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How Spending for Flood Adaptations Affects the Federal Budget

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Summary

Flooding is among the costliest natural disasters in the United States. Over the next few decades, damage from flooding is expected to worsen because of continued coastal development and changes in the climate. In this report, the Congressional Budget Office examines how spending for flood adaptations today might affect the federal government's potential costs for disaster relief later, as well as what households are likely to pay for flood insurance that is subsidized by the federal government.

Effects on Federal Spending for Disaster Relief

Flood adaptations, such as building dams and levees and elevating or buying out properties, reduce the amount of flood damage that would otherwise be expected to occur in the future. Two agencies typically receive most of the federal funding to provide such adaptations: the Army Corps of Engineers (Army Corps) and the Federal Emergency Management Agency (FEMA).

On average, every $1 billion spent by those agencies for flood adaptations—taking into account the required contributions from state and local governments—will reduce future flood damage by about $3 billion to $4 billion over 30 years, measured in today's dollars, CBO estimates. The specific amount depends on whether the future avoided damage is discounted (or converted into an equivalent value today) at the borrowing rate for Treasury securities or at a fair-value rate that incorporates market risk—the element of financial risk that is associated with the overall performance of the economy rather than with the performance of a specific investment.

Lawmakers have typically provided discretionary appropriations for disaster relief in response to hurricanes, which inflict substantial damage through flooding; for hurricanes that made U.S. landfall in the 2000s and 2010s, spending from that funding averaged about 45 percent of the estimated damage. Less damage would occur in the future with more flood adaptations than without, so additional federal spending for adaptations would be expected to reduce the need for future federal disaster relief.

The evidence suggests that flood adaptations funded through the Army Corps and FEMA have reduced expected damage by more than their cost, and by CBO's estimates, future reductions in federal spending for disaster relief would exceed the amounts spent for flood adaptations, on average. If lawmakers' future appropriations for disaster relief are similar to those for the 2000–2019 period, each $1 billion of flood adaptation spending by the federal government would decrease discretionary spending for disaster relief by $1.8 billion (in present-value terms) over 30 years, CBO projects, if discounted using Treasury borrowing rates. If reductions in future flood damage and spending were discounted at a fair-value rate, the reduction in discretionary disaster relief spending would be $1.4 billion (in present-value terms) over 30 years.

Potential future spending reductions would depend on decisions made by future lawmakers about the amount of future disaster relief, the kinds of adaptations funded, and matching rates of state and local governments. To account for that uncertainty, CBO has calculated ranges for potential future spending reductions from $1 billion in additional spending for flood adaptations. Over

Notes: Numbers in the text may not amount to totals because of rounding. To adjust values for the effects of inflation, the Congressional Budget Office used the gross domestic product price index from the Bureau of Economic Analysis. References to state and local governments include the governments of U.S. states, the District of Columbia, local communities, Indian tribes, and U.S. territories.

30 years, reductions in federal spending for disaster relief could range from $1.2 billion to $2.5 billion using the Treasury discount rate or from $0.9 billion to $2.0 billion using the fair-value discount rate. (All reductions in federal spending for disaster relief in this analysis are calculated as present values.)

In the cost estimates that CBO prepares for legislation, the agency generally does not incorporate the effects of current spending on future discretionary appropriations because those appropriations have yet to be made by lawmakers and are thus unknown. As a result, the expected reductions in spending from avoided disaster relief will not show up as offsetting amounts in a cost estimate prepared for budget enforcement purposes for a bill that includes funding for flood adaptations.

Effects on Spending for Flood Insurance

Federal spending for flood adaptations could also affect the cost of flood insurance. Historically, lawmakers have subsidized the purchase of insurance through the National Flood Insurance Program (NFIP). Under current law, by about fiscal year 2032, the bulk of NFIP policyholders will pay premiums that reflect their full estimated risk of losses from flooding, CBO projects. As subsidies for NFIP policies are phased out, greater spending for flood adaptations will mainly benefit households and businesses that buy that insurance by lowering their premiums.

The reductions in the flood insurance program from additional spending for flood adaptations would be much smaller than the projected reductions in spending for disaster relief. In CBO's estimation, each $1 billion of federal spending for flood adaptations would reduce claims by NFIP policyholders, decreasing in turn the premiums they pay for NFIP insurance and any federal subsidies over the 30-year period by $0.3 billion (using the Treasury discount rate or the fair-value discount rate). The expected reductions per policyholder would amount to about $70 over 30 years (calculated using the Treasury discount rate).

Reductions in Flood Damage From Adaptations

Flood damage in the United States is projected to increase. Spending on adaptation measures, which are designed to reduce the likelihood or severity of flood damage, would reduce future damage compared with what it would have been otherwise.

Flood Damage

Flooding in the United States has caused $55 billion per year of damage (measured in 2025 dollars), on average, over the decade that ended in 2024, CBO estimates.[1] That amount includes damage to homes, businesses, and public infrastructure (such as roads and bridges). It also includes the costs of temporary housing, losses from business interruption, and emergency response.

The costs of flood damage to society are larger than the monetary sums. A full evaluation of those costs would include hard-to-measure impacts such as deaths, injuries, or long-term effects on mental health. CBO's estimates do not include those costs.

Looking ahead, changes in climate conditions, such as higher sea levels and more intense storm surges and rainfall, will increase damage from flooding by 2050 by about one-quarter to one-third in real terms (in other words, after removing the effects of inflation), CBO projects. Continued development in coastal and riverine areas that are exposed to flooding is also expected to increase costs by as much as or more than climate change will.[2]

Effects of Adaptations on Flood Damage

Some flood adaptation measures are large community-level projects, such as dams, levees, floodwalls, water channel improvements, and coastal barriers. Other flood adaptations are smaller property-level measures. Those include elevating homes, buying out frequently flooded properties, or relocating homes to less flood-prone areas.

Of all federal agencies, the Army Corps, FEMA, and the Department of Housing and Urban Development (HUD) spend the most on flood adaptation measures. The Army Corps usually builds community-level adaptations, and FEMA more often funds property-level

1. Congressional Budget Office, *Federal Spending for Flood Adaptations* (September 2024), www.cbo.gov/publication/59971; and National Oceanic and Atmospheric Administration, National Centers for Environmental Information, "Billion-Dollar Weather and Climate Disasters: Events" (accessed September 29, 2026), www.ncei.noaa.gov/access/billions/events.

2. Congressional Budget Office, *Potential Increases in Hurricane Damage in the United States: Implications for the Federal Budget* (June 2016), www.cbo.gov/publication/51518. See also Oliver E. J. Wing and others, "Inequitable Patterns of U.S. Flood Risk in the Anthropocene," *Nature Climate Change*, vol. 12 (February 2022), pp. 156–162, https://doi.org/10.1038/s41558-021-01265-6.

adaptations. HUD funds both community- and property-level adaptations. In addition, through its Community Development Block Grant Mitigation (CDBG-MIT) grants and mitigation grant set-asides, HUD helps protect utilities and other local public infrastructure. The Army Corps and FEMA have received regular appropriations for flood adaptations, and their spending from 2020 to 2024 totaled roughly $2 billion a year, on average (in 2025 dollars). HUD has received appropriations for flood adaptations as part of disaster relief legislation.[3]

Estimates of Damage Reduction. The damage that will result from flooding in any given year and the potential reductions from flood adaptations are very uncertain. One way to calculate damage reductions when future amounts are uncertain is to weight the possible outcomes by the probability that they will occur and add them up to capture all the possibilities. That weighted average is called an *expected value*. It measures what those damage reductions are likely to be in the future. For this report, CBO also calculated a *present value* to estimate the reductions in flood damage. That present value describes what that likely future outcome is worth today, which is important because the benefits of flood adaptations accrue over a long period and the value of those future benefits today is smaller than the value in the years they are realized.

A present value translates a flow of current and future costs or benefits into an equivalent value today. That translation is carried out by using a conversion factor known as a discount rate.[4] In this case, discount rates convert 30 years of cash flows into a single lump-sum amount measured in the value of present-day dollars. Discount rates account for the time value of money: the fact that an amount received or paid today is more valuable (because it can earn interest) than the same amount received or paid in the future. Present-value estimates are useful for calculating budgetary effects that can occur far into the future and for helping lawmakers compare different policies.

By CBO's estimates, the average expected reduction in future damage ranges from $3 to $4 per dollar of *federal* spending on flood adaptations over a 30-year period. To arrive at that average, CBO reviewed and adjusted estimates from the Army Corps and FEMA.[5] (Estimates of the expected reductions from projects funded by HUD are not available.) Although the effects of individual adaptation projects can vary widely, benefit-cost analyses by the Army Corps indicate that its projects were expected to reduce flood damage, in present-value terms, by a total of $2 to $6 per dollar of spending from all sources. (CBO calculated that central range by dropping the highest and lowest one-sixth of estimates from the Army Corps.) The average expected reduction was $3 per dollar spent. FEMA's adaptation projects will reduce future flood damage by roughly $2 per dollar of spending from all sources, on average, in CBO's assessment.

To arrive at a single average effect for damage reduction per dollar of federal spending, CBO adjusted those values for three factors: a standardized time frame, a constant discount rate, and cost-sharing requirements for state and local governments.

- **Time frame.** A typical Army Corps project, such as building a levee or a dam, is estimated to provide flood reduction benefits over 50 years. A typical FEMA project, such as a property buyout or elevation, is evaluated for 30 years of benefits. For this report, the time frame for Army Corps projects has been standardized to 30 years. (The present value of the damage reduction evaluated over 30 years is approximately 80 percent of the present value of the damage reduction evaluated over 50 years.)
- **Discount rate.** The discount rates that the Army Corps and FEMA use to calculate the benefits of their projects in present dollars differ from each other (as required by law) and from CBO's estimated discount rates. Because they are lower, CBO's estimated rates increase the damage reduction effect by about one-fifth, on average; the full range of discount rates extends the damage reduction effect from an increase of one-twentieth to an increase of one-third. (The rates that CBO used for this analysis are discussed in the section below titled "Effects of Adaptations on Spending for Disaster Relief.")

3. For example, lawmakers provided HUD with supplemental appropriations ($16 billion) for adaptation grants in fiscal years 2018 and 2019 for specific places that had suffered from certain disasters.

4. For details about how those values are calculated, see Congressional Budget Office, *How CBO Uses Discount Rates to Estimate the Present Value of Future Costs or Savings* (October 2024), www.cbo.gov/publication/60284.

5. For those findings, see Congressional Budget Office, *Federal Spending for Flood Adaptations* (September 2024), www.cbo.gov/publication/59971.

- **Matching requirements.** The required matching rate for state and local governments is about 25 percent of the costs of flood adaptation projects. The Army Corps usually requires a cost-sharing split of 65 percent federal and 35 percent state and local; FEMA typically requires a 75/25 split. Some FEMA programs offer lower matching rates: For flood adaptation spending in response to disasters during specific periods, in low-income communities, or for properties that have repeatedly suffered severe losses, the matching rates for state and local governments can be as low as 10 percent (or even zero).

Some projects will reduce damage by more than the average, especially those that protect densely populated communities facing high risk of flooding. Other projects will reduce damage by less than the average. The benefits also depend on how development patterns, local land-use decisions, and climate conditions evolve. Allowing for uncertainty, the evidence suggests that flood adaptations funded through the Army Corps and FEMA reduce expected damage by more than their cost.[6]

Estimates of the Effects of Substantially Greater Spending. CBO's estimates of reductions in flood damage are based on amounts spent for flood adaptations in the past. Significantly increasing the amount of spending for flood adaptation programs in the future might not reduce flood damage to the same extent. In CBO's estimation, expected reductions tend to be greater for programs that explicitly prioritize projects using benefit-cost analyses (such as the Army Corps of Engineers' construction program) than for programs that use other selection criteria. Nevertheless, any program's spending for adaptations is likely to have diminishing returns after the most advantageous projects (those that offer the most benefit for the cost) have been completed.

The returns diminish at substantially higher spending amounts. After $90 billion of cumulative spending specifically for property-level adaptations (across all sources of spending), for example, the marginal effects of additional spending would fall below the averages cited, CBO estimates, but still be above the cost of the adaptations.[7]

About $90 billion of property-level adaptations—if the adaptations were selected solely on the basis of the damage they avoided—would be expected to reduce future flood damage by at least $2 per dollar spent. Spending beyond that amount, up to an additional $100 billion, would be expected to reduce future flood damage by less than $2 but more than $1 per dollar spent. (Such spending would exceed the roughly $2 billion a year that the Army Corps and FEMA spent, on average, for flood adaptations from 2020 to 2024.) Spending for adaptations in excess of $190 billion would be expected to reduce future flood damage by less than $1 per dollar spent. If those property-level adaptations were funded with the usual amount of cost sharing by state and local governments, the equivalent amounts of federal spending would be about one-quarter less.

If community-level adaptations followed a pattern similar to that of property-level adaptations, the threshold at which the marginal effects of additional spending on community-level adaptations declined below the historical average would be roughly $180 billion of cumulative spending. (Community-level adaptations represent about two-thirds of all spending for the Army Corps' and FEMA's flood adaptation projects.) Given typical matching requirements of about 25 percent for state and local governments, the marginal effects of additional spending on community-level adaptations would be likely to decline below the historical average after about $135 billion of cumulative federal spending.

All of those spending thresholds could be higher if some projects were selected for reasons other than cost-effectiveness. At the same time, significant increases in federal spending for flood adaptations above the typical annual rates could prompt state and local governments to reduce their spending for other flood adaptation projects that do not involve federal funding. That outcome would tend to offset some of the damage reduction associated with a given amount of federal spending.

Effects of Adaptations on Federal Spending for Disaster Relief

Spending for flood adaptations is expected to reduce future federal spending for disaster relief and, on average, more than offset the costs of the adaptations over

6. Congressional Budget Office, *Federal Spending for Flood Adaptations* (September 2024), www.cbo.gov/publication/59971.

7. Evan Herrnstadt and Jared Jageler, *Flood Damage Avoided by Potential Spending on Property-Level Adaptations*, Working Paper 2024-03 (Congressional Budget Office, May 2024), www.cbo.gov/publication/58168. The underlying analysis is subject to several sources of uncertainty, including uncertainty about flood risk modeling, climate change, the relationship between flood depths and property damage, information about the value and foundations of structures, and the costs of adaptations.

time. That outcome would depend on two conditions: that new flood adaptations have effects similar to those of previous ones and that future Congressional decisions about disaster relief are comparable to past decisions. Because those decisions have yet to be made, the reductions in future spending estimated here are not reflected in CBO's cost estimates.

The budgetary effects of spending for flood adaptations also depend on future decisions (by Congress, the affected agencies, and state and local governments) about what flood adaptation projects to implement and how to fund them. The more cost-effective the set of projects funded, the larger the expected reductions in both total flood damage and associated outlays for disaster relief. Lawmakers may also value objectives other than budgetary savings, such as promoting equity across communities.

Federal Disaster Relief

After major floods and hurricanes, the federal government often provides financial assistance to households, businesses, and state and local governments. Most of that assistance takes the form of discretionary appropriations—money that Congress must explicitly appropriate—rather than automatic payments under permanent programs. The largest sources of disaster relief include FEMA's programs for public and individual assistance. Following some disasters, additional funding has been provided through the Army Corps or HUD.

Historically, Congress has relied heavily on supplemental appropriations, which are used to provide funds for a fiscal year already in progress, to fund disaster relief. From fiscal year 2005 to 2024, supplemental appropriations for FEMA and the Army Corps totaled more than $20 billion per year, on average (after the effects of inflation have been removed). Very large spikes in funding have followed catastrophic storms such as Hurricanes Katrina, Rita, and Wilma in 2005 and Hurricanes Harvey, Irma, and Maria in 2017. In recent years, Congress has also provided annual appropriations to fund disaster relief.

Effects of Adaptations on Spending for Disaster Relief

To calculate the expected value of changes in future spending for disaster relief, CBO analyzed two factors: the amount of disaster relief lawmakers provided in the past, and the discount rate used to express the flows of future spending in a single value.

Past and Future Spending. To quantify the typical extent of federal spending for disaster relief, CBO compared actual spending after hurricanes with estimates of the total damage those storms caused. For hurricanes that made U.S. landfall between 2000 and 2019, federal disaster relief spending averaged about 45 percent of estimated damage.[8] CBO's analysis indicates that lawmakers have tended to provide a larger amount of aid (measured as a share of the estimated damage) when a disaster is severe.

If Congress continued to respond to flood damage by providing disaster relief that covered about the same 45 percent share of damage as it did for disasters during the 2000s and 2010s, then boosting adaptation spending today would save the federal government more than the cost of that spending over time.

- Using an inflation-adjusted, Treasury-based discount rate, CBO estimates that $1 billion of federal spending for flood adaptations in the current year would reduce federal disaster relief spending over the next 30 years by $1.8 billion in present-value terms.
- Using a fair-value discount rate, which reflects market risk, CBO estimates that $1 billion of federal spending for flood adaptations in the current year would reduce federal disaster relief spending over the next 30 years by $1.4 billion in present-value terms.

(For a discussion of the calculations underlying those amounts and the other results presented in this report, see the appendix.)

Discount Rates. The two estimates of the effects of adaptations on disaster relief spending vary because of the discount rates that CBO used to convert future dollars of spending into today's dollars. A lower discount rate (in this case, the inflation-adjusted, Treasury-based rate of 2.2 percent) places more weight on future outcomes, making long-run reductions in spending look larger in present-value terms. A higher discount rate (in

8. For more discussion about federal disaster relief spending, see Congressional Budget Office, *Federal Spending for Flood Adaptations* (September 2024), www.cbo.gov/publication/59971. Disaster relief funds can sometimes take several years to be appropriated, awarded, and spent. Starting in 2020, some supplemental appropriations for disaster relief also included funds to address the COVID-19 pandemic.

this case, the fair value–based rate of 4.2 percent) does the opposite: It shrinks the present value of future flows, which reduces the value of long-lived projects like flood adaptations.

The choice of discount rate is not simply a technical detail. It reflects how much weight lawmakers place on future taxpayers relative to current ones and how they account for the risk embedded in disaster-related spending. Treasury-based discount rates summarize the average long-term effects on federal debt, whereas fair-value discount rates attempt to incorporate the cost of market risk.

The market values of financial assets reflect their market risk. If an asset pays more when the economy is performing well and less when the economy is performing poorly, investors tend to discount future cash flows from that asset more. When the government creates programs that are subject to market risk (such as government credit programs, in most cases), it passes that risk on to taxpayers and program beneficiaries. Market risk may also be applicable to disaster relief spending because that spending is expected to be greater during periods of faster economic growth (when values for properties and businesses are higher) and during periods of greater climate change (which historically has accompanied faster economic growth). Estimates made using a Treasury-based rate are thought to incorporate no market risk, whereas fair-value estimates incorporate full market risk. In both cases, the analysis suggests that cost-effective flood adaptations are expected to pay for themselves in terms of reduced federal disaster spending.

Treatment in CBO's Cost Estimates. Because disaster relief is funded through annual and supplemental appropriations, it does not increase or decrease automatically when expected damage rises or declines. CBO's cost estimates for legislation that would provide funding for flood adaptations do not include estimated reductions in future spending for disaster relief.[9] Likewise, cost estimates for legislation that would reduce spending for flood adaptations, encourage development in flood-prone areas, or otherwise increase the likelihood of future flooding generally do not reflect increases in spending for disaster relief. Reasons for that budgetary treatment include the following:

- Funding for most disaster relief programs depends on future appropriations yet to be made by Congress;
- Following long-standing budgetary rules, CBO's cost estimates for appropriation acts exclude changes in mandatory spending that would result from increases or decreases in discretionary funding for related activities; and
- The time frame for CBO's estimates of budgetary effects is 10 years, which is not long enough for adaptation projects to be completed and to realize their full effects.

Effects Under Different Decisions by Future Lawmakers

Lawmakers might decide to provide disaster relief that covers a larger or smaller share of flood damage in the future, and those choices would have different budgetary effects (see Table 1). Only under a scenario in which Congress cut back on disaster relief spending as a share of disaster damage would flood adaptation spending be expected to cost more to implement than it would generate in future cost reductions. That outcome, which would represent a departure from past experience, would occur only if the effects are measured using the fair-value discount rate.

Other decisions made by lawmakers—directing spending to specific kinds of flood adaptations, for example—would also affect the federal budget. In addition, lawmakers might change the extent to which federal projects require state and local matching funds, which could shift the cost-sharing burden and have budgetary consequences.

Effects From Different Shares of Damage Covered by Disaster Relief Spending. The net budgetary effects from flood adaptations depend on how much disaster relief Congress chooses to provide in the future. Disaster relief is not provided automatically; it is the outcome of repeated decisions by lawmakers in response to specific events. For hurricanes during the 2000–2019 period, lawmakers provided disaster relief that paid for about 45 percent of disaster damage, on average, but future Congresses might provide a larger or smaller share.

9. The Congressional Budget Act of 1974, often called the Budget Act, requires CBO to estimate the costs of bills and resolutions approved by House and Senate committees. For more details, see Congressional Budget Office, *CBO Describes Its Cost Estimating Process* (April 2023), www.cbo.gov/publication/59003. CBO's cost estimates are intended to ensure that when Members consider legislation, they have information about the budgetary consequences of enacting it. That information can be used to enforce budgetary rules or targets.

Table 1.

Estimated Reduction in Disaster Relief Spending From $1 Billion in Federal Flood Adaptation Spending Under Different Choices by Future Lawmakers

Billions of dollars

Decisions by future lawmakers	Reduction in discretionary spending for disaster relief: Discounted at Treasury rate	Reduction in discretionary spending for disaster relief: Discounted at fair-value rate
Share of damage covered by disaster relief spending		
55 percent	2.2	1.7
45 percent	1.8	1.4
30 percent	1.2	0.9
Kind of project		
Property elevations	2.5	2.0
Mix of property elevations (79 percent) and buyouts (21 percent)	2.2	1.7
Property buyouts	1.5	1.2
State and local matching rate		
35 percent	2.1	1.6
25 percent	1.8	1.4
No required match	1.3	1.0

Source: Congressional Budget Office. See www.cbo.gov/publication/62554.

The reductions are measured as present values over 30 years. Present values translate a flow of current and future costs or benefits into an equivalent value today. The estimated amounts depend on whether the future avoided damage is discounted at the borrowing rate for Treasury securities or at a fair-value rate that incorporates market risk—the element of financial risk that is associated with the overall performance of the economy rather than with the performance of a specific investment.

The budgetary results depend on selecting adaptations that reduce flood damage by more than they cost. The selection of projects that reduce flood damage by less than they cost would lower the expected reduction in future federal spending.

Adaptation spending delivers the largest anticipated budgetary payoff in policy environments where the government typically responds to major disasters by providing large amounts of aid. In those environments, the damage that has been avoided by preventive spending could reduce pressure on lawmakers to provide relief appropriations. If Congress chose to provide less assistance in the future than it has in the past, the potential reduction in federal spending would still be positive but smaller, and a greater share of the costs of flood damage would be borne directly by households, businesses, and state and local governments.

For hurricanes that made landfall during the 2000–2019 period, the amount of assistance provided by lawmakers followed a general pattern. Lawmakers tended to provide disaster relief at a lower rate when the damage from individual storms was smaller and at a higher rate when the damage from individual storms was larger. For example, hurricanes that resulted in damage of $80 billion or more (in 2025 dollars) had an average of about 55 percent of their damage covered by federal disaster relief. But hurricanes that resulted in damage of less than $80 billion had an average of about 30 percent of their damage covered by federal disaster relief.[10]

CBO used those two alternative average shares and the two methods of discounting to estimate the effects of potential future reductions in disaster relief spending.

- **Results using the Treasury discount rate.** If lawmakers provided compensation for 55 percent of future disaster damage, then a $1 billion increase in adaptation spending would reduce the amount of future disaster relief spending by $2.2 billion in present-value terms over 30 years. If lawmakers instead covered only 30 percent of disaster damage, the corresponding decrease would be $1.2 billion. The expected breakeven point—the share of future disaster damage that would need to be covered for the cost of adaptations to equal the present value of expected reductions in future disaster relief spending—would be 25 percent. That is, if lawmakers provided funding for at least 25 percent of future disaster damage, flood adaptation spending would be expected to pay for itself in present-value terms over a 30-year period when valued using a Treasury discount rate.
- **Results using the fair-value discount rate.** If lawmakers provided compensation for 55 percent of future disaster damage, then a $1 billion increase in adaptation spending would reduce the amount of future disaster relief spending by $1.7 billion in present-value terms over 30 years. If lawmakers instead covered only 30 percent of disaster damage, the corresponding decrease would be $0.9 billion. The expected breakeven point would be 33 percent.

10. Flooding from the rising sea levels and more intense hurricanes that are expected to result from climate change will exacerbate damage from individual flood events in the future. See Congressional Budget Office, *The Risks of Climate Change to the United States in the 21st Century* (December 2024), www.cbo.gov/publication/60845.

If lawmakers covered less than that share, more spending for flood adaptations would not be expected to result in a net reduction in federal disaster relief spending when measured on a fair-value basis.

Effects From Different Kinds of Flood Adaptation Projects. The budgetary payoff from changes in spending for flood adaptations also depends on which kinds of adaptations the agencies fund.

Projects that offer greater reductions in flood damage per dollar of spending will have a larger effect on the federal budget. For individual properties, the most common projects implemented to reduce flood risk are property elevations (when an owner raises the home on piles or stilts) and buyouts (when the government purchases a property at fair market value so that it is no longer used for housing).

If policymakers spent $1 billion on cost-effective property elevations and required a 25 percent match from state and local governments, future federal discretionary spending for disaster relief would decrease by $2.5 billion over the next 30 years (when discounted at Treasury rates), CBO estimates.[11] If $1 billion was spent on buyouts under those conditions, the reduction in expected federal disaster spending would be smaller, at $1.5 billion, over a 30-year period. Even though buyouts would yield a smaller reduction in future spending, on average, they have some advantages over elevations. In particular, by stopping the use of property for residential purposes, buyouts offer benefits that last longer, and buyouts are more cost-effective for properties with structures that would be very difficult and costly to elevate.

When results are calculated using the fair-value discount rate, the patterns are similar, but the effects are smaller. For spending by type of property-level adaptation, the decrease from $1 billion of adaptation spending would range from $1.2 billion (buyouts only) to $2.0 billion (property elevations only).

Those budgetary results depend on selecting adaptations that reduce flood damage by more than they cost. If projects were selected that reduced flood damage by less than they cost, the expected reduction in future federal spending would be smaller. Prioritizing the selection of projects on the basis of their damage reduction effects would increase the expected reduction in future federal spending.

Effects From Different State and Local Matching Rates. The spending required of state and local governments through the matching rate for federal flood adaptation projects varies. The Army Corps usually requires state and local cost sharing of 35 percent for its flood adaptation projects, for example. Applying that matching rate to all flood adaptation spending would increase the expected reduction in federal spending for disaster relief to $2.1 billion over 30 years for each $1 billion of federal spending, if calculated using the Treasury discount rate.

Although FEMA's standard matching rate is 25 percent, some FEMA programs eliminate any state and local government match for flood adaptations under certain conditions. If the state and local match were waived for all flood adaptation projects, each $1 billion of federal spending would reduce expected federal spending for disaster relief by $1.3 billion over 30 years—again, calculated using the Treasury discount rate. Using the fair-value discount rate, the reduction in disaster relief spending would be $1.0 billion.

Effects of Adaptations on the Cost of Coverage Through the National Flood Insurance Program

Most homeowner's insurance does not cover flood damage. Flood insurance is a separate policy that can cover damage to buildings, their contents, or both. The National Flood Insurance Program (which is managed by FEMA) offers flood insurance to property owners, renters, and businesses. The program subsidizes coverage for some properties, making it less expensive and more widely available than private flood insurance. Homes and businesses that are located in high-risk flood areas and that have mortgages from government-backed lenders (such as Fannie Mae and Freddie Mac) are required to have flood insurance.

In addition to their effect on disaster relief spending, flood adaptations affect the cost of coverage available through the NFIP. By reducing flood damage, those adaptations decrease insurance claims, enabling the program to charge lower premiums to reflect less expected flood damage. Whether the benefits accrue to the federal government or to policyholders depends on the degree

11. Evan Herrnstadt and Jared Jageler, *Flood Damage Avoided by Potential Spending on Property-Level Adaptations*, Working Paper 2024-03 (Congressional Budget Office, May 2024), www.cbo.gov/publication/58168.

to which the NFIP's premiums are subsidized, which has been changing over time. In 1990, roughly 40 percent of NFIP policies were subsidized, but the rate had fallen to 22 percent as of 2023.[12] If ongoing changes to the NFIP eliminated future subsidies for its policies, greater spending for flood adaptations would mainly benefit policyholders by making premiums more affordable. If the program remained partially subsidized in the long run, greater spending for flood adaptations would add to the expected reduction in spending for future federal disaster relief.

Premiums, Costs, and Subsidies

The NFIP offers federally backed flood insurance to households and businesses in participating communities throughout the United States. (Availability is contingent on communities' agreeing to regulate development in their mapped floodplains.) NFIP policies are especially important in areas where private flood insurance is scarce or expensive, such as coastal or low-lying areas. Nonetheless, most properties at risk of flooding are not covered by NFIP policies.[13] Program terms typically limit the amount of coverage available for residential and commercial properties to $250,000 and $500,000 per structure, respectively. (Nearly all NFIP policies, 95 percent, are for single-family or multifamily residential properties.)[14] Over the 2015–2024 period, NFIP claims averaged $4.4 billion (in 2025 dollars), representing 8 percent of flood damage, CBO estimates.[15]

From 2023 to 2025, NFIP premiums and fees averaged $5 billion per year. The ongoing difference between NFIP claims and related costs and program premiums and fees is expected to be less than $1 billion annually and declining. Historically, the NFIP has charged some policyholders subsidized premiums that fall below the amount required to fully pay for their expected losses. Those subsidized premiums typically apply to policyholders with structures that were built before flood risk maps were developed in the 1970s and 1980s. As a result of insuring some properties at a loss, the NFIP has accumulated debt that it owes to the U.S. Treasury. Lawmakers directed the Treasury to forgive $16 billion of that debt in 2017, but the remaining debt, which has continued to grow, totaled $23 billion as of March 2026.

To continue to better align the NFIP's premiums with its costs, FEMA rolled out a new system in October 2021 called Risk Rating 2.0. That system, which uses a new method for assessing premiums, is designed to eventually fully account for property-level flood risk.[16] Under Risk Rating 2.0, subsidies are gradually being phased out, although policies are subject to caps on how fast premiums can increase each year.

Effects on Claims

Spending for flood adaptations would reduce flood damage, which would reduce the amount the NFIP would be expected to pay out in claims. The present value of the reduction in claims would depend on the discount rate used for the calculation:

- Using a Treasury-based discount rate of about 2.2 percent (after adjusting for inflation), CBO estimates that $1 billion in flood adaptation spending would decrease claims over the next 30 years by $0.3 billion.
- Using a higher fair-value discount rate of 3.1 percent that reflects the market rates of return on residential and business capital, CBO estimates that the decrease in claims over the next 30 years from $1 billion in flood adaptation spending would also be $0.3 billion.[17]

12. For historical estimates, see Government Accountability Office, *Flood Insurance: More Information Needed on Subsidized Properties*, GAO-13-607 (July 2013), www.gao.gov/products/gao-13-607. For 2023 data, see Diane P. Horn and Baird Webel, *Introduction to the National Flood Insurance Program (NFIP)*, Report R44593, version 75 (Congressional Research Service, April 7, 2026), www.congress.gov/crs-product/R44593.

13. For further discussion of flood insurance for properties at risk of flooding, see Congressional Budget Office, *Flood Insurance in Communities at Risk of Flooding* (July 2024), www.cbo.gov/publication/60042.

14. Peter G. Peterson Foundation, "Budget Basics: The National Flood Insurance Program" (accessed on June 8, 2026), www.pgpf.org/article/the-national-flood-insurance-program/.

15. Federal Emergency Management Agency, "Historical NFIP Claims Information and Trends" (accessed on October 2, 2026), https://tinyurl.com/4yzczvj9.

16. For more information about NFIP premiums and Risk Rating 2.0, see Congressional Budget Office, *Flood Insurance in Communities at Risk of Flooding* (July 2024), www.cbo.gov/publication/60042.

17. For the fair-value discount rates for residential capital (3 percent) and business capital (12 percent) that inform this discount rate estimate, see Congressional Budget Office, *How CBO Uses Discount Rates to Estimate the Present Value of Future Costs or Savings* (October 2024), www.cbo.gov/publication/60284. This fair-value rate is lower than the 4.2 percent fair-value rate used for damage to all properties earlier in the report because NFIP properties are almost entirely residential.

Actual reductions in claims would depend on the location of the flood adaptations. Because most properties at risk of flooding are not covered by NFIP policies, the effect of adaptations on NFIP claims would be smaller, on average, than the effects of adaptations on flood damage or spending for disaster relief.

A reduction in NFIP claims would affect both policyholders and the government. For each $1 billion of spending for flood adaptations, the expected reduction in claims would amount to about $70 per policyholder, calculated using the Treasury discount rate and measured as a present value over 30 years. (The NFIP has about 4.5 million policyholders.) Reductions in claims also would affect the premiums charged by the program and the subsidies provided by the federal government to address the differences between claims and premiums.

Under current law, by about fiscal year 2032, the bulk of NFIP policyholders will pay premiums that reflect their full estimated risk of losses from flooding, CBO projects. In that situation, flood adaptations that lowered expected claims would chiefly benefit policyholders (by lowering their premiums) rather than the federal government (by directly saving it money). If implementation of Risk Rating 2.0 was delayed or modified or if the federal government otherwise continued to subsidize the program, reductions in the NFIP's cost of coverage would decrease federal costs.

The effects of different kinds of flood adaptation projects on NFIP claims would be similar to their effects on the federal budget through changes in spending for disaster relief. NFIP claims would decline more if the government funded the kinds of projects that offered greater flood damage reductions per dollar of spending than if it funded the kinds of projects that offered lesser reductions. One program in particular, FEMA's Flood Mitigation Assistance program, stipulates that funds be used to reduce repetitive losses specifically for NFIP-insured buildings. Spending for that program would be expected to have a greater impact than average on NFIP claims.

Appendix: Calculating the Budgetary Effects of Flood Adaptation Spending

In a previous analysis, the Congressional Budget Office estimated the present value of expected reductions in flood damage from adaptations funded through the Army Corps of Engineers and the Federal Emergency Management Agency (FEMA).[18] This appendix describes the three-part method that CBO used to calculate those budgetary effects: First, CBO standardized the reductions in damage from flood adaptation spending; second, it calculated reductions in federal disaster relief spending for all properties; and third, it calculated reductions in the cost of coverage for properties insured through the National Flood Insurance Program (NFIP).

Part 1: Standardize Damage Reductions for a Uniform Time Frame and Federal Cost Share

The damage reductions presented in the earlier report were first standardized to apply to an even mix of flood adaptation spending across the Army Corps and FEMA for a 30-year time frame. The discounted present value of flood damage reductions per dollar of spending for the Army Corps' flood adaptations was $3; for FEMA's flood adaptations, it was $2. For this set of calculations, the damage reduction effects were estimated over 30 years for both agencies. (FEMA's estimates span a 30-year period, so no adjustment is necessary; for Army Corps' projects with a useful estimated life of 50 years, 80 percent of the damage reduction occurs over the first 30 years.)

The damage reductions were also adjusted to apply per dollar of federal spending instead of applying to all government spending, which includes contributions from state and local governments. The federal share of flood adaptation spending is taken to average about 75 percent; that distribution results in 33 percent more damage reduction per federal dollar spent. (The Army Corps usually requires a 65/35 federal/nonfederal split; for FEMA, the typical split is 75/25, but the federal share is sometimes larger. Certain FEMA programs offer lower state and local government matching rates of 10 percent or even zero for flood adaptations built in response to disasters during specific periods, built in low-income communities, or for properties that have had severe repetitive losses.)[19]

When standardized for cost shares and a common time frame, the average of those two damage reduction amounts over a 30-year period is $2.94.

(1) ($3 * 80% * 50% + $2 * 50%) * 133% = $2.94

The damage reduction effects of adaptations do not include certain adjustments, although those adjustments are likely to roughly balance each other out. On the one hand, factors such as sea level rise and more intense precipitation from climate change are expected to increase flood damage and therefore increase the damage reduction effects of adaptations. At least some of the studies that informed CBO's estimates of flood damage reductions did not include those effects, but treatments varied among studies. As a result, the effects of climate change, which are expected to increase flood damage by roughly one-quarter to one-third by 2050, are not included in these calculations.[20]

On the other hand, this analysis does not include other effects that are likely to occur but have not been studied in the context of spending for flood adaptations. Those factors include changes in state and local spending beyond matching requirements (substitution effects) and the diminishment over time in the functionality of flood adaptations that take the form of physical capital (depreciation). Such factors would tend to lessen the damage reduction effects of adaptations. For example, in the context of highway spending, CBO's estimate of the substitution effect for grants is 26 percent of the amount of federal spending, and its estimate of depreciation of the public capital stock is 3 percent per year.[21]

Part 2: Calculate Reductions in Disaster Relief Spending for All Properties

The standardized damage reductions from federal flood adaptation spending used the original underlying

18. Congressional Budget Office, *Federal Spending for Flood Adaptations* (September 2024), www.cbo.gov/publication/59971.

19. Nicole T. Carter and others, *Flooding: Selected Federal Assistance and Programs to Reduce Risk*, Report R47286, version 2 (Congressional Research Service, October 18, 2022), www.congress.gov/crs-product/R47286.

20. Congressional Budget Office, *Federal Spending for Flood Adaptations* (September 2024), www.cbo.gov/publication/59971.

21. For the estimate of the fiscal substitution effect, see Sheila Campbell and Chad Shirley, *Fiscal Substitution in Spending for Highway Infrastructure,* Working Paper 2021-13 (Congressional Budget Office, October 2021), www.cbo.gov/publication/57430. For a discussion of depreciation of public infrastructure capital, see Congressional Budget Office, *Effects of Physical Infrastructure Spending on the Economy and the Budget Under Two Illustrative Scenarios* (August 2021), www.cbo.gov/publication/57327.

discount rates used by the agencies. CBO transformed them into reductions in federal disaster relief spending using Treasury and fair-value discount rates.

Calculate Discount Rates for All Properties. The Army Corps and FEMA use different discount rates—as required by law—when estimating the present discounted value of flood damage reductions. Those rates were converted to the discount rates used by CBO to calculate the present discounted value of federal spending for disaster relief.

The conversion used the average of the discount rates for the Army Corps' and FEMA's damage reduction estimates.[22] For the Army Corps, the average discount rate used in the benefit-cost analyses for which the discount rate was available (29 of the 33 projects) amounted to 3.9 percent. CBO estimated the discount rate for FEMA to be 5 percent by equally weighting the 3 percent discount rates used in prior CBO work and the 7 percent used by the FEMA benefit-cost analysis studies, all of which were considered to arrive at the FEMA flood damage reduction value.[23] The average discount rate of those values is 4.5 percent in real terms (adjusted to remove the effects of inflation).

(2) 3.9% * 50% + [(3% + 7%) / 2] * 50% = 4.5%

CBO often provides estimates of the long-term effects of federal activities on the budget using both Treasury rates and fair-value rates. For example, CBO calculates official estimates of the cost of federal credit programs using procedures described in the Federal Credit Reform Act of 1990 (FCRA), but the agency frequently supplements them with estimates generated using the fair-value approach. That approach measures the market value of the government's obligations by accounting for market risk. (Market risk is the component of financial risk that is associated with the overall performance of the economy rather than with the performance of a specific investment; it results from shifts in macroeconomic conditions, such as productivity and employment, and from changes in expectations about future macroeconomic conditions.)

The markets involved with flood adaptations are those for residential and business properties. The real discount rate that CBO uses for residential capital is 2.6 percent, and the real rate for all businesses is 12.4 percent.[24] To weight those two rates, CBO calculated the shares of spending for the Army Corps and FEMA programs that go to property-level or community-level adaptations. For property-level protections, the shares are 1 percent for the Army Corps and 64 percent for FEMA; for community-level protections, the shares are 99 percent for the Army Corps and 36 percent for FEMA.[25]

Property-level protections are taken to apply solely to residential properties and are discounted using the residential capital rate. Community-level protections are given a weighted average of residential and business property discount rates because they protect both houses and businesses. Those weights are based on the relative share of damage from floods suffered by households (76 percent) and businesses (24 percent).[26] The weighted-average real discount rate of those values is 4.2 percent.

(3) 2.6% * 1% * 50%
(property level, Army Corps)

+ 2.6% * 64% * 50%
(property level, FEMA)

+ [2.6% * (99% * 76%) + 12.4% * (99% * 24%)] * 50%
(community level, Army Corps)

+ [2.6% * (36% * 76%) + 12.4% * (36% * 24%)] * 50%
(community level, FEMA)

= 4.2%

Under FCRA, CBO calculates the present value of projected future cash flows by discounting those flows using interest rates on fixed-rate, zero-coupon Treasury

22. Congressional Budget Office, *Federal Spending for Flood Adaptations* (September 2024), www.cbo.gov/publication/59971.

23. For the 3 percent discount rate used in prior work, see Evan Herrnstadt and Jared Jageler, *Flood Damage Avoided by Potential Spending on Property-Level Adaptations*, Working Paper 2024-03 (Congressional Budget Office, May 2024), www.cbo.gov/publication/58168.

24. For details about how those values are calculated, see Congressional Budget Office, *How CBO Uses Discount Rates to Estimate the Present Value of Future Costs or Savings* (October 2024), www.cbo.gov/publication/60284.

25. Based on data in Figures 6 and 7 in Congressional Budget Office, *Federal Spending for Flood Adaptations* (September 2024), www.cbo.gov/publication/59971.

26. Ibid., based on data in Figure 11.

securities that match the maturity of the cash flows of the program.[27] With that discounting method—known as the "basket of zeros" approach—the return on a Treasury security maturing in one year would be used to discount cash flows one year after disbursement, the return on a two-year security would be used for cash flows two years after disbursement, and so on. The real Treasury rate, which adjusts the nominal Treasury rate for inflation, averages approximately 2.2 percent over the 30-year period.

Calculate Reductions in Disaster Relief Spending Using CBO's Discount Rates. CBO converted the average damage reductions to fair-value and Treasury discounted amounts using the corresponding discount rate ratios. Those ratios are based on the prediscounted cash flows from the flood damage reductions being divided across the 30-year time horizon equally. In the case of the fair-value rate, that means adjusting from the average real discount rate of 4.5 percent used in the agencies' estimates to the average of 4.2 percent discussed above. Hence, the $2.94 damage reduction value is multiplied by 1.04 (the ratio of a dollar per year discounted for 30 years at 4.2 percent divided by a dollar per year discounted for 30 years at 4.5 percent). For the Treasury rate, the adjustment involves a change from a real discount rate of 4.5 percent to one of 2.2 percent; that adjustment multiplies the $2.94 damage reduction value by 1.35.

(4a) $2.94 * 1.04 = $3.07
(using fair-value discount rate)

(4b) $2.94 * 1.35 = $3.96
(using Treasury discount rate)

For this report, federal disaster relief spending for all properties was calculated as a simple percentage of flood damage. To estimate the budgetary changes in spending for disaster relief, CBO multiplied the damage reduction by the typical share of damage covered by disaster relief. Disaster relief spending averaged about 45 percent of disaster damage over the 2000–2019 period, based on the amount of federal spending for disaster relief in response to hurricanes and the amount of damage caused by hurricanes. That share was later allowed to vary in sensitivity analyses.

(5a) $3.07 * 45% = $1.38
(using fair-value discount rate)

(5b) $3.96 * 45% = $1.78
(using Treasury discount rate)

Part 3: Calculate Claims Reductions for NFIP-Insured Properties

The standardized damage reductions from flood adaptation spending using the original underlying discount rates were also transformed into the reductions in claims on properties covered by the NFIP using the Treasury and fair-value discount rates for those properties.

Calculate Discount Rates for NFIP Properties. CBO used a similar approach to calculate the anticipated changes in costs for NFIP-insured properties. Residential properties make up about 95 percent of the properties covered under the NFIP; the rest are a mix of business and nonbusiness, nonresidential properties.[28] The fair-value discount rate was calculated using the same 2.6 percent real rate for residential capital and 12.4 percent real rate for business capital applied to that mix of properties.

(6) 2.6% * 95% + 12.4% * 5% = 3.1%

As before, the real Treasury rate was about 2.2 percent.

Calculate Reductions in NFIP Costs Using CBO's Discount Rates. CBO then converted the average damage reductions for NFIP-insured properties to fair-value and Treasury rate–discounted amounts using the corresponding discount rate ratios. In the case of the fair-value rate for NFIP-insured properties, the $2.94 damage reduction value was multiplied by 1.24, the ratio corresponding to the 3.1 percent discount rate calculated above. For the Treasury rate, as with the prior calculation, the $2.94 damage reduction value was multiplied by 1.35.

(7a) $2.94 * 1.24 = $3.64
(using fair-value discount rate)

(7b) $2.94 * 1.35 = $3.96
(using Treasury discount rate)

27. A zero-coupon security is one whose face value is repaid when the security matures. It is typically sold for much less than its face value but earns no interest. Because a zero-coupon security does not make periodic interest payments, its return is simply the difference between the purchase price and the face value paid at maturity.

28. Peter G. Peterson Foundation, "Budget Basics: The National Flood Insurance Program" (accessed on June 8, 2026), www.pgpf.org/article/the-national-flood-insurance-program/.

NFIP claims were calculated to be 8.0 percent of flood damage, on the basis of the 10-year historical averages of claims and of flood damage. Claims-related cost reductions were calculated by multiplying the damage reductions for NFIP properties by that share.

(8a) $3.64 * 8.0% = $0.29
(using fair-value discount rate)

(8b) $3.96 * 8.0% = $0.32
(using Treasury discount rate)

This report was prepared at the request of the Ranking Member of the Senate Committee on the Budget. In keeping with CBO's mandate to provide objective, impartial analysis, the report makes no recommendations.

Chad Shirley wrote the report with guidance from Joseph Kile. Nicholas Chase, Chad Chirico, Michael Falkenheim, Sebastien Gay, Evan Herrnstadt, Justin Humphrey, Wendy Kiska, Aaron Krupkin, Sam Papenfuss, Jon Sperl, Robert Sunshine (a consultant to CBO), and David Torregrosa offered comments. Joshua Silverman fact-checked the document.

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CBO seeks feedback to make its work as useful as possible. Please send comments to communications@cbo.gov.

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