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Housing in the U.S. Floodplains

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As sea levels rise due to climate change, planners and policymakers in flood-prone areas must prepare for the future in order to protect vulnerable residents from the effects of flooding. To do this, they need access to vital information about the people and housing located in the floodplain. The NYU Furman Center, with funding from the Kresge Foundation, is meeting this need with FloodzoneData.us, a tool that makes available estimates at the national, state, county, and census tract level of the housing stock and population in floodplains.[1] This data can help policymakers assess needs and formulate plans and policies for floodplain management.

The NYU Furman Center's accompanying data brief series summarizes and highlights the data available at FloodzoneData.us. This first brief describes the housing in the nation's floodplains. The second brief, which will be released later this spring, will describe the people living in the nation's floodplains; and, coming this summer, the third brief will compare the housing and population in floodplains across different geographies (regions, states, and metro areas).

Introduction

As extreme climate events become more common, the properties located in the nation's floodplains—and the people they house—face increasing risks. Severe storms are becoming more frequent and some vulnerable areas along the coasts are experiencing flooding even with less serious storms and high tides. The Federal Emergency Management Agency (FEMA) publishes and maintains Flood Insurance Rate Maps to administer the National Flood Insurance Program (NFIP). These maps divide the United States into two zones based on current flood risk: the 100-year floodplain and 500-year floodplain. The 100-year floodplain includes areas with a one percent probability of flooding each year, and the 500-year floodplain includes areas with a 0.2 percent probability of flooding each year.[2] While these probabilities do not suggest imminent risk, this terminology can be misleading. A recent *New York Times* article about the challenge facing the NFIP explained it well:

> A "hundred-year flood" sounds like a factor of time, as if the land were expected to flood only once every 100 years, but what it's really meant to express is risk—the land has a 1 percent chance of flooding each year. As waters rise, though, flooding in low-lying places without sea walls ... will become more and more common until the presence of water is less about chance and more about certainty.[3]

Indeed, FEMA flood risk measures do not take into account future sea level change estimates. As sea levels rise, flooding will become more commonplace for a larger swath of the U.S.

1 FloodzoneData.us combines U.S. Census Bureau data and data from the National Housing Preservation Database with the National Flood Hazard Layer (NFHL), which contains the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps (FIRMs). FEMA is the entity that defines the boundaries of the 100 and 500 year floodplains. The NFHL covers 71 percent of the counties in the U.S., and approximately 92 percent of the population. Some areas with flood risk are not covered by the NFHL. For more information about the NFHL see FEMA. (April 2017). *The National Flood Hazard Layer*. https://www.fema.gov/media-library-data/1492206395397-ddb37681a7ad12e4ae9365b3aa5f84ed/The_National_Flood_Hazard_Layer.pdf.

2 FEMA. Flood Zones: Definition/Description. https://www.fema.gov/flood-zones

3 Jarvis, B. (April 18, 2017). *When Rising Seas Transform Risk Into Certainty*. New York Times Magazine. https://nyti.ms/2oR3AR0.

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Flooding threatens the safety of residents, who may face immediate danger trying to escape rising waters or may be deprived of life-sustaining services following a flood. There are also serious financial risks that come with living in a floodplain. Residents of buildings that do not meet flood-resistant design standards risk destruction of their possessions, and the potential loss of their housing unit. For owners of residential property, the cost of making buildings flood-proof can be quite high.[4] Failure to retrofit properties for flooding may also affect flood insurance costs, as the federal government gradually phases in actuarially sound flood insurance premiums under the National Flood Insurance Program in these areas.[5] These issues have been described in detail in previous work by the NYU Furman Center: *Planning for Resilience: The Challenge of Floodproofing Multifamily Housing* (published October 2015) and *The Price of Resilience: Can Multifamily Housing Afford to Adapt?* (published July 2014).

Policymakers, service providers, and community members confronting the risks and needs of residents in the nation's floodplains must address a range of housing-related questions, including how best to meet the needs of those living in floodplains, how to regulate new development and existing structures, and how to cover costs associated with floodplain management (along with a host of issues unrelated to housing, of course). To consider these questions, first communities need to understand the characteristics of the housing units in their floodplain.

In this brief, we describe the housing stock in 100-year floodplains and combined 100- and 500-year floodplains in 2011-2015.[6] During this period, five percent of all occupied housing units in the United States were located in the 100-year floodplain, and 10 percent were located in combined floodplains (see **Appendix** for number of housing units in the 100-year and combined floodplains by state based on the National Flood Hazard Layer). Based on estimates from FloodzoneData.us, below we describe the size of housing in U.S. floodplains, the shares that are rental and owner-occupied, the age of the housing, and whether the housing is government subsidized. As we describe below, all of these factors are important to understand when assessing the risk from flooding and the challenges of retrofitting.

Size and Tenure

How best to make buildings more resilient against future flooding will depend partly on the type of residential buildings occupying the floodplain. Single-family homes are, generally speaking, easier to adapt for flooding risk than larger buildings, which can be more complicated to elevate. Single-family properties, however, are less likely than multifamily properties to have professional ownership and management, which may affect the type of assistance owners need to implement and finance resilience retrofits. Whether residents are owners or renters also may inform local needs assessments and planning. It may be easier for renters to move, whereas owners may be more tied to at-risk properties. On the other hand, this may not be the case for lower-income renters or renters in areas with low vacancy rates and relatively high rents.

4 For single-family homes, flood proofing that is compliant with FEMA regulations and typically also local regulations requires elevation of the structure; for larger multifamily properties, it can involve elevating mechanical equipment and either filling in spaces below the flood elevation or designing those spaces so water can freely flow in and out. If owners do not take steps to retrofit their properties, they run the risk of incurring significant damage and costs if flooding occurs.

5 FEMA. (April 3, 2014). *Homeowner Flood Insurance Affordability Act Overview*. https://www.fema.gov/media-library-data/1396551935597-4048b68f6d695a6eb6e6e7118d3ce464/HFIAA_Overview_FINAL_03282014.pdf

6 Unless otherwise noted, the data in this report are based on the American Community Survey 2011-2015 five-year estimates. These data are period estimates and should be interpreted as a measure of the conditions during the full date range.

Figure 1 shows the share of units in the nation's floodplains that were housed in buildings of different sizes in 2011-2015. As the figure shows, the shares in 100-year floodplains and the combined floodplains were approximately the same. Most housing units in the nation's floodplains were in single-family homes.[7]

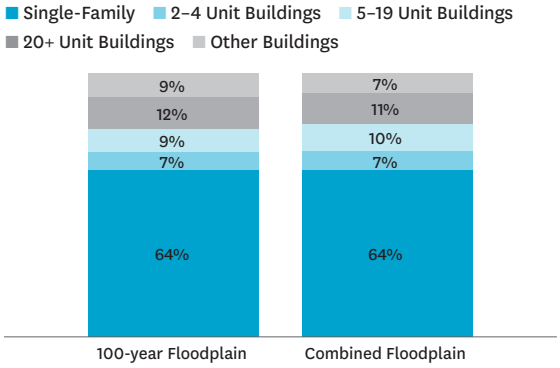
In the U.S., 64 percent of all housing units were occupied by owners and 36 percent by renters in 2011-2015. Figure 2 shows that a slightly lower share of units was occupied by renters in 100-year floodplains: 66 percent of units were owner-occupied and 34 percent were renter-occupied. However, in the combined floodplains, a higher share of housing units was occupied by renters: 62 percent were owner-occupied and 38 percent were renter-occupied.

Building Age

Congress created the National Flood Insurance Program in 1968.[8] In order to participate, jurisdictions are required to adopt a floodplain management ordinance.[9] Units that pre-date the local adoption of those ordinances are more likely to be out of compliance with the design and construction standards they require. Thus, the age of the buildings in floodplains may offer some insight into whether buildings are designed or retrofitted for flooding.

Figure 3 shows that 22 percent of all housing units in both 100-year and combined floodplains were built prior to 1960. Newer units account for a smaller proportion of units in the floodplain.

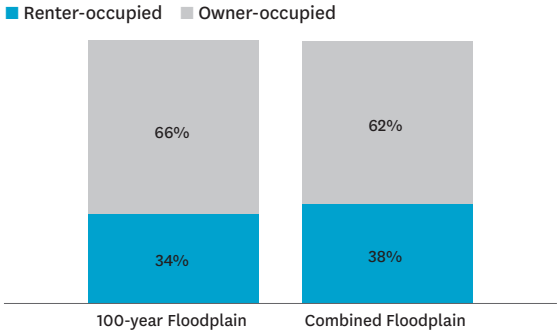
Figure 1: Share of Units in the Floodplain by Building Type, 2011-2015



Note: Figures do not sum to 100% due to rounding.

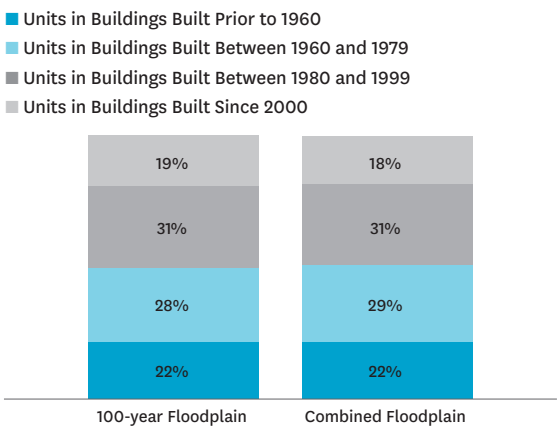
Sources: American Community Survey, U.S. Federal Emergency Management Agency, NYU Furman Center

Figure 2: Share of Units in Floodplain by Tenure, 2011-2015, United States



Sources: American Community Survey, U.S. Federal Emergency Management Agency, NYU Furman Center

Figure 3: Share of Units in Floodplain by Age of Building, 2011-2015



Note: Figures do not sum to 100% due to rounding.

Sources: American Community Survey, U.S. Federal Emergency Management Agency, NYU Furman Center

7 The distribution of units in the nation's floodplains largely mirrors that of the U.S. as a whole. Sixty-seven percent of the housing units in the U.S. are found in single-family homes. Eight percent are in two- to four-unit buildings; 18 percent of units are in larger buildings. Six percent of units are categorized as "other" (e.g., houseboats, RVs, and mobile homes occupied as an individual's current place of residence) in the U.S. as a whole. Nine percent of units are classified as "other" in the 100-year floodplain, and seven percent of units in the combined floodplains.

8 FEMA. March 2011. *Answers to Questions About the NFIP*. https://www.fema.gov/media-library-data/20130726-1438-20490-1905/f084_atq_11aug11.pdf at 1.

9 *Id.*

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Of units in the 100-year floodplain, 19 percent were built since 2000. Eighteen percent of units in the combined floodplain were built since 2000.

Subsidized and Public Housing

Government-subsidized housing is an important local resource, and communities should be concerned when it is vulnerable to flooding. Knowing the subsidy status of housing in the floodplain is relevant for two additional reasons. First, owners and occupants of subsidized housing may have limited resources for addressing the costs of flooding. Second, subsidized housing poses unique regulatory or administrative hurdles for owners implementing resilience upgrades or flood proofing.

Table 2 shows the number of rental housing units in floodplains that are either public housing or privately owned, subsidized housing.[10] Four percent of all privately owned, subsidized housing units in the U.S. are located in the 100-year floodplain (155,935 units); and eight percent are in the combined floodplain (343,351 units). A larger share of the nation's public housing stock is found in the nation's floodplain. Five percent of all public housing units are located in the 100-year floodplain (56,132 units), and nearly one in 10 units (nine percent) are in the combined floodplain (104,497 units).

Table 2: Subsidized Housing Units in the U.S. and the Floodplain

	100-Year Floodplain	Combined Floodplain	U.S.
Public Housing Units	56,132	104,497	1,114,191
Share of all U.S. Public Housing Units	5%	9%	100%
Privately Owned Federally Subsidized Rental Units	155,935	343,351	4,106,628
Share of all U.S. Privately-Owned Subsidized Rental Units	4%	8%	100%

Sources: National Housing Preservation Database, U.S. Federal Emergency Management Agency, NYU Furman Center

Conclusion

As more localities in the U.S. face more frequent flooding, the need to plan for current and future risk from flooding is becoming a greater priority. A crucial prerequisite for this planning is having access to data to better understand the needs of the housing stock in the floodplains.

While this national snapshot may be helpful for planning at the federal level, local governments will of course need to explore the data in FloodzoneData.us at smaller geographies. For access to the data presented in this brief at the state, county, and Census tract levels, as well as additional population data, visit FloodzoneData.us. This data tool is intended to provide local officials and practitioners with the data necessary to plan for resilience.

10 The data presented in FloodzoneData.us about subsidized housing is from the National Housing Preservation Database, which include information about federally assisted rental housing. *See* National Housing Preservation Database. Data Sources. http://www.preservationdatabase.org/datasources.php

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Number of Occupied Housing Units in the 100-Year and Combined Floodplain by State

State	100-Year Floodplain*		Combined Floodplain*	
	Number of occupied housing units	State Rank	Number of occupied housing units	State Rank
Alabama	128,846	15	158,299	18
Alaska	8,271	48	9,990	49
Arizona	99,388	19	1,774,600	3
Arkansas	82,189	24	132,171	21
California	388,325	3	1,964,142	2
Colorado	43,615	32	72,818	31
Connecticut	86,907	23	112,430	24
Delaware	34,713	37	41,368	41
District of Columbia	3,465	50	7,474	50
Florida	1,893,920	1	2,611,010	1
Georgia	231,038	6	298,567	8
Hawaii	46,243	30	51,786	36
Idaho	17,047	44	46,244	38
Illinois	118,485	17	169,816	16
Indiana	121,354	16	166,822	17
Iowa	40,825	34	50,134	37
Kansas	44,039	31	96,531	29
Kentucky	90,049	22	107,737	25
Louisiana	247,341	5	337,611	6
Maine	17,904	43	19,415	46
Maryland	56,411	29	70,255	33
Massachusetts	181,393	9	253,606	10
Michigan	140,620	14	186,653	14
Minnesota	56,622	28	74,471	30
Mississippi	145,578	13	179,403	15
Missouri	76,393	25	97,274	28
Montana	15,824	45	26,643	44
Nebraska	39,982	35	71,453	32
Nevada	31,772	38	131,706	22
New Hampshire	37,073	36	45,072	39
New Jersey	230,313	7	302,674	7
New Mexico	41,125	33	52,196	35
New York	269,165	4	426,338	5
North Carolina	225,079	8	281,882	9
North Dakota	22,977	41	67,174	34
Ohio	159,918	11	209,247	13

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State	100-Year Floodplain*		Combined Floodplain*	
	Number of occupied housing units	State Rank	Number of occupied housing units	State Rank
Oklahoma	90,510	21	139,348	20
Oregon	59,125	27	107,332	26
Pennsylvania	160,839	10	229,281	11
Rhode Island	29,053	40	43,381	40
South Carolina	–	51	6,550	51
South Dakota	18,781	42	26,034	45
Tennessee	92,805	20	121,718	23
Texas	611,937	2	986,202	4
Utah	11,108	47	36,067	43
Vermont	13,564	46	15,663	47
Virginia	153,168	12	216,450	12
Washington	29,863	39	40,217	42
West Virginia	62,339	26	98,580	27
Wisconsin	112,100	18	139,529	19
Wyoming	5,317	49	12,292	48

**Estimates based on the 100-year and combined floodplains as defined by the National Flood Hazard Layer (NFHL). NFHL coverage varies by state.*

Sources: American Community Survey, U.S. Federal Emergency Management Agency, NYU Furman Center

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The NYU Furman Center advances research and debate on housing, neighborhoods, and urban policy.