

ISSUE BRIEF

SEEKING HIGHER GROUND: HOW TO BREAK THE CYCLE OF REPEATED FLOODING WITH CLIMATE-SMART FLOOD INSURANCE REFORMS

The National Flood Insurance Program (NFIP) was designed to help Americans recover from flood disasters, but it can also unintentionally trap homeowners who would prefer to move somewhere safer. Instead of moving, many policyholders find themselves rebuilding their homes again and again.¹ Across the United States, more than 30,000 “severe repetitive loss properties” (SRLPs) have been covered under the NFIP. These properties have flooded an average of five times, according to FEMA data acquired by NRDC through a Freedom of Information Act request.^{2,3}

More and more Americans are living in areas that are vulnerable to flooding and sea level rise.^{4,5,6} In the face of rising flood risks and damages, the NFIP should provide interested homeowners the option of relocating. This issue brief proposes flood insurance reforms that would make it possible for the owners of repeatedly flooded homes to receive a buyout of their property after a flood, removing the uncertainty that surrounds FEMA’s existing buyout efforts. Under this proposal, homeowners would be able to voluntarily sign up for a buyout before the next flood

occurs. If a flood then substantially damages their home, FEMA would quickly provide funding that enables the local government to purchase the flood-prone property and convert it to open space while freeing the owner to relocate.

This year, Congress is debating the future of the NFIP. This presents a critical opportunity to make buyouts of flood-prone properties a more realistic option for more homeowners. With floods and flood damages on the rise, now is the time for climate-smart reforms to the National Flood Insurance Program.

In 1986, Olga McKissic purchased a split-level home in Louisville, Kentucky. Between 1997 and 2015, her home flooded four times with as much as 18 to 20 inches of water. Because Olga had flood insurance through the National Flood Insurance Program (NFIP), she was able to repair her home after each event.⁷

While flood insurance helped pay for the cost of repairs and the cost of replacing some of Olga’s lost possessions, it could not compensate her for the repeated trauma of being flooded and the time she spent putting her life and her household back in order after each flood. In 2015, Olga decided to sell the house. She managed to find a buyer for her flood-prone home, but there was yet another flood and the sale fell through.

In the wake of the 2015 floods, the city of Louisville and the Metropolitan Sewer District created a program to purchase damaged homes. Under this program, damaged structures would be demolished and the land maintained as open space to ensure that flood-prone sites were not built on again. Because of limited funding, the Metropolitan Sewer District would not pay more than \$100,000 per home.⁸ As Olga’s was worth more than \$100,000, she did not want to sell for a low price, lose her equity in the property, and be left unable to purchase a comparable home elsewhere.

Later, the District decided to seek a grant from the Federal Emergency Management Agency (FEMA) to purchase more homes, including Olga’s, that could be valued at more than \$100,000. But now, two years after the 2015 flood, that grant request to FEMA has yet to be approved, and Olga still owns a home that has flooded multiple times. The District has told her it can take years for FEMA to authorize funding to purchase flood-prone homes—a common complaint of communities that seek FEMA’s assistance to help owners of vulnerable properties to relocate. Meanwhile, Olga continues to hope that she will receive an offer to purchase her home before it floods again.

WHAT IS THE NATIONAL FLOOD INSURANCE PROGRAM?

The NFIP was created in 1968 to provide low-cost insurance to people whose homes were susceptible to flooding. The program is administered by FEMA. Today, the NFIP covers about 5.1 million properties worth more than \$1.25 trillion collectively.⁹ The program performs three primary functions:

1. **It provides low-cost flood insurance to 5.1 million properties** in more than 22,000 communities in all 50 states and U.S. territories.¹⁰
2. In cooperation with states and communities across the United States, **it produces and distributes flood-risk maps** highlighting the geographic areas that are most susceptible to floods.¹¹ Flood zone mapping is an ongoing effort, as flood risk changes over time due to altered weather conditions and shifts in land use, among other factors. Ninety-eight percent of Americans live in areas where FEMA has produced flood maps.¹²
3. **It establishes minimum building and zoning codes** that are intended to guide new real estate development away from flood-prone areas. Under the NFIP, cities, counties, and communities must adopt codes stringent enough for their residents to be eligible to purchase insurance through the NFIP. Even with the requisite local codes and standards in place, the United States has experienced explosive population growth in vulnerable coastal areas.¹³

Since its inception, the NFIP has provided more than \$57 billion to help policyholders rebuild their homes in the aftermath of inland floods and coastal storms.¹⁴ But the NFIP is troubled and is currently \$24.6 billion in debt because it pays out more in damages than it collects in insurance premiums from policyholders.¹⁵ The NFIP became mired in debt after Hurricane Katrina struck the Gulf Coast in 2005, causing catastrophic losses throughout Louisiana and Mississippi. This debt has continued to grow as multiple catastrophic floods (those with losses in excess of \$500 million each) have occurred since 2005 (see Table 1).¹⁶

The NFIP's financial debt is a symptom of many problems. Major flood events are becoming increasingly common.^{18,19} Flood damages are increasing, illustrated by the fact that 81 percent of all NFIP losses have occurred since 2000, even though the program was created four decades ago. In addition, about 20 percent of policyholders under the NFIP pay insurance premiums that are artificially low and do not reflect the true likelihood of flood damages. Congress has taken some steps to address this problem, but it has not been completely fixed.²⁰

One other major shortcoming of the NFIP is that it has focused on rebuilding flooded properties—often multiple times—instead of helping homeowners relocate.

FLOOD, REBUILD, REPEAT: THE UNINTENDED CONSEQUENCES OF FLOOD INSURANCE

Between 1978 and 2015, the NFIP paid \$5.5 billion to repair and rebuild more than 30,000 “severe repetitive loss properties.”^{21,22} These homes and businesses have been rebuilt multiple times in the wake of floods or hurricanes and are the most flood-prone properties insured through the NFIP. While they represent just 0.6 percent of the 5.1 million properties insured through the NFIP, they account for a disproportionate 9.6 percent of all damages paid, as of 2015.²³ Continually rebuilding these severe repetitive loss properties accounts for part of the \$24.6 billion debt that the NFIP has accrued in recent years—a financial burden on all taxpayers. This growing debt is why the U.S. Government Accountability Office (GAO) placed the NFIP on its list of programs that pose a “high risk” to the nation’s fiscal sustainability.²⁴

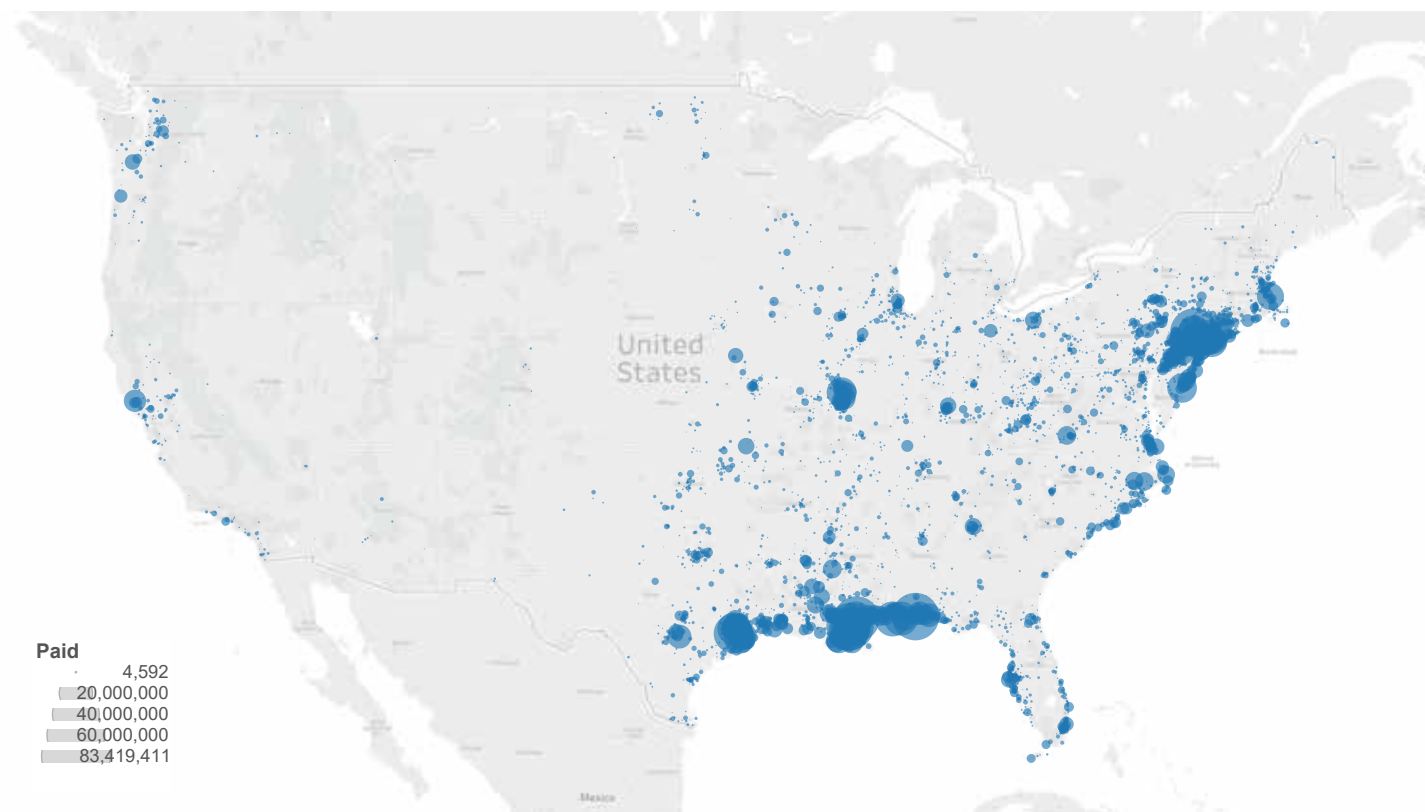
Judging from their history, many severe repetitive loss properties are likely to be flooded again. In some cases, homeowners might prefer to relocate to higher ground, which would spare them the trauma of enduring and recovering from repeated flooding. This would also save taxpayers the expense of rebuilding the same properties after every flood. But the NFIP's current structure does

TABLE 1: STORMS CAUSING CATASTROPHIC LOSSES FOR THE NATIONAL FLOOD INSURANCE PROGRAM SINCE HURRICANE KATRINA IN 2005¹⁷

MONTH/YEAR	STORM EVENT	NFIP DAMAGES PAID
August 2005	Hurricane Katrina	\$16,319,693,811
September 2008	Hurricane Ike	\$2,698,943,618
August 2011	Hurricane Irene	\$1,343,016,957
August 2012	Tropical Storm Isaac	\$556,845,352
October 2012	Superstorm Sandy	\$8,544,480,946
August 2016	Louisiana Severe Storms and Flooding	\$2,363,749,364
October 2016	Hurricane Matthew	\$589,490,594

FIGURE I: DAMAGES PAID BY THE NFIP TO REBUILD SEVERE REPETITIVE LOSS PROPERTIES BETWEEN 1978 AND 2015.

The top states, ranked by both the number of properties and total damages, are Louisiana (7,223 properties, \$1.22 billion in damages), Texas (4,889 properties, \$0.96 billion), New Jersey (3,246 properties, \$0.66 billion), New York (1,802 properties, \$0.40 billion), Florida (1,601 properties, \$0.37 billion), and Missouri (1,526 properties, \$0.19 billion).²⁷



little to incentivize this approach. While the NFIP currently provides some assistance to homeowners, most of it goes toward elevating their homes on pilings or raising their foundations.^{25,26} However, increased elevation may end up being only a temporary fix, particularly as sea levels rise in coastal areas and larger floods become increasingly likely along inland rivers.

Severe repetitive loss properties are predominantly single-family homes (81 percent) but also include multi-unit structures, larger residential buildings, and business properties.²⁸ The FEMA data indicate that these properties routinely flood every two to three years and have been rebuilt an average of five times.²⁹

Among severe repetitive loss properties, less valuable homes were more likely to suffer flood damages that exceeded the property's value. Among single-family homes worth less than \$250,000, the average sum of all damages (\$133,923) exceeded the value of the average home (\$109,882). Among single-family homes worth more than \$250,000, however, average damages were some \$200,000 less than the average home's value.³⁰

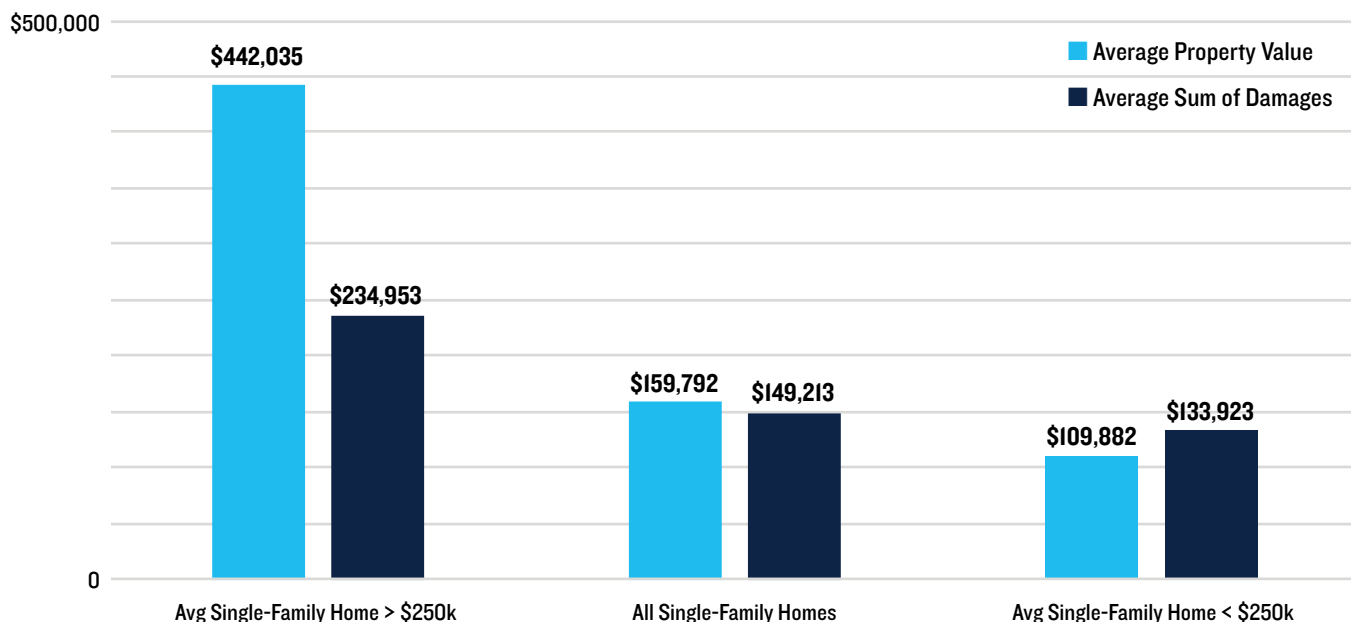
Our analysis indicates that lower-income homeowners may be more likely to suffer total flood damages that exceed their home's value.³¹ Even with higher-value single-family homes factored in, the difference between average damages and average property value would be eliminated by just one additional flood, since the average damage claim is more than \$28,000.³²

In some cases, it would be cost effective to intervene earlier and purchase properties if homeowners want to relocate, particularly for properties worth less than \$250,000. Buyouts would lower the amount of flood damage claims paid by the NFIP; they would also enable homeowners and their families to move somewhere safer and avoid the hardship of additional floods.

Yet only 1 in 5 of the 30,000 severe repetitive loss properties analyzed by NRDC (5,961 properties) received some form of federal financial assistance to reduce the overall risk of flood damage, usually by elevating the house on pilings, raising their foundations, or relocating.³³ Of those who received assistance, only 2,601 property owners received buyouts, enabling them to move to higher ground.³⁴

FIGURE 2: LESS-EXPENSIVE HOMES ARE MORE LIKELY TO SUFFER DAMAGE THAT EXCEEDS THE PROPERTY'S VALUE

Among severe repetitive loss properties worth less than \$250,000, the average single-family home suffered total damages amounting to 122 percent of the property value. For properties worth more than \$250,000, average total damages were 53 percent of the average property value. Across all severe repetitive loss properties that are single-family homes, the average property value was just slightly more than the average sum of all flood damages.



Another 2,092 properties were demolished with no federal assistance.³⁵ In other words, efforts to mitigate the damages to repeatedly flooded properties were far surpassed by the number of properties that needed assistance.

When FEMA provides funding to purchase vulnerable homes, it comes mostly from programs other than the NFIP.³⁶ Through these programs, it can take years for a community and homeowners to secure funding and see flood-prone homes purchased, the owners and their families relocated, and the property returned to open space. Not only do these programs take a long time, but compared with what is spent to rebuild properties through the NFIP, Congress provides little money for FEMA to relocate homeowners. Since 2000, the NFIP has spent \$46.6 billion to repair and rebuild policyholders' homes.³⁷ Over that same period, FEMA provided just \$804 million to purchase flood-prone properties from willing homeowners through its Hazard Mitigation Grants Program, the biggest source of funding available for this purpose.³⁸ Therefore, for every \$100 FEMA has spent to rebuild properties through the NFIP, a paltry \$1.72 has been spent to help move people to higher ground.

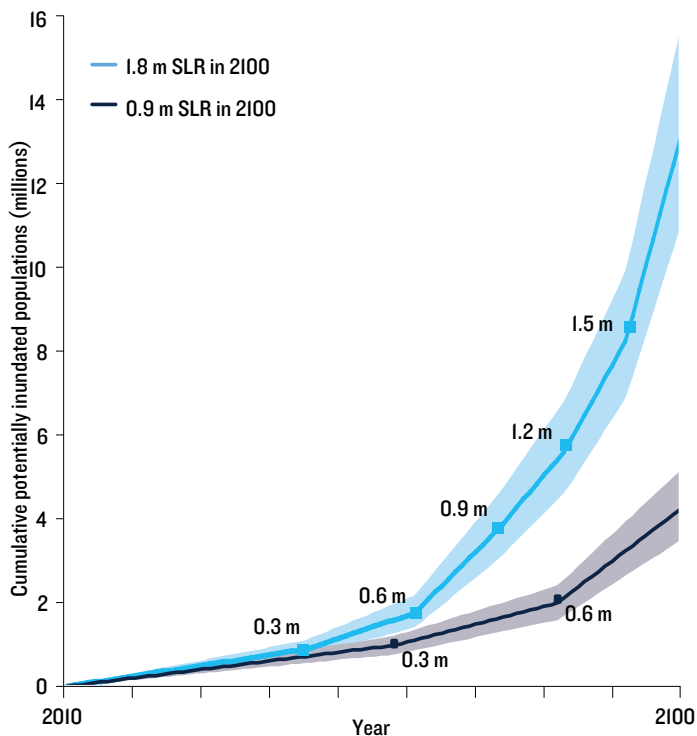
Without relocation assistance, homes become locked in a cycle of “flood, rebuild, repeat”—an unintended consequence of the NFIP’s focus on rebuilding in the wake of a flood. This rebuilding cycle can trap people in a costly and dangerous situation and waste billions of dollars in the process. With every storm, hurricane, and flood, more and more homes fall into this cycle. Between 1978 and 2007 the number of repeatedly flooded properties increased by an average of 5,188 per year, while FEMA mitigated only about 500 per year over that same period.³⁹ The number of properties that flood multiple times is growing ten times faster than our efforts to assist existing flood-prone properties by elevation of the building or through the purchase and voluntary relocation of the owners.^{40,41} Today we know that more than 30,000 households are classified as severe repetitive loss properties. In the coming decades, millions of families and homeowners will face the chronic risk of flooding as sea levels rise and rivers flood more frequently due to climate change.⁴²

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SEA LEVEL RISE, FLOODING, AND CLIMATE CHANGE

Climate change is driving global sea level rise. By 2100, the oceans could rise by as much as 9.8 feet along the East Coast of the United States, according to the latest projections from the National Oceanic and Atmospheric Administration (NOAA).⁴³ Sea level rise will exacerbate flooding-related problems in the United States. One study projects that by the end of this century, 3 feet (0.9 meters) of sea level rise could inundate the homes of 4.2 million Americans; a rise of 6 feet (1.8 meters) could affect 13.1 million.⁴⁴ Another study estimates that existing homes worth a combined \$882 billion could end up underwater if sea levels rise 6 feet.⁴⁵ These homes are likely to become severe repetitive loss properties before being permanently lost. Under the current system, the NFIP will likely pay to rebuild these properties multiple times before they are ultimately inundated.

FIGURE 3: IN THE UNITED STATES, THE HOMES OF 4.2 MILLION PEOPLE COULD BE INUNDATED BY 3 FEET (0.9 METERS) OF SEA LEVEL RISE, AND 13.1 MILLION COULD BE AFFECTED BY A RISE OF 6 FEET (1.8 M) BY THE END OF THIS CENTURY. REPRINTED WITH THE AUTHOR'S PERMISSION⁴⁶



Sea level rise is not only a concern for the future: in the United States, many areas on the East and Gulf Coasts are already experiencing its consequences. For example, sea level rise has increased incidents of tidal flooding (also known as “sunny day flooding”). These floods are not caused by a hurricane or a storm, but occur instead during high tides, which are becoming higher with each passing year. A growing number of cities, such as Wilmington, North Carolina, and Annapolis, Maryland, now experience chronic tidal flooding due to sea level rise.⁴⁷ In Atlantic City, New

By the end of this century, the homes of 4.2 to 13.1 million Americans could be inundated by rising sea levels. Under the current system, the NFIP will likely pay to rebuild these properties multiple times before they are ultimately inundated.

Jersey, high tides are now 1 foot higher than they were a century ago, and flooding is a chronic problem, particularly for those in low-lying areas, who are often lower-income residents.⁴⁸ Extreme tidal floods are “reaching higher grounds and covering larger areas,” and “the frequency and duration of these extreme flood events are increasing” due to sea level rise, according to NOAA.⁴⁹ Cities such as San Francisco, Baltimore, Boston, Philadelphia, and Charleston, South Carolina, used to experience tidal floods roughly once a year but now experience them multiple times a year, and the frequency will only increase in the decades to come.⁵⁰

Coastlines are not the only areas facing an increasing risk of flooding. Many inland floodplains could expand in size by 45 percent by the end of the century, which in turn increase the number of NFIP losses, according to a FEMA-commissioned study.⁵¹ In the Midwest, rivers already flood more frequently than in the past, according to University of Iowa researchers.⁵² In addition, some of America’s most damaging floods since 2005 have occurred on inland rivers, including inland flooding in central Louisiana in 2016 (generating \$2.4 billion in claims) and in the Carolinas from the rains brought by Hurricane Matthew in 2016 (\$589 million in claims).⁵³

WE NEED TO HELP, NOT HINDER, FAMILIES WHO WANT TO GET OUT OF HARM’S WAY

In many cases, homeowners want to break the cycle of flooding and rebuilding but are unable to afford abandoning their home and unwilling (or unable) to sell it to an unsuspecting buyer, passing their flooding problem to someone else.

We therefore propose that qualifying homeowners be offered a guarantee of a future buyout as a benefit of their flood insurance coverage.⁵⁴ Under this proposal, qualifying homeowners could voluntarily commit to accepting a buyout of the home when it is substantially damaged in a future flood disaster.⁵⁵ This agreement would ensure that homeowners who want to move will receive assistance to relocate to higher ground. The local community or the state would be responsible for purchasing the damaged home using funds provided by FEMA through the National Flood Insurance Fund.⁵⁶ Once the buyout is complete, the damaged home would be demolished, the property would become open space, and the owners would move to a safer location.

***The NFIP could help as many as 0.51 to 1.59 million eligible families
move out of areas vulnerable to sea level rise.***

Additional funding could be made available to families who have trouble finding a new home they can afford outside the flood zone in the same community, something FEMA can already do at present. This proposal is not intended to replace FEMA's current mechanisms for supporting buyouts, but would be a complement to those existing efforts, helping more people relocate to safer ground more quickly.

Our proposed buyout approach avoids many of the problems associated with traditional buyouts. Currently, months may pass after a flood before a homeowner is given an opportunity to have her property purchased. By that time, most affected homeowners have completed repairs and are no longer interested in moving. Even for those who are interested, years can go by before the local government receives funding from FEMA.^{57,58} These delays create a race against the clock, leaving the homeowner to hope that the purchase will go through before another flood hits. Moreover, not all interested homeowners are guaranteed that their homes will be purchased. Ultimately, the number of flood-prone homes purchased is dependent on the amount of funding, the number of homeowners interested in being bought out, and the number of owners who see the process through to the end. This combination of factors injects a huge amount of uncertainty into the whole undertaking.

Under our buyout proposal, the homeowner would have the option to lock in a guaranteed buyout before a major flood occurs. This option would be available through an agreement with FEMA and the local community or state and would establish an estimated purchase price. FEMA would agree to provide funding to purchase the home, and the state or local community would be responsible for purchasing the property from the owner, demolishing the structure, and maintaining the resulting open space in the future.

The proposed buyout approach differs from FEMA's current practice for purchasing properties in at least one important way: much of the work is done before a flood occurs, rather than months afterward. Key factors such as eligibility and initial valuation of the home would be established in advance of a flood.

This approach benefits both homeowners and the local government. For the homeowner, it helps avoid the scenario of filing a flood damage claim and repairing a home, only to be approached about a buyout months later and enduring a multiyear wait before knowing whether the property will be purchased. For the local government, securing agreements for purchasing properties in advance of the next flood allows it to plan for a future where fewer people live in flood-prone areas. Voluntary preflood agreements would help expedite the actual purchase of the property after a flood damages a home, sparing both the owner and the community the years

of uncertainty that are an unfortunate reality of traditional buyouts.⁵⁹

Under the proposed approach, the NFIP would prioritize assistance to low- and middle-income families who live in areas at high risk of flooding now or in the future. Proactive, voluntary buyouts would not be available to all NFIP policy holders. Instead, participation in the buyout program would require that the following criteria be met:

- The homeowner has flood insurance, and the property is valued at less than \$250,000 (the maximum insurable value under the NFIP).
- The owner is low- or middle-income (earns less than 120 percent of adjusted median income for their community).
- The property has a history of being damaged in floods or is at a high risk of being flooded in the future.
- The property is located in a community that supports and promotes efforts to help people relocate from flood-prone areas and is willing to take ownership.
- FEMA determines that it would be cost-effective to purchase the property, rather than have the NFIP continue to pay to rebuild.

For interested homeowners, a voluntary buyout would become a benefit of their existing flood insurance coverage under the NFIP. As a result, this proposal would enable many low- and middle-income homeowners to move out of harm's way, including those who currently cannot secure assistance to do so.

As an added benefit, homeowners would qualify for lower flood insurance premiums and would be able to continue living in their community until their home is heavily damaged, triggering the buyout of the property that enables them to relocate. This is consistent with how the NFIP already rewards homeowners who reduce their risk of flooding. If a homeowner elevates her home, she gets cheaper flood insurance because the home is less likely to be damaged. Likewise, if an eligible homeowner agrees to relocate, she should get a break on the price of flood insurance. This reduced premium might also encourage more homeowners to sign up for coverage.

AS SEA LEVELS RISE, SO DO THE COSTS OF REPEATEDLY FLOODED PROPERTIES

NRDC has estimated that if sea levels rise 3 to 6 feet by the end of the century, the NFIP could pay between \$143 billion and \$447 billion in flood insurance claims to the owners of 820,000 to 2.57 million repeatedly flooded homes in coastal areas.⁶⁰ Much of this cost could be avoided if more homeowners relocate before taxpayers pay to rebuild their properties multiple times.

If such an option were made available to low- and middle-income owners of homes valued at less than \$250,000 who meet the criteria described above, the NFIP could help 0.51 to 1.59 million eligible families move out of areas vulnerable to sea level rise. Our estimates indicate that acquiring all of these properties would cost from \$52 billion to \$163 billion between now and the end of the century, or at an annual cost of about \$600 million to \$2.0 billion.⁶¹ This estimate assumes that all qualified owners will accept a buyout and relocate. Clearly some property owners will not. But many of those who recognize the peril they face from rising sea levels will want to move to higher ground sooner, rather than later.

Purchasing this many properties would come at a substantial cost, but it would actually represent significant savings over the existing approach of “flood, rebuild, repeat.” Our calculations suggest that estimated damages to the same pool of properties would be between \$72 billion and \$224 billion, or an annual cost of about \$900 million to \$2.76 billion. Moreover, buyouts offer additional benefits to homeowners, who will be spared the trauma of ruined property and possessions, inability to go to work or school, exposure to mold, and other flood-related problems.

Evidence suggests that a significant proportion of homeowners would prefer to relocate. A study by the University of Illinois found that 68 percent of floodplain property owners surveyed would consider signing up for a voluntary pre-flood buyout program.^{62,63} About one-third of those respondents’ homes had flooded at least once already. Only about half of all surveyed homeowners carried flood insurance.

A CLIMATE-SMART AGENDA FOR THE NATIONAL FLOOD INSURANCE PROGRAM

Climate change is increasing the likelihood of flooding in the United States, both in coastal areas and along inland waterways. But the NFIP in its current form fails to recognize this reality and rather is a liability to the country when it comes to coping with climate change impacts.

With floods and flood damages on the rise, now is the time for climate-smart reforms to the National Flood Insurance Program. The NFIP should be a linchpin of the nation’s efforts to prepare for escalating flood risks, but instead it perpetuates the growing problem of properties that are flooded and rebuilt repeatedly. The flood insurance program should be helping people move away from areas that are vulnerable to flooding when the homeowner wants to relocate. Doing so would ultimately result in savings to the NFIP and taxpayers.

Support for relocation in the wake of a flood is just one component of a climate-smart NFIP. The NFIP should also:

- **Give owners the right to know about their home’s history of flood damages.** Often, people buy a house only to find out later that it is susceptible to flood damage. If previous owners ever filed an NFIP claim, FEMA already knows that property’s flood history.

Homeowners, whether or not they currently have NFIP coverage, should have a right to this information. Providing the flood history of a property can help homeowners make better decisions.⁶⁴

- **Make more data on the NFIP publicly available.** The public has a right to know where flood damages occur, the cost of those damages, and what communities are doing to reduce their vulnerability to flooding and sea level rise. FEMA should make this information available to decision makers, researchers, community organizations, and the public.⁶⁵
- **Flood maps should show how sea level rise and other effects of climate change will impact future flood risk.** Flood maps are used by government officials, developers, and planners to decide where it is safe to build. Without the inclusion of future flood risks, communities cannot make fully informed and sustainable decisions.
- **Invest in resilience and in reducing our vulnerability to flooding.** According to the National Academy of Sciences, more funding should be dedicated to reducing vulnerability to flooding, rather than rebuilding over and over.⁶⁶

CONCLUSION

Much of the debate about flood insurance reform has revolved around eliminating the NFIP’s \$24.6 billion debt, but doing so in a way that keeps flood insurance affordable to low- and middle-income homeowners. These are important concerns to address. However, decision makers too often see flood insurance as a solution to flooding. It is not. Insurance does not keep a flood from happening; it simply gives a policyholder assistance to rebuild after a flood.

But what if rebuilding is not the best option? If a home has flooded multiple times, rebuilding is probably not the best decision, given the likelihood of another flood. As flooding becomes more likely, the NFIP must provide homeowners with a more efficient, equitable, and expedient way to move out of harm’s way.

Our proposal would help reduce the number of properties that flood repeatedly and the growing number of properties that are increasingly likely to be flooded in the future. This proposal would help decrease the problem of flood-prone properties and give more homeowners the option to relocate to a safer place sooner. It would be a valuable complement to the assistance that FEMA and other agencies already make available—assistance that cannot reach everyone who needs it.

The United States needs a flood insurance program that can handle future challenges. Flood risks are already on the rise, as are flood damages. We can no longer simply rebuild after every flood. For homeowners who recognize the need to move to higher ground, the National Flood Insurance Program should enable them to do just that.

ENDNOTES

- 1 Even worse, many homeowners, particularly low-income families, face a difficult dilemma: they may not be able to afford the cost of flood insurance, but neither can they afford to be uninsured because of the high flood risk.
- 2 A “severe repetitive loss property” is one that has had 1) four or more flood insurance claim payments that each exceeded \$5,000, with at least two of those payments occurring within a 10-year period; or 2) two or more flood insurance claims payments that together exceeded the value of the property. Also see 42 USC Sec. 4104c(h)(3).
- 3 Federal Emergency Management Agency (hereinafter FEMA), Severe Repetitive Loss Property Data, 1978–2015, acquired June 7, 2016, by the Natural Resources Defense Council through a Freedom of Information Act request submitted June 20, 2014 (hereinafter referred to as FEMA SRLP Data).
- 4 National Climate Assessment, “Extreme Weather: Overview,” 2014, <http://nca2014.globalchange.gov/highlights/report-findings/extreme-weather>.
- 5 Matthew Hauer, Jason Evans, and Deepak Mishra; “Millions Projected to Be at Risk from Sea-Level Rise in the Continental United States,” *Nature Climate Change* 6 (April 2016): 691–695, <https://www.nature.com/nclimate/journal/v6/n7/full/nclimate2961.html>.
- 6 Krishna Rao, “Climate Change and Housing: Will a Rising Tide Sink All Homes?” Zillow.com, June 2, 2016, <https://www.zillow.com/research/climate-change-underwater-homes-12890/>.
- 7 Olga McKissic, personal communication with Catherine Kemp, February 2017; personal communications with Rob Moore, May and June 2017.
- 8 The median home price in Louisville is \$116,000, according to the real estate website Zillow.com, <https://www.zillow.com/louisville-ky/home-values/>.
- 9 President’s Budget FY18, Department of Homeland Security, FEMA, p. 530, <https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/budget/fy2018/dhs.pdf>.
- 10 FEMA, “Policy & Claim Statistics for Flood Insurance,” last updated March 2017, <https://www.fema.gov/policy-claim-statistics-flood-insurance>.
- 11 All FEMA flood maps, also known as Flood Insurance Rate Maps or FIRMs, can be accessed at <https://msc.fema.gov/portal>.
- 12 President’s Budget FY18, Major Savings and Reforms, p. 46, <https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/budget/fy2018/msar.pdf>.
- 13 National Oceanic and Atmospheric Administration (hereinafter NOAA), *National Coastal Population Report: Population Trends from 1970 to 2020*, March 2013, <http://oceanservice.noaa.gov/facts/coastal-population-report.pdf>.
- 14 FEMA, NFIP Loss Statistics as of March 31, 2017, accessed May 23, 2017, <https://bsa.nfipstat.fema.gov/reports/1040.htm>.
- 15 U.S. Government Accountability Office (hereinafter GAO), *Flood Insurance: Comprehensive Reform Could Improve Solvency and Enhance Resilience*, GAO-17-425, April 2017, <http://www.gao.gov/assets/690/684354.pdf>.
- 16 Other notable storms included Hurricane Ivan, which struck Houston in 2004, causing \$1.6 billion in damage claims for the NFIP; and Hurricanes Rita and Wilma, which in 2005 struck the same areas of the Gulf Coast earlier ravaged by Katrina, resulting in a combined \$841 million in damage claims.
- 17 FEMA, “Significant Flood Events” as of March 31, 2017, <https://www.fema.gov/significant-flood-events>.
- 18 Ibid.
- 19 Between 1978 and 2005, only four flood events caused more than \$500 million in losses to the NFIP: Hurricane Ivan in 2004 (\$1.6 billion), Hurricane Isabel in 2003 (\$500 million), Tropical Storm Allison in 2001 (\$1.1 billion), and widespread flooding in Louisiana in 1995 (\$585 million). Since 2005 there have been seven (see Table 1).
- 20 GAO, *Flood Insurance: Comprehensive Reform Could Improve Solvency*.
- 21 Of these properties, 15,389 are no longer insured through the NFIP. According to FEMA’s data, 4,665 of the uninsured properties were purchased and demolished, and 1,126 were elevated or flood-proofed. Owners of the remaining 9,598 properties appear to have simply dropped coverage, possibly losing the ability to access any federal disaster aid in the future.
- 22 FEMA SRLP Data.
- 23 Ibid.
- 24 GAO, National Flood Insurance Program: High Risk List, February 2017, https://www.gao.gov/highrisk/national_flood_insurance/why_did_study.
- 25 The NFIP provides direct assistance to property owners through its “Increased Cost of Compliance” coverage. Among single family homes, 62 percent of assistance provided goes towards home elevations.
- 26 Lingle and Kousky, “Mitigation Post-Flood: FEMA’s Increased Cost of Compliance (ICC) Coverage, July 7, 2017, <http://www.rff.org/blog/2017/mitigation-post-flood-fema-s-increased-cost-compliance-icc-coverage>. Also see 42 USC Sec. 4104c, Mitigation Assistance, and 42 USC 4011(b), Additional Coverage for Compliance with Land Use and Control Measures.
- 27 FEMA SRLP Data.
- 28 Ibid.
- 29 Ibid.
- 30 Ibid.
- 31 This assumes that a property’s value is a reasonable surrogate for an owner’s income level.
- 32 Ibid.
- 33 Ibid.
- 34 Ibid.
- 35 Ibid.
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- 60 These projections are based on the likely number of properties that could be affected by sea level rise, the proportion of those properties that are likely to have NFIP coverage, and the average cumulative amount of damage suffered by repeatedly flooded properties. See Appendix I for a description of how these estimates were made.
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- 64 A provision that would accomplish this was recently passed by the U.S. House of Representatives as part of H.R. 2874, 115th Congress, Sec. 107.
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APPENDIX I: SEVERE REPETITIVE LOSS DATA (SRLP) AND THEIR USE IN OUR ANALYSIS

Through a Freedom of Information Act (FOIA) request, NRDC obtained data from the Federal Emergency Management Agency (FEMA) on 30,369 severe repetitive loss properties (SRLPs). These data were received in June 2016 and covered the period from January 1, 1978, through November 30, 2015 (the date the file was created). Nothing in these data allowed us to determine the exact location of a property or the identity of the owner(s), but the data did include the following information on individual properties:

- state, municipality, and zip code of each property
- date of each flood that resulted in a claim to FEMA's National Flood Insurance Program (NFIP) and the corresponding payments received for damages to the building and its contents
- property type (e.g., single-family, business, multifamily)
- property value as of the last recorded loss or damage claim, limited to the value of the structure and not necessarily the combined value of the structure and the land
- flood zone location (e.g., Zone A, Zone V, etc.)
- whether the structure was built before December 31, 1974 or pre-dates the creation of NFIP flood maps (so-called Pre-Flood Insurance Rate Maps, or Pre-FIRM), or was built after that time (Post-FIRM)
- what, if any, mitigation actions were taken (e.g., home was elevated, property was acquired and demolished, etc.)

Some of the properties had extremely low values, and 156 had a listed value of \$0. There were also 700 properties classified as condominiums, and their value was listed as "999999999." The properties with a value of \$0 or "999999999" were excluded from all calculations of average damages and average property values. Many of the condominium properties appeared to be worth in excess of \$250,000, based on the damages associated with them, and therefore would have been excluded from our calculations for acquisition costs anyway, since only properties worth less than \$250,000 were considered.

ANALYSIS OF SEVERE REPETITIVE LOSS DATA

We used these data to do some basic characterization of severe repetitive loss properties, or SRLPs. We then used this information to estimate damages and property values of potential SRLPs that may be created due to sea level rise.

We calculated the average property value, the average amount of total damage claims paid per property, the number of SRLPs, the number of these that were worth less than \$250,000, and the number of properties that had incurred total damages exceeding 50 percent of the property's value. We examined the number of properties valued at less than \$250,000 because that is the maximum amount of coverage that currently can be purchased through the NFIP, and because that is the maximum value of a property that would be eligible for purchase under our buyout proposal. We also looked at single-family homes (as opposed to multifamily buildings). We determined how many properties fit into each of these categories (see Table A1).

TABLE A1: NUMBER OF SEVERE REPETITIVE LOSS PROPERTIES (SRLPS), THE NUMBER THAT ARE SINGLE-FAMILY HOMES, AND THE NUMBER OF EACH THAT ARE WORTH LESS THAN \$250,000 COMPARED WITH THE NUMBER OF THOSE PROPERTIES THAT INCURRED TOTAL DAMAGES GREATER THAN 50 PERCENT OF THEIR VALUE

	Total Properties (% of SRLPs)	Number of Properties for Which the Sum of All Damages > 50% of Value (% of SRLPs)
SRLPs	30,369 (100%)	23,947 (79%)
SRLPs < \$250k	23,208 (76%)	20,798 (68%)
Single-Family SRLPs	24,665 (81%)	20,879 (69%)
Single-Family SRLPs < \$250k	20,707 (68%)	18,807 (62%)

We calculated the average property value and average amount of total damage claims paid by the NFIP for properties in these same categories (see Table A2).

TABLE A2: PROPERTY VALUES AND DAMAGE CLAIMS FOR SEVERE REPETITIVE LOSS PROPERTIES				
	Average Total Damage Claims		Average Property Values	
	All Properties	Properties with Total Damages > 50% of value	All Properties	Properties with Total Damages > 50% of value
All SRLPs	\$174,114	\$179,619	\$304,514	\$146,791
SRLPs < \$250k	\$135,129	\$142,768	\$110,745	\$103,171
Single-Family SRLPs	\$149,213	\$159,153	\$159,792	\$125,907
Single-Family SRLPs < \$250k	\$133,923	\$140,962	\$109,882	\$102,827

Under the NFIP, separate policies are written to cover structure and contents, and damages are separately assessed for the building and the contents of the building. Both types of damage are included in the average total damages we calculated, as they represent the total cost to the NFIP.

These data were not adjusted for inflation. Therefore, the dollar values of damages are understated, because damages that took place in the past would be higher if adjusted for inflation to 2017 dollars. According to FEMA, the property values recorded in the data were current at the time of the last flood damage claim; it is possible some of these were subsequently updated at the time of a policy renewal. While these values may not all be current, they represent the best available data we could acquire.

ESTIMATES OF THE IMPACTS OF SEA LEVEL RISE

We estimated the number of properties potentially at risk of repeatedly flooding and becoming severe repetitive loss properties, starting with projections of the total U.S. population that may be inundated by sea level rise. A recent paper in *Nature Climate Change* estimated that the homes of as many as 4.2 million people could be inundated by 3 feet of sea level rise by the end of this century, and that the homes of 13.1 million people could be at risk from a 6-foot sea level rise.¹

Most projections of this sort assume that population in the future will be identical to the population today. But the United States has seen a steady migration of population toward its coastlines for decades.² We used the results of the *Nature Climate Change* study because it included both the current population living in areas that may be inundated and projections of coastal population over the coming decades.

These projections still underestimate the number of people potentially affected by sea level rise, as they account only for direct inundation and do not attempt to estimate the much larger number of people who will be living in areas susceptible to flooding as storm surges and other effects of coastal storms push farther inland. It is also worth noting that 3 to 6 feet of sea level rise is plausible according to the National Oceanic and Atmospheric Administration's most recent projections and does not represent NOAA's worst-case scenarios.³

From these population projections, we calculated a rough estimate of the number of properties potentially affected, using an average of 2.5 people/household, which is the average household size in coastal counties of the United States, according to NOAA's *National Coastal Population Report*.⁴

$$\text{Properties} = \frac{(\text{Estimated Population})}{(2.5 \text{ people/household})}$$

This yielded an estimate of 1.68 million properties affected by 3 feet of sea level rise and 5.24 million properties impacted by 6 feet of sea level rise.

Not all of these properties will be covered by the NFIP. The NFIP has never managed to achieve 100 percent coverage of flood hazard zone property owners. A RAND Corporation study of flood insurance market penetration found that, on average, 49 percent of single-family homeowners in special flood hazard areas purchase NFIP coverage (Coverage_{NFIP}).^{5,6} While the RAND study highlighted single-family homes, we applied this figure to all properties to estimate the number of likely repeatedly flooded properties that would also be covered under the NFIP (Properties_{NFIP}).

$$Properties_{NFIP} = (Properties) \times (Coverage_{NFIP})$$

This yielded an estimate of 0.82 million of properties that would be threatened with 3 feet of sea level rise and 2.57 million properties put at risk by 6 feet of sea level rise. Currently, 5.1 million properties have coverage through the NFIP, but we did not try to distinguish between properties that currently have NFIP coverage and those that may acquire it in the future. We were concerned only with the overall number of properties that may be covered in the future.

ESTIMATED LOSSES AND ACQUISITION COSTS

Using our previously calculated values of $Properties_{NFIP}$ we estimated how many properties with NFIP coverage may be single-family homes and how many of those may be worth less than \$250,000. For these estimates we relied on the SRLP data in Table A1. We made the assumption that all properties that will be inundated by sea level rise will be severe repetitive loss properties. We further assumed that the data we have from FEMA on the existing 30,369 SRLPs is representative of future SRLPs. We therefore used the numbers of SRLPs in Table A1 to estimate how many properties in the future may be worth less than \$250,000, how many may be single-family homes, and how many may suffer damages in excess of 50 percent of their property value.

For example, to estimate the total number of properties covered by the NFIP in the future that may suffer total damages in excess of 50 percent of the property's value with 3 feet of sea level rise:

$$Properties_{50\% \text{ Losses} (3 \text{ ft SLR})} = Properties_{NFIP (3 \text{ ft SLR})} \times \frac{Properties_{50\% \text{ Losses} (Table A1)}}{Properties_{All \text{ SRLPs} (Table A1)}}$$

Inserting the values from Table A1:

$$Properties_{50\% \text{ Loss} (3 \text{ ft SLR})} = 0.82 \text{ million (calculated above)} \times \frac{23,947}{30,369}$$

$$Properties_{50\% \text{ Loss} (3 \text{ ft SLR})} = 0.65 \text{ million}$$

Similar calculations resulted in the estimates presented in Table A3.

TABLE A3: ESTIMATED NUMBER OF PROPERTIES WITH NFIP COVERAGE THAT WILL BE AFFECTED BY 3 FEET AND 6 FEET OF SEA LEVEL RISE AND HOW MANY OF THOSE WILL SUFFER DAMAGE THAT EXCEEDS 50 PERCENT OF THE PROPERTY'S VALUE				
	3 Feet of Sea Level Rise (millions of properties)		6 Feet of Sea Level Rise (millions of properties)	
	Properties with NFIP Coverage	Properties with NFIP Coverage and Total Damages > 50% of Property Value	Properties with NFIP Coverage	Properties with NFIP Coverage and Total Damages > 50% of Property Value
All SRLPs	0.82	0.65	2.57	2.03
SRLPs < \$250k	0.63	0.56	1.96	1.76
Single-Family SRLPs	0.67	0.57	2.09	1.77
Single-Family SRLPs < \$250k	0.56	0.51	1.75	1.59

The total damages and property values were then estimated by multiplying the number of properties in Table A3 by the corresponding value for average damages and property values in Table A2.

$$Total \text{ Damages} = Properties_{Table A3} \times Avg \text{ Total Damage}_{Table A2}$$

$$Property \text{ Value} = Properties_{Table A3} \times Avg \text{ Property Value}_{Table A2}$$

For example, to calculate the total damages to all SRLPs with 3 feet of sea level rise:

$$Total\ Damages_{All\ SRLPs\ (3\ feet\ SLR)} = Properties_{All\ SRLPs\ (3\ feet\ SLR)} \times Avg\ Total\ Damages_{All\ SRLPs\ (3\ feet\ SLR)}$$

$$Total\ Damages_{All\ SRLPs\ (3\ feet\ SLR)} = 0.82\ million \times \$174,114$$

$$Total\ Damages_{All\ SRLPs\ (3\ feet\ SLR)} = \$143\ billion$$

The property value of these same properties was then estimated using the following:

$$Property\ Value_{All\ SRLPs\ (3\ feet\ SLR)} = Properties_{All\ SRLPs\ (3\ feet\ SLR)} \times Avg\ Property\ Value_{All\ SRLPs\ (3\ feet\ SLR)}$$

$$Property\ Value_{3\ feet\ SLR} = 0.82\ million \times \$304,514$$

$$Property_{3\ feet\ SLR} = \$250\ billion$$

Similar calculations were done for all SRLPs, single-family SRLPs, and for the subsets of those properties valued at less than \$250,000. These results are summarized in Tables A4 and A5.

TABLE A4: ESTIMATED DAMAGES TO SRLPS AND SINGLE-FAMILY SRLPS AND THEIR ESTIMATED PROPERTY VALUE WITH 3 FEET OF SEA LEVEL RISE. FOR PROPERTIES VALUED AT LESS THAN \$250,000 AND FOR PROPERTIES THAT SUFFER DAMAGE IN EXCESS OF 50% OF THEIR VALUE, THE TOTAL AVERAGE DAMAGES EXCEED THE AVERAGE PROPERTY VALUE

	Damages—3 Feet Sea-Level Rise (billions of dollars)		Property Values—3 Feet Sea-Level Rise (billions of dollars)	
	Properties with NFIP Coverage	Properties with NFIP Coverage and Total Damages > 50% of Property Value	Properties with NFIP Coverage	Properties with NFIP Coverage and Total Damages > 50% of Property Value
All SRLPs	\$143	\$117	\$250	\$95
SRLPs < \$250k	\$85	\$80	\$70	\$58
Single-Family SRLPS	\$100	\$91	\$107	\$72
Single-Family SRLPs < \$250k	\$75	\$72	\$62	\$52

TABLE A5: ESTIMATED DAMAGES TO SRLPS AND SINGLE-FAMILY SRLPS AND THEIR ESTIMATED PROPERTY VALUE WITH 6 FEET OF SEA LEVEL RISE. FOR PROPERTIES VALUED AT LESS THAN \$250,000 AND FOR PROPERTIES THAT SUFFER DAMAGE IN EXCESS OF 50 PERCENT OF THE PROPERTY'S VALUE, THE TOTAL AVERAGE DAMAGES EXCEED THE AVERAGE PROPERTY VALUE

	Damages—6 Feet Sea-Level Rise (billions of dollars)		Property Values—6 Feet Sea-Level Rise (billions of dollars)	
	Properties with NFIP Coverage	Properties with NFIP Coverage and Total Damages > 50% of Property Value	Properties with NFIP Coverage	Properties with NFIP Coverage and Total Damages > 50% of Property Value
All SRLPs	\$447	\$365	\$783	\$298
SRLPs < \$250k	\$265	\$251	\$217	\$182
Single-Family SRLPS	\$312	\$282	\$334	\$223
Single-Family SRLPs < \$250k	\$234	\$224	\$192	\$163

ENDNOTES

1 Hauer, Evans, and Mishra, “Millions Projected to Be at Risk.”

2 NOAA, *National Coastal Population Report*.

3 NOAA, *Global and Regional Sea Level Rise Scenarios*.

4 There were 49.4 million housing units in coastal shoreline counties as of 2010, and the population of those counties was 123.3 million. NOAA, *National Coastal Population Report*.

5 It is also worth noting that the percentage of properties with coverage varies a great deal by region.

6 Lloyd Dixon et al., *The National Flood Insurance Program's Market Penetration Rate: Estimates and Policy Implications*, RAND Corporation, February 2006, Executive Summary, p. xvi.