561

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