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Riskier Business: How Climate is Already Challenging Insurance Markets

UNITED STATES SENATE COMMITTEE ON THE BUDGET HEARING

MR. RADE MUSULIN

Opening Statement

Chairman Whitehouse, Ranking Member Grassley, and distinguished Members of the Committee, thank you for the opportunity to appear before you today.

My name is Rade Musulin. I am an Actuary who has extensive experience in natural hazard risks and funding arrangements for the damage and loss they cause. I have worked with many public sector entities on policy responses to challenges of insurance availability, affordability, and community resilience.

This work included participating in Florida's response to Hurricane Andrew, which involved the creation of the Florida Hurricane Catastrophe Fund and Citizens Property Insurance Corporation.

The Cat Fund and Citizens can access different forms of funding than traditional insurance companies. Instead of holding sufficient capital or reinsurance before an event to cover the cost of potential losses, both entities use public sources of capital to reduce upfront costs by partially funding losses post-event through bonding and assessments. All property insurance policyholders, whether in Citizens or not, are subject to its assessments, while the Cat Fund can assess almost all policies, including automobile.

This approach exposes Floridians to debt and repayment if large losses occur, and it subsidizes high-risk policies from the entire population. These pools, others like them in many coastal states, and the NFIP have contributed to rapid development in high-risk areas, driving higher costs in the long run.

In Florida, national insurers have reduced their exposure, as a significant portion of the insurance market has moved to Citizens or smaller insurers with limited capital that are heavily dependent on external reinsurance.

To date, Florida's system has been successful in meeting its claim obligations, while improvements in building codes have reduced loss exposure. However, for a variety of reasons, including exposure to hurricanes, claims cost inflation, and high litigation, Florida insurance premiums are the highest in the nation, causing significant affordability stress for consumers. According to market research from Bankrate, the average premium for $300,000 of homeowner insurance in Florida is three times the national average, with premiums in high-risk areas exceeding five times[1].

A major hurricane hitting a densely populated area like Miami could trigger large and long-lasting post-event assessments, or even exceed the system's funding capacity.

Continued rapid exposure growth and more extreme hurricane losses amplified by climate change will cause increasing stress on the nation's insurance system, which may be felt through solvency issues, non-renewals, growth of government pools, and affordability pressure.

[1] Bankrate, 'Home Insurance Rates by State', https://www.bankrate.com/insurance/homeowners-insurance/states/#home-insurance-rates-by-state.

Evidence of increasing risk abounds, including Hurricane Otis in 2023, which rapidly intensified from a tropical storm to a Category 5 hurricane - and devastated Acapulco in Mexico. Last summer, water temperatures off Florida exceeded 100F. Last week, the National Oceanic and Atmospheric Administration forecast an extremely active hurricane season in 2024. We have seen losses in the mid-Atlantic from Sandy, record flooding from Harvey, and extreme devastation from Maria. In coming decades, we must prepare for the possibility of more extreme hurricanes and coastal flooding from Texas to New England.

Florida's experience is a warning of what the future may hold in other states. Despite its innovative and extensive efforts to address its hurricane problem, premiums are high, consumers may face large assessments, and many are dependent on Citizens and smaller insurers.

Most current building codes and land use policies do not reflect potential future risk. Even if we undertook rapid action to address this, existing exposure and likely development will leave us vulnerable to large losses for decades to come, which may trigger more widespread availability and affordability issues, or calls for federal assistance.

The combination of demographics, development, and disasters poses a significant risk to our financial system, and climate change increases that risk. Addressing this will be a long-term effort which involves difficult policy choices.

Thank you.

A brief history of the Florida Property Insurance Market

The following section provides some background on the property insurance market in Florida, including some of the challenges it faced in the lead up to and aftermath of Hurricane Andrew in 1992.

According to the US Census Bureau, between 1950 and 1990 Florida's overall population increased 367%, from 2.8 million to 12.9 million. The growth was not uniform, with much of it occurring in the most catastrophe-prone part of the state near Ft. Lauderdale and Miami. This period was also one of rapid wealth accumulation - as the US emerged from the post-World War II era with strong economic growth. During this period, the value of property exposed to severe hurricanes grew substantially.

This period of rapid development coincided with decades of below-average hurricane activity due to the Atlantic Multi-Decadal Oscillation. Consumers, government, and insurers were lulled into a false sense of security. When the state experienced severe hurricanes in the distant past, there were few people, and when the population grew the state experienced few hurricanes.

Insurers at the time, due to limited technology and low-resolution data, adopted basic actuarial models that significantly underestimated hurricane risk. Notably, these methods failed to account for how new construction, shifts in the geographic distribution of risk, and insurance coverages (including "guaranteed replacement cost") might affect both the cost and size of potential losses. This resulted in insurers overextending exposure with overly generous terms and inadequate premiums.

Access to affordable home insurance, compounded by a lack of awareness of the true risk of hurricane loss, failed to encourage sufficient investment in loss mitigation measures. The problem was illustrated by a study done by the Insurance Institute for Property Loss Reduction following Hurricane Andrew (1992). It found that homes built after 1980 were three times more likely to have been rendered uninhabitable in winds up to 97 mph in Andrew than those built before 1980 (10% vs. 33%).

This combination of rapid growth and development, coupled with inadequate risk assessment and loss mitigation, ultimately left the Florida property insurance market vulnerable and woefully unprepared.

Hurricane Andrew made landfall south of Miami in August 1992. The Category 5 hurricane destroyed over 25,000 homes[2] (with an additional 100,000 damaged) across South Florida and inflicted $16 billion[3] (in 1992 USD) in insured losses, making it the costliest natural disaster in the nation's history at the time. This equates to $35 billion in today's dollars after adjusting for inflation using the U.S. Consumer Price Index, a figure which would be much larger if changes in population and wealth were reflected.

[2] National Oceanic and Atmospheric Administration, Atlantic Oceanographic and Meteorological Laboratory, '25th Anniversary of Hurricane Andrew', https://www.aoml.noaa.gov/25th-anniversary-hurricane-andrew/.
[3] Insurance Information Institute, 'Facts & Statistics: Hurricanes', https://www.iii.org/fact-statistic/facts-statistics-hurricanes.

The magnitude of this loss was a significant shock to the insurance industry, eventually resulting in the insolvency of seven domestic insurance companies and one foreign company[4]. This does not account for the companies that became 'technically insolvent' and required the transfer of funds from parent companies to sufficiently cover the cost of claims. While larger insurers with greater financial resources were able to absorb losses without failure, this was not without consequence. The severity of losses from Andrew induced widespread market disruption, causing insurers to take unprecedented actions including cancellations, non-renewals, requests for large rate increases and withdrawals from the market. Reinsurance rates increased and the majority of private insurers eventually stopped writing new property policies. This made it much harder for homeowners in Florida to access affordable insurance.

This mass exodus of insurers from the Florida market exposed many systemic vulnerabilities and was the impetus for significant changes involving catastrophe exposure modelling, building codes, and the role of government-regulated insurance entities.

Some key responses in the aftermath of Andrew are outlined below.

Moratorium on cancellations, non-renewals, and rate regulation (1992)

The steps that insurers were taking to mitigate losses, including cancelling policies, denying renewals, and applying large rate increases would have left homeowners without affordable (as perceived at the time) insurance in a time of need. To prevent this, legislators imposed a six-month moratorium on these practices. This was later followed by a three-year moratorium to prevent insurers from reducing their market share too quickly. Specifically, insurers could only decline to renew up to 5 percent of their property book in any 12-month period. Stricter underwriting was implemented for new business.

Creation of the Joint Underwriting Association (JUA - 1993) to provide last resort coverage along with the existing Florida Windstorm Underwriting Association (FWUA - 1972)

The FWUA existed to provide windstorm coverage in coastal areas particularly prone to hurricane risk that private insurers were reluctant to insure. The JUA was established in 1993 to further help fill these gaps and additionally to provide a broader range of coverage (beyond just windstorm) as other insurers reduced their exposure or withdrew from the market.

Creation of the Florida Hurricane Catastrophe Fund (FHCF)

The FHCF was created to stabilize the insurance market by providing reinsurance, reimbursing a portion of the private insurer's losses due to catastrophic hurricanes. By spreading the risk, the FHCF aimed to prevent drastic premium increases and make coverage more affordable and accessible.

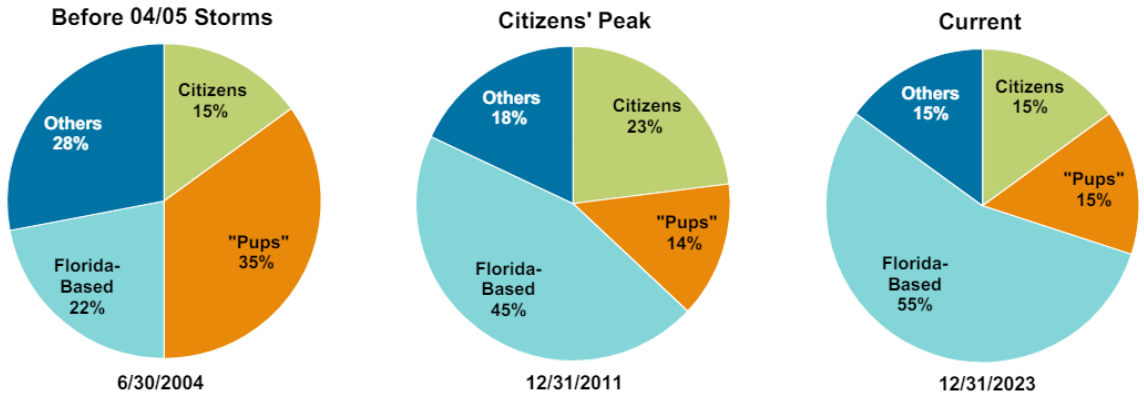
While the FHCF remains a critical component of Florida's insurance market, its long-term financial stability is sometimes questioned, especially after the major hurricane seasons in recent years leading to diminishing surplus. Maintaining the FHCF's financial position through adequate funding and sound policies is an ongoing challenge for the state.

[4] Insurance Information Institute, 'Hurricane Andrew: The Costliest Hurricane in U.S. History', https://www.iii.org/sites/default/files/paper_HurricaneAndrew_final.pdf.

Merging of JUA and FWUA into Citizens Property Insurance Corporation (Citizens - 2002)

Although the JUA was initially intended to be a temporary entity, the need for a more permanent solution to the insurance availability crisis became evident as private insurers continued to reassess their risk appetite for writing business in Florida in the years following Andrew. Citizens was created through the merger of JUA and FWUA and designed to function as an insurer of last resort to provide homeowners with property coverage when they were unable to obtain it from private insurers.

Over the last two decades, continued pressure on availability and affordability has seen Citizens gradually change from its role as insurer of last resort. Changes in legislation allowed almost all risks to be accepted and, in many cases, at a lower price than what is charged by its private counterparts[4]. Citizens' market share (by total insured value) continued to increase, peaking at 23% in late 2011[5]. Its substantial exposure has raised concerns over its ability to meet claim payouts in the event of a catastrophic loss without resorting to assessments on all Florida policyholders. Presently, Citizens has a market share of 15% (shown in the figure below[5]) and the management of its size and risk exposure remains a key policy issue.



Transfer of exposure to "pups" and Florida-based insurers

During this period, modern catastrophe modelling techniques demonstrated that major insurers were at risk of impairing their national operations from risk in Florida. This led many companies to create Florida subsidiaries, effectively capping their exposure at the amount of capital placed in the subsidiary. Concurrently, many new companies were formed, partly reflecting incentives to depopulate Citizens to reduce the assessment risk to policyholders. While these companies were regulated by the solvency standards of the state, compared to the pre-1992 market, characterized by large national insurers with large capital bases, the new companies were typically backed by less capital and relied much more heavily on reinsurance from both the FHCF and private sources.

[5] Citizens Property Insurance Corporation, 'Market Share Report', December 31, 2023, https://www.citizensfla.com/documents/20702/93160/20231231+Market+Share+Report.pdf/.

Creation of the Florida Commission on Hurricane Loss Projection Methodology (FCHLPM)

Hurricane Andrew exposed significant flaws in the methods used by insurers to assess and model hurricane risk. Recognizing the need for more transparent and rigorous risk assessments, the FCHLPM was developed in 1995 with the goal to improve the accuracy of rate setting, reducing the likelihood of widespread insurer insolvencies in the event of another major hurricane.

Today, the FCHLPM continues its role in Florida's insurance market by reviewing and auditing hurricane models used by insurers to ensure they meet the standards for scientific validity and accuracy. This ongoing management promotes greater transparency and accountability within the industry, aiming to stabilize insurance market rates and protect consumers.

Enactment of tougher building codes in 2002

When Hurricane Andrew hit, there were more than 400 different building codes across the state of Florida. These were inconsistently enforced, and poor compliance led to the destruction of thousands of homes during Andrew and other hazard events. In response, the Florida Building Code was developed in 2002 as a single statewide standard which mandated stricter hurricane-resistant standards for new construction.

The FBC continues to evolve and is updated triennially to reflect the latest advancements in construction technology and hurricane engineering. These updates ensure that new structures built in Florida meet standards for wind and flood resistance, better withstanding the potential impacts of hurricanes and ultimately reducing losses in the long run.

Florida's property insurance market has been tested many times since Hurricane Andrew. A sampling of severe events includes (noting other hurricanes, such as Irma, also affected Florida during the period):

- Four Hurricanes in 2004 (Charley, Frances, Ivan, Jeanne)

Florida was struck by four major hurricanes in the unprecedented 2004 hurricane season, critically testing the system and the reforms implemented during the preceding decade.

The total impact (insured and uninsured) of the four hurricanes on Florida totaled over $60 billion (CPI-adjusted)[6].

- Hurricanes Katrina and Wilma (2005)

The total impact (insured and uninsured) of the two storms on Florida totaled almost $40 billion (CPI-adjusted)[12].

This chain of devastating hurricanes in back to back seasons led to Citizens levying a series of assessments on its own policyholders in order to cover its losses. In 2007 it imposed a 1.4% emergency assessment on all policyholders in the state (whether written by Citizens or not; reduced to 1% in 2011) and also a policyholder surcharge of up to 15% on its own policyholders.

[6] National Centers for Environmental Information, 'Billions of Dollars in Damages', Accessed October 27, 2023, https://www.ncei.noaa.gov/access/billions/

- Hurricane Ian (2022)

According to Gallagher Re in its 2022 Hurricane Assessment: "Ian will become one of the most expensive and difficult recoveries for any U.S. hurricane on record". The Category 4 storm resulted in $120 billion in economic loss and $60 billion in insured losses[7]. It is the costliest hurricane in Florida's history and the second costliest in US history (the costliest being Hurricane Katrina in 2005).

The projected losses incurred by Citizens was $3.6 billion dollars (as at December 31 2023)[8] with about $1.4 billion expected to be ceded to the FHCF and private reinsurance[9].

The FHCF projected an ultimate loss amount of $10 billion for Hurricane Ian[10]. A loss of this magnitude would have depleted the entirety of the FHCF's projected fund balance and the majority of its pre-event bonds. As stated in FHCF's Annual Report[11] at February 2024, "The FHCF would need to rely on post-event bonding and emergency assessments to pay claims if a storm or storms of moderate to significant magnitude impacted Florida in the 2024-2025 contract year."

The NFIP faced a significant number of claims due to the heavy rainfall and storm surge caused by Ian. it paid out over $4 billion in flood insurance payments[12].

Hurricane Ian placed six insurers into receivership in 2022 and ultimately led to numerous insolvencies. In turn, the Florida Insurance Guaranty Association (FIGA) has levied a 2% assessment on policyholders in 2022 followed by an emergency 1% assessment in 2023 in response to the liquidation of United Property & Casualty Insurance Company[13]. At this point, Citizens has not announced assessments in response to Hurricane Ian.

The insurance market for homeowners in Florida – affordability challenges and market risks in 2024 and beyond

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2024 – the current state of the Florida market for home insurance

Florida's property insurance market remains in a troubled state as we begin the 2024 hurricane season. Below is an outline of a few key indicators:

- Premiums

    - The average home insurance premium for Florida (for a sum insured of $300,000) is well above other states, including other Gulf States such as Texas.

[7] Swiss Re, 'Tropical Cyclones', https://www.swissre.com/risk-knowledge/mitigating-climate-risk/tropical-cyclones.html
[8] Citizens Property Insurance Corporation, '2023 Annual Statement', 2023, https://www.citizensfla.com/documents/20702/29655847/2023+Annual+Statement.pdf
[9] Citizens Property Insurance Corporation, 'Citizens Updates Hurricane Ian Estimates', November 14, 2022, https://www.citizensfla.com/documents/20702/20355943/20221114+Press+Release+Citizens+updates+Hurricane+Ian+estimates.pdf/
[10] Florida Housing Finance Corporation, 'Florida Housing Finance Corporation Annual Report', 2022, https://fhcf.sbafla.com/media/uvmnfyka/2022-fhcf-annual-report.pdf
[11] Florida Housing Finance Corporation, 'FHCF 2024 PML Report', 2024, https://fhcf.sbafla.com/media/410lkiue/fhcf-2024-pml-report-final.pdf
[12] Artemis, 'NFIP Reinsurance Set to Trigger as Hurricane Ian Claims Hit $4.3bn', 2023, https://www.artemis.bm/news/nfips-reinsurance-set-to-trigger-as-hurricane-ian-claims-hit-4-3bn/
[13] FIGA Facts, 'Assessments', https://figafacts.com/assessments/

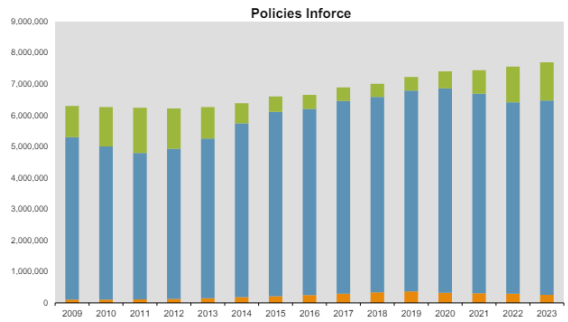
- According to market research from Bankrate, the average premium for $300,000 homeowner insurance in Florida is $6,366 compared to the national average of $2,153[1].
- Higher premium rates in Florida have been exacerbated by the impact of Hurricane Ian, which led to insurer insolvencies, including United P&C, Weston P&C, FedNat, and Southern Fidelity[14].

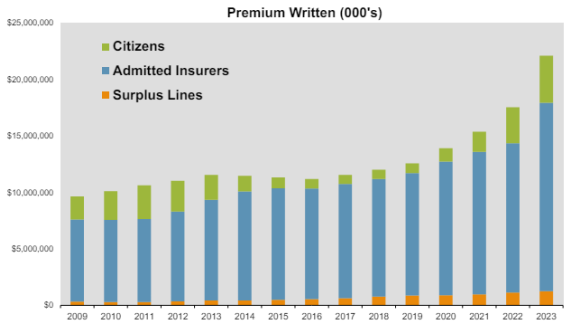
- Market size

  - Premium volume is estimated to be a total of $22 billion (as at December 31, 2023). This compares to $18 billion in the year prior[11].
  - 7.4 million property policies in force. There has been a continued upward trend in the total number of policies in force since 2012.
  - Total insured value is estimated at $3.7 trillion, which has also continued to increase since 2012.

- Citizens

  - Citizens is collecting $4.2 billion in annual premiums.
  - It issued 1.2 million, or 16%, of the total policies in force in 2023.
  - The total value insured by Citizens is $547 billion, or 15% of the state's total sum insured.
  - Citizens' estimated Probable Maximum Loss (PML) for a return time of 100 years is $17.7 billion (as at Dec 31, 2023)[15].





- FHCF

  - The FHCF has a statutory coverage obligation of $17 billion for 2024, including an estimated claims-paying capacity of $7.8 billion over 0-12 months[16]. The remainder of its maximum potential liability is met through $3 billion of available pre-event bond proceeds and an approximate $8 billion borrowing capacity.
  - As of December 31, 2023, the FHCF had an estimated fund balance of approximately $4.3 billion after paying or reserving for losses from Hurricanes Irma, Michael, and Ian in the total amount of approximately $19 billion[17].

[14] Florida Office of Insurance Regulation, 'Insolvency Reports', https://www.myfloridacfo.com/division/receiver/companies/insolvency-reports.
[15] Citizens Property Insurance Corporation, 'Annual Report of Aggregate Net Probable Maximum Losses', February 1, 2024, https://www.citizensfla.com/documents/20702/96554/20240201+Annual+Report+of+Aggregate+Net+Probable+Maximum+Losses.pdf.
[16] Florida Housing Finance Corporation, 'Florida Housing Finance Corporation Annual Report', 2023, https://fhcf.sbafla.com/media/jezfd0d1/2023-fhcf-annual-report.pdf.
[17] Florida Housing Finance Corporation, 'FHCF 2024 PML Report', 2024, https://fhcf.sbafla.com/media/410lkiue/fhcf-2024-pml-report-final.pdf

- To secure additional liquidity for the 2024-2025 contract year, the fund has recently issued $1 billion of its Series 2024A pre-event bonds, bringing its total liquidity resources to $10 billion (as at May 2024)[18].
- The FHCF would need to rely on post-event bonding and emergency assessments to pay claims in the event of catastrophic losses in the 2024- 2025 contract year.

FHCF Obligations and Liquidity Resources – 2024-2025 Contract Year	Amount ($B)
Total Potential FHCF Obligations	$17.00
Projected 2024 Year-End Fund Balance	$6.91
Series 2020A Pre-Event Bonds Balance*	$2.25
Series 2024A Pre-Event Bonds Balance	$1.00
Total Liquidity Resources	$10.16
Total Liquidity Resources Below Potential Obligations	$6.84

Numbers may not add due to rounding.

** $1.25 billion of the currently outstanding $3.50 billion 2020A Pre-Event Bonds matures on July 1, 2025. These funds would be available as liquidity if needed but are expected to be used to pay the principal due on July 1, 2025.*

- National Flood Insurance Program (NFIP)

  - Prior to the sophisticated models of today, flood risk was difficult to measure and not provided by most private insurers.
  - Presently, private insurers are more comfortable with underwriting flood coverage and we have seen the number of NFIP policies reduce from 5.1 million at its peak to 4.7 million in 2023.
  - Florida comprises the largest proportion of these policies, with over 35% of total policies in force, reinforcing the state's vulnerability to flood risk[19].

What is the outlook for 2024?

The latest outlook from NOAA predicts the worst hurricane season in decades with a potential of four to seven 'major' hurricanes forming due to record high ocean temperatures[20].

The risks that threaten the US coastal home insurance industry, and particularly Florida, are potentially devastating. If and when major losses materialize many of the same challenges that have occurred in the past will persist and grow. Further severe hurricanes may:

- Place pressure on premiums with a further decline in the availability of affordable home insurance in Florida and other impacted states.
- Further disrupt private insurers that may limit the risks they will cover when faced with higher reinsurance rates or depleted capital.
- Cause more homeowners to seek coverage with Citizens or residual markets in other states. Heightened exposure could increase the risk of Citizens implementing policyholder assessments or seeking federal Government support. This will necessitate Citizens once again working with smaller insurers to depopulate.

[18] Florida Housing Finance Corporation, 'FHCF May 2024 Bonding Capacity Report', 2024, https://fhcf.sbafla.com/media/awmhd2tz/fhcf-may-2024-bonding-capacity-report.pdf.
[19] Florida Realtors , https://www.floridarealtors.org/news-media/news-articles/2024/04/fla-leads-2022-2023-flood-insurance-payouts and FEMA, https://www.fema.gov/press-release/20230425/fema-publishes-nfip-claims-and-policy-data
[20] The Washington Post, 'Hurricane Season Forecast: Active Storms Expected', May 23, 2024, https://www.washingtonpost.com/weather/2024/05/23/hurricane-season-forecast-active-storms/.

Will we learn from past warnings that went unheeded?

The Hurricane Pam exercise conducted in 2004 was designed to simulate the impact of a major hurricane on the Gulf Coast of the US, and accurately revealed several vulnerabilities that were exposed by Hurricane Katrina in the following year. This exercise demonstrated that FEMA and other agencies were able to clearly articulate the risks of an event which had not yet happened but that warning came too late to implement effective mitigation measures before Katrina.

What would happen if the Great Miami Hurricane of 1926 occurred today?

A combination of increased development and asset values would lead to significantly higher insured losses should major Florida hurricanes of the past be experienced today. The 1926 "Great Miami Hurricane" was estimated in 2017 to cost upwards of $125 billion.

Figure 1:
Estimated Insured Losses for the Five Largest Historical Hurricanes Affecting Florida Based on Current Exposures

Date	Event Name	Category	2017 Insured Loss
Sept. 18, 1926	Great Miami Hurricane	4	$128 billion
Sept. 17, 1928	Great Okeechobee Hurricane	4	$78 billion
Sept. 17, 1947	1947 Fort Lauderdale Hurricane	4	$62 billion
Aug. 24, 1992	Hurricane Andrew	5	$56 billion
Sept. 10, 1960	Hurricane Donna	4	$50 billion

Source: AIR Worldwide, 2017

* Modeled loss to onshore property, contents and business interruption, and additional living expenses for residential, mobile home, commercial and auto exposures as of Dec. 31, 2016, using the indexed takeup rates provided in the 2017 CATRADER release. Losses include demand surge and account for storm surge.

Citizens is positioned at the forefront of the financial response and its capacity to fulfil its claim payout obligations without government support would be severely tested.

Climate change and its impact on hurricanes and coastal hazards

The IPCC'S Sixth Assessment Report (2021) presents a strong body of scientific evidence that human influence has unequivocally warmed the atmosphere, ocean, and land, triggering many weather and climate extremes in every region across the globe. The scientific consensus concerning the impact of a warming climate on future hurricane severity is strong: climate modeling studies[21] project an increased intensity in tropical cyclones which will likely cause more severe rainfall and heightened coastal flood risk from storm surge[22].

Florida, which already has some of the highest and most frequent hurricane risks in the US due to its unique geography, may face a greater threat from increasingly powerful hurricanes.

- Hurricane intensity is projected to increase in the future:
    - Most models show an increase in average hurricane intensity, fueled by warming ocean temperatures and air humidity.
    - This means that a greater *proportion* of hurricanes that form will reach major intensity (Category 3, 4, or 5), implying an increase in the destructive potential per storm, assuming no reduction in size[23].
    - Under a 2 degree Celsius global warming scenario, the proportion of Atlantic hurricanes reaching Category 4 or 5 are projected to increase by about 10%, with peak wind speeds projected to increase about 3%[24].
    - The increased intensity of tropical cyclones across different regions of the world is shown in the figure below[25].

- Hurricanes are becoming more unpredictable by strengthening faster:
    - Warmer waters are also leading to an increase in rapid intensification[22], a phenomenon that describes hurricanes becoming stronger faster.
    - Faster strengthening of storms lead to higher unpredictability, resulting in lower preparedness and more economic damage.

- Hurricane rainfall rates are projected to increase:
    - Warmer air temperatures are able to hold more water vapor, resulting in more extreme precipitation events.
    - Consequently, rainfall rates within Atlantic hurricanes are projected to increase by about 15% for a 2 degree Celsius global warming scenario[23].

[21] Klotzbach, P. J., Bowen, S. G., Pielke Jr, R. A., & Bell, G. D. (2018). Continental US hurricane landfall probability has decreased over the past 100 years. Bulletin of the American Meteorological Society, 101(3), 194-194.
[22] NASA, 'A Force of Nature: Hurricanes in a Changing Climate', https://science.nasa.gov/earth/climate-change/a-force-of-nature-hurricanes-in-a-changing-climate/.
[23] NOAA Geophysical Fluid Dynamics Laboratory, 'Global Warming and Hurricanes', https://www.gfdl.noaa.gov/global-warming-and-hurricanes/.
[24] National Oceanic and Atmospheric Administration, 'State of the Science: Atlantic Hurricanes and Climate Change', May 2023, https://sciencecouncil.noaa.gov/wp-content/uploads/2023/05/1.1_SOS_Atlantic_Hurricanes_Climate.pdf.
[25] Knutson, T. et al., 2020: Tropical Cyclones and Climate Change Assessment. Part II: Projected Response to Anthropogenic Warming. Bull. Amer. Meteorol. Soc., https://doi.org/10.1175/BAMS-D-18-0194.1

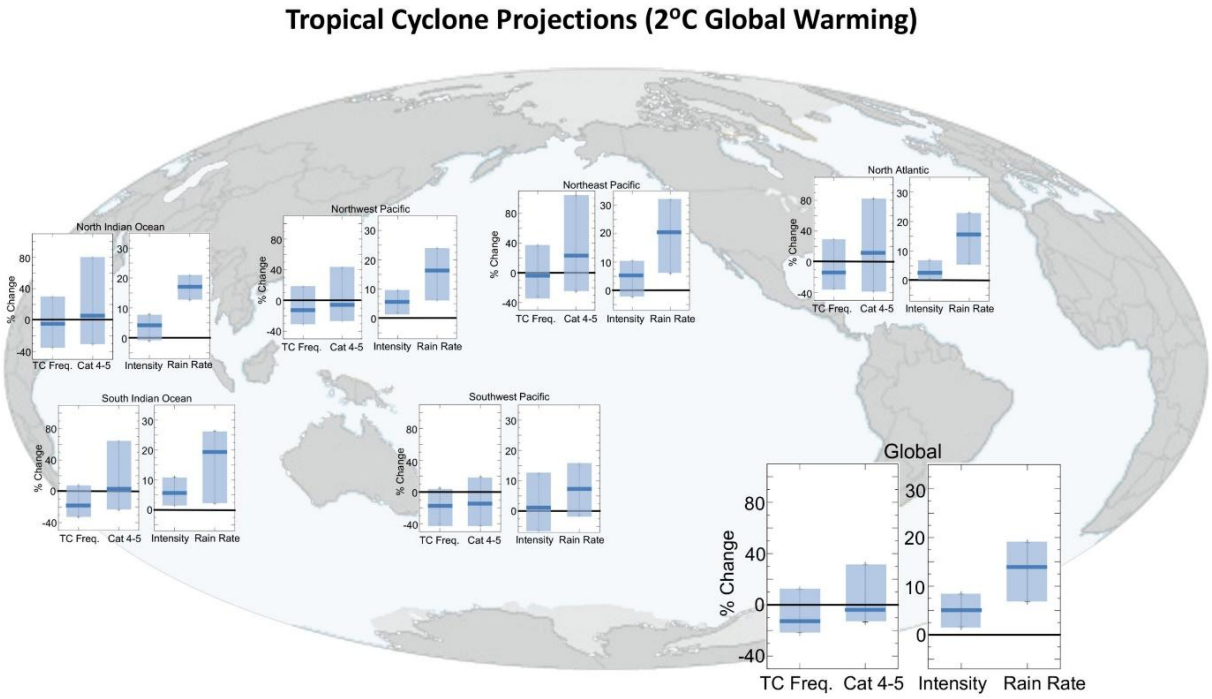
- Additionally, due to climate change-induced warming in the Arctic, storm speeds are projected to slow, resulting in more rainfall being dumped over a particular area before the storm moves on[26].

- More powerful and damaging storm surges due to rising sea levels

  - Sea levels are anticipated to rise by about 0.4 to 0.8 meters by 2100[4].
  - Higher sea levels increase the threat of coastal inundation from storm surge, as more water will be pushed further inland even with weaker hurricanes.

- There is a possibility of "poleward migration" of storms, which could impact higher latitude exposure concentrations in the mid-Atlantic and New England regions[27].

This combination of more severe natural disaster events and increasing development and property value would mean large rises in disaster costs in the future for Florida and other parts of eastern US.



[26] Environmental Defense Fund, 'The Science Is Clear: Climate Change Is Causing More Damaging Hurricanes in Florida', November 1, 2023, https://blogs.edf.org/climate411/2023/11/01/the-science-is-clear-climate-change-is-causing-more-damaging-hurricanes-in-florida/

[27] https://texmex.mit.edu/pub/emanuel/PAPERS/Knutson_etal_2020.pdf

The projected economic cost of hurricanes for the Federal Budget

In June 2016, the Congressional Budget Office (CBO) released a paper on the implications for the Federal Budget of potential increases in hurricane damage in the United States. This paper includes commentary on climate change and coastal development and their effects on hurricane damage.

The CBO estimated the change in damage from hurricanes by comparing expected damage under current conditions with expected damage in selected future years - being 2025, 2050 and 2075 - under conditions expected to prevail at the time. The CBO noted that sea levels and frequency of hurricanes are affected by climate change.

The CBO concluded that:

- The growth in expected hurricane damage is expected to exceed the growth in the nation's ability to pay for such damage, with mean expected damage to be 0.16 percent of GDP in 2025, 0.19 percent in 2050, and 0.22 percent in 2075.
- Climate change and coastal development will occur simultaneously, and each factor will compound the increase in expected damage caused by the other.
- The expected damage from hurricanes will constitute a larger share of per capita income for people living along the East and Gulf coasts than for the average person in the United States – with 'substantial expected damage' defined as expected per capita damage that is greater than 5 percent of the county's average per capita income.
- 5.8 million people are projected to face expected damage that exceeds the 5 percent threshold by 2050, and 10 million people by 2075.

The CBO's paper outlines the federal budgetary implications of hurricane damage, noting discretionary spending required for FEMA's Disaster Relief Fund, and mandatory spending required to support claim payments made through the National Flood Insurance Program.

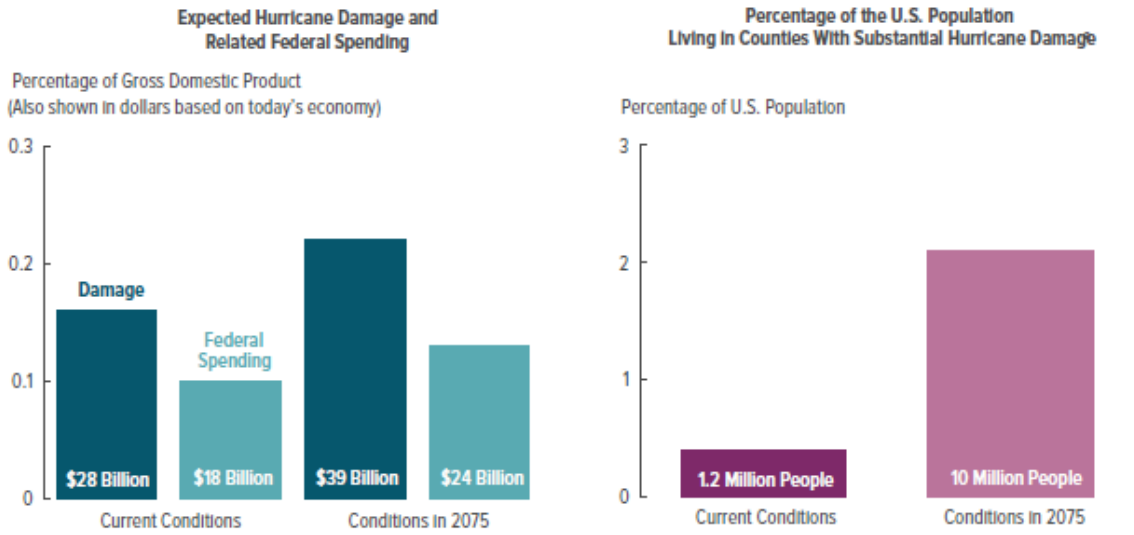
The CBO found that federal spending as a percentage of damage rose from 17 percent before Katrina struck to 62 percent from Katrina forward.

CBO's estimates of hurricane damage, federal spending and the substantially affected population (for 'current conditions' and conditions in 2075) are set out in Summary Figure 1 below[28].

[28] Congressional Budget Office, 'Potential Increases in Hurricane Damage in the United States: Implications for the Federal Budget', June 2016, p 34.

Summary Figure 1. Return to Reference

Estimates of Hurricane Damage, Federal Spending, and the Substantially Affected Population



Source: Congressional Budget Office.

CBO's estimate of expected annual hurricane damage at present—the "reference case"—is based on estimates of the current frequency of hurricanes, current state-specific sea levels, and the current valuation of property exposed to hurricanes.

CBO's estimates of federal spending are based on a scenario in which federal aid for relief and recovery—measured as a percentage of the damage resulting from hurricanes—stays roughly the same as it has been over the past decade.

CBO's estimates of expected hurricane damage in 2075 are based on the average results of 5,000 simulations, with each simulation using a unique set of draws (random selections) for the underlying conditions that determine expected damage.

a. People exposed to substantial hurricane damage are defined as those living in counties in which per capita expected damage is greater than 5 percent of the county's per capita income.

The CBO examined several options for policymakers seeking to reduce future federal spending on hurricane damage, namely:

- A coordinated effort to significantly reduce global greenhouse gas emissions between now and 2075 (with the caveat that reductions in global emissions would begin to have more significant effects on the rise in sea levels by the end of the century).
- Requiring greater cost sharing by private entities and state and local governments to provide an incentive for them to more fully account for the extent of expected damage and thereby reduce the pace of coastal development – with options including increasing insurance requirements for households and businesses, increasing the minimum amount of statewide per capita damage that is used as the primary criterion for providing federal assistance, and reducing the statutorily set minimum share of costs borne by the federal government for assistance provided from FEMA's Disaster Relief Fund.
- Investing in structural changes to reduce vulnerability to hurricane damage.

While the CBO's study was conducted several years ago its fundamental conclusions remain valid today.

Implications for other states

There are parallels between the situation in Florida before Andrew and the mid-Atlantic and New England areas today. While risk assessment tools are well advanced and scientific understanding of risk is far better, aside from Sandy the region has not experienced a large event in recent decades. There are large risk concentrations from Maryland to Maine, and building codes are far less stringent than in Florida. In addition, there is a high proportion of older properties surrounded by large trees that have not been stressed by extreme hurricanes.

Further, places like Norfolk, Virginia, and New York City are susceptible to significant coastal flooding. The densely built up New Jersey shoreline consists of many vulnerable barrier islands also prone to erosion and flooding. If major storms hit areas like these, losses could be catastrophic. Climate change many make such events much more likely.

Many states in these areas lack the type of public insurance systems which Florida has built up over several decades since Andrew. An extreme hurricane event could trigger widespread market disruptions of the type seen in Florida after Andrew. States' ability to use tools of the type created in Florida would be limited by their smaller size and lower premium bases available for assessments to support insurers of last resort or post-event bonding in a facility like the FHCF.

These conditions represent a significant risk to consumers, insurers, financial institutions, and governments. While it is not possible to anticipate what policy responses might be developed in response to a catastrophic loss, experience from Sandy indicates that the Federal government would be called on to provide significant relief, in addition to its existing obligations under the NFIP, various federal infrastructure responsibilities, or disaster relief programs.

A significant risk would follow the event if insurance markets were sufficiently disrupted to expose mortgage lenders to default losses on mortgages in high risk area if insurance (including against flood from the NFIP) is unaffordable, unavailable, or not adequate to cover the loan exposure. This issue is beyond the scope of my testimony, but a risk which merits close attention.

Mr. Rade Musulin

Qualifications

Associate of the Casualty Actuarial Society

Member of the American Academy of Actuaries

Certified Catastrophe Risk Management Professional

Graduate of the Australian Institute of Company Directors

BA in Applied mathematics
John Hopkins
University (US)

Profile

Rade has 45 years' experience in insurance, specializing in property pricing, natural perils, reinsurance, agriculture, catastrophe risk modelling, public policy development, and climate risk. Rade was named co-Actuary of the Year by the Australian Actuaries Institute in 2023 for his work on climate risk and sustainability, including being the International Actuarial Association's representative at the UN Climate Conferences COP27 and COP28.

Rade has spent the majority of his career developing frameworks for funding extreme events in the United States, Asia, and Australia. He has been active in projects to improve adaptation and resilience through forward looking building code and land use policies, including understanding the financial system's exposure to growth in high-risk areas and how shifts in risk resulting from global warming may affect future disaster funding needs.

He was previously CEO of FBAlliance and a senior executive at the Florida Farm Bureau Insurance Companies, both part of the American Farm Bureau system, providing insurance services to Farm Bureau members in the US. He also served as COO Analytics for Aon Benfield Asia Pacific, leading a team delivering technical support for reinsurance placements in the region.

Rade has deep experience working with government agencies in many countries, bringing global best practice to extreme event management and climate risk assessment. Rade has served in government related roles, including as Chair of the Florida Hurricane Catastrophe Fund Advisory Council and as a policy advisor to government insurance pools. He currently leads Finity's stakeholder engagement for the Cyclone Reinsurance Pool for the Australian Reinsurance Pool Corporation and Commonwealth Treasury.

Rade has also been a lecturer for university programs on catastrophe risk and is on the Editorial Board of Oxford University's Environmental Hazards Journal.

He is a past Vice President of the American Academy of Actuaries and past Chair of the Australian Institute's Climate and Sustainability Working Group. He is the current Chair of the International Actuarial Association's Resource and Environment Virtual Forum and a member of its Insurance Regulation Committee.

Select Publications

Lead author for the International Actuarial Association's Climate Science: A Summary for Actuaries, which was developed in collaboration with the Working Group I Technical Support Unit of the Intergovernmental Panel on Climate Change (IPCC).

Lead author of the Australian Actuaries Institute's Research Paper Property Insurance Affordability: Challenges and Potential Solutions.

Member of the Flood Insurance Working Group (Chair 2017) that authored the American Academy of Actuaries The National Flood Insurance Program: Challenges and Solutions.

Author of two articles on the drivers of growing catastrophe risk and its potential effects on the US economy, Demographics, Development, and Disasters and Rising Tides.

Co-author of the Australian National Climate Change Adaptation Research Facility report Market-based Mechanisms for Climate Change Adaptation.