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**Written Testimony**

**House Select Committee on the Climate Crisis**

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Chair Castor, Ranking Member Graves, and members of the Select Committee:

Thank you for inviting me to testify today. My name is Lauren Alexander Augustine, and I am the Executive Director of the Gulf Research Program at the National Academies of Sciences, Engineering, and Medicine. The views I express today are my own and not the views of the National Academies as an institution unless otherwise noted.

I appreciate the opportunity to speak about equity, resilience, and adaptation. The Intergovernmental Panel on Climate Change (IPCC) Working Group II Report warns that climate change will impact more people in “grave and mounting” ways. So, the question before all of us is how can we avoid “grave and mounting” outcomes and instead achieve equity and resilience as we adapt to climate change.

There are three main elements to my testimony today that could help reduce the costs of disasters and improve the safety and resilience of the citizenry. First, I will talk about the components of equity and resilience: environment, energy, economy, and people. None of these components are static; and, they interact in ways that impact and are impacted by each other. The second part is about integrating across levels of government to connect communities to the knowledge and resources they need.

Finally, there is a fierce urgency of now. We have a rapidly closing window of opportunity in which to reduce our planet-warming emissions and make investments today that will create a more prosperous,

healthy, and equitable future for all Americans. Now is a once-in-a-generation opportunity to bend the arc towards equity and resilience.

#### **ELEMENTS OF EQUITY AND RESILIENCE**

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*An effective and equitable resilience strategy will require managing environmental, economic and demographic risks.*

The environment and climate, our economy, and where and how our populations live are basic elements that determine to what extent our communities will be equitable, adaptive, and resilient.

On **environment and climate transitions**: the scientific evidence is unequivocal that climate change is a threat to human well-being and planetary health. The IPCC Working Group II Report on Impacts, Adaptation and Vulnerability is clear and dire in its predictions as to how climate change will be seen and felt. It is the latest in a series of reports from scientific experts and academies around the world about the impacts climate change will bring. We can already see some of these changes. In 2017, the US saw its costliest hurricane season, pushing 2005—the infamous year with Hurricanes Katrina, Rita, and Wilma—to the second most costly; 2021 was the third costliest. In 2017, Hurricanes Harvey, Irma, and Maria and the California wildfires affected 47 million people, some 15% of the US population (Hill, 2021), and those three hurricanes rank in the top 5 costliest hurricanes in the United States history (NOAA, 2022).

Climate change means that we can expect to see a rise in the number of billion-dollar disasters, as well as the likelihood of modest or even smaller events occurring in rapid sequence, the aggregate of which can create more damage, costs, and trauma than a single large event. Compounding and sequential disasters will look like the 2020 hurricane season, the most active Atlantic hurricane season ever in the United States. In that season, a record 11 hurricanes made landfall in the United States; a record five (5) named storms made landfall in the Gulf of Mexico states; and ten storms underwent rapid

intensification, a process that requires extremely warm water (near or above 30 °C, 86 °F). Climate change also led to several anomalous events in 2021, like the hurricane-force winds in April that capsized the Seacor Power lift boat and killed 13 people; deadly tornadoes in December that killed 100 people in Kentucky; and Hurricane Ida—which devastated Grand Isle, Louisiana—claimed 75 lives along its five-day path to Philadelphia and New York City where it resulted in deadly flooding.

These are some of the dramatic events, the ones that capture national attention and make headlines. There are also gradual environmental changes in the form of sea-level rise, incremental increases in “nuisance flooding,” coastal land loss, land subsidence, heat waves, and, of course, the slow march of drought. Combined with aging and deteriorating infrastructure, it is easy to understand the dire warnings in the IPCC Working Group II Report cautioning that some areas will become “uninhabitable.”

On **economic transitions**: thanks to COVID-19, we all have a new sense of how quickly societal fortunes can shift and what a “new normal” can look like. One thing remains true: a healthy economic base is one of the capitals of community resilience. In a primary driver of our economy, the energy sector, key transitions are underway. These include a shift from oil and gas production to exportation driven by high domestic onshore production; a dramatic decline in production of both oil and gas in shallow waters of the Gulf of Mexico since 1996; a significant increase in the production of oil in deeper waters in the same time;<sup>1</sup> and a transition to clean energy in electricity generation and transportation. These transitions will manifest in how and where we travel, and what the future workforce needs could be. For example, major multinational energy companies, such as BP, Shell and Total, have recently made commitments to achieve net-zero in their internal emissions around mid-century and are shifting their core businesses towards a more balanced portfolio that includes renewable sources.

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<sup>1</sup> Burgess, G.L., K.K. Cross and E.G. Kazanis. 2020. *Estimated Oil and Gas Reserves Gulf of Mexico OCS Region, December 31, 2018*. Bureau of Ocean Energy Management, New Orleans, LA.

In 2019, 99.3% of the oil and 99.5% of the natural gas produced in the US offshore was from the Gulf of Mexico,<sup>2</sup> and the region's energy dominance will continue for the near future. Even still, major hydrocarbon-producing states like Louisiana and Texas are beginning to plan for a future with substantially less greenhouse gas emissions and less economic dependence on fossil fuels. In fact, Louisiana published its first Climate Action Plan this year that outlines major strides to achieve net-zero greenhouse gas emissions for the entire state economy (Climate Initiatives Task Force, 2022). It is clear that changes in these and in other sectors will continue. The challenge is to ensure these changes occur in ways that allow our economic bases to remain robust—even dominant—as a foundation to resilience will require.

**On population transitions:** Where communities are located, how land is used and developed, and population density and demographics all affect how extreme weather impacts people. Disasters do not discriminate, but low-income populations, racial and ethnic minorities, the elderly, renters, non-native English speakers, children, and those with mobility challenges are disproportionately affected (NASEM 2019). Climate change is a threat- and a risk-multiplier. In other words, disasters magnify the inequities that exist in societies such that those who are already at a disadvantage see their disadvantages compound when disasters strike. Population density drives much of the impact, losses, and costs of climate change, which is why urban areas have the deepest pockets of vulnerability due to the high concentrations of people exposed to a single event. More than 82% of the US population lives in urban areas today, reflecting a gradual but steady increase from the 73% urban population 20 years ago<sup>3</sup>. Nearly 100 million Americans live in coastal areas (including coasts of the Gulf and Great Lakes), and 60 million of those people live in the areas most vulnerable to hurricanes (US Census, 2019). Development

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<sup>2</sup> U.S. Energy Information Agency. [www.eia.gov/dnav/pet/pet\\_crpdn\\_adc\\_mbbl\\_m.htm](http://www.eia.gov/dnav/pet/pet_crpdn_adc_mbbl_m.htm)  
Aaron O'Neill. <https://www.statista.com/statistics/269967/urbanization-in-the-united-states/> February 2, 2022

<sup>3</sup> Aaron O'Neill. <https://www.statista.com/statistics/269967/urbanization-in-the-united-states/> 02 February 2022

patterns, impervious surfaces, and building materials—these all influence whether our built environment will help us or hurt us when the weather turns extreme in terms of flooding, heat, and wind. In short, the ways and places in which we live are likely to continue to impact and be impacted by our changing environment (NOAA, 2021).

Thus, the mix of people, economy, and the environment shape the changes coming our way. At the Gulf Research Program, we seek to find balance and alignment across the diverse priorities and challenges of the environment, energy, and the people of the Gulf Region under conditions of change and uncertainty. The five states around the Gulf of Mexico—Texas, Louisiana, Mississippi, Alabama, and Florida—account for more than 60% of the federal disaster relief fund expenditures. If we can find a workable balance in this region across energy, the economy, the environment, and people, this region could serve as a model for other parts of the country.

#### **RESILIENCE IS LIKE A ZIPPER**

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*An integrating approach that works across levels of government to connect communities to the knowledge and resources they need is essential.*

Resilience is many things: a spring (physics), a curve (Madni et al, 2020), even a set of community assets (NASEM 2019). I think of resilience like a zipper: there are many dimensions and pieces to it (the teeth) that when undone do not do anyone much good. But together, it connects distant ends with lots of steps and pieces in between them into something useful, strong, and protective.

One end of this zipper is the officials and communities at the local level and the other end is the national guidance and federal resources. Resilience emerges in the connecting of these ends when local communities are able to harness support from all levels of government—under a mix of policies and practices—to plan and prepare for, absorb, respond to, and recover from disasters and adapt to new conditions (NASEM 2012). The Stafford Act provides guidance, authorities, and resources for essential

support functions in responding to a disaster, but this focus on post-disaster funding may inadvertently contribute to the chronic underfunding and inadequate investments in local and state authorities for preparedness and adaptation (Hill, 2022). So, another function of the zipper is to connect post-disaster resources with those related to planning, mitigation, and adaptation.

The Gulf of Mexico region provides excellent examples for how this kind of resilience zipper can work. The Gulf Research Program (GRP) was created with an endowment from the criminal penalties from the Deepwater Horizon oil spill, and our charge is to use science, engineering, and medicine to enhance offshore energy safety, environmental protection, and community health and resilience to benefit the people of the Gulf. Our role is like the slider and the pull on a zipper; the environment, energy, and climate dimensions, as well as the data and resources associated with them, are like the teeth; the top end has the federal resources and authorities; and the base and the foundation of the zipper, is the local communities. The GRP, specifically, and science, more generally, can help interpret and translate data; connect the federal family of resources with local priorities; and build capacity in the region for local solutions to address the issues related to offshore energy, the environment, and the people.

**Data and information.** If the IPCC Working Group II Report tells us anything, it is that a strong scientific evidence base supports their dire warnings and predictions. Sometimes, it is hard to know what to do with data in the contexts of smaller geographies, regional dynamics, or resource-constrained decision making. Organizations like the GRP can be very helpful in working with local entities to interpret, translate, and apply data. Let's take sea-level rise in the Gulf of Mexico region: later this century, changes in sea level relative to the land will be a significant factor affecting coastal ecosystems and communities in the Gulf. More reliable projections of relative sea-level rise are needed for natural-resource management, restoration, and ensuring the resilience of Gulf communities (NASEM 2018). The GRP works at the regional scale to interpret, translate, and describe sea level variation and rise specifically within the Gulf of Mexico. Ultimately, the GRP's work will apply this understanding to more

reliable forecast models and projections, making the science and data more relevant and useful to local and regional decision makers.

**Federal agencies as a resource.** The federal agencies provide structure, guidance, and yes, sometimes limitations, to local activities related to building equity and resilience. The GRP will connect and facilitate the best and the most helpful elements of federal resources to local resilience efforts. For example, through the GRP regional sea-level rise work, we require our partners to work with the National Aeronautics and Space Administration (NASA) Sea Level Change Team or NOAA's Center for Operational Oceanographic Products and Services (CO-OPS) to capitalize on those federal programs' deep datasets, responsibilities, and institutional knowledge for more accurate regional sea level predictions. To ensure that the base of the zipper is included, the GRP further requires these models, projections, and information products to be useful to end-users, including decision-makers, natural-resource managers, and state and local entities. Other federal agencies are also resources to the Gulf, given the billions of dollars the region receives in disaster funds each year, plus the substantial flood protection and navigation infrastructure in the region. In November 2021, the same day President Biden signed the Bipartisan Infrastructure Investment and Jobs Act into law, the GRP held a "serious game" [workshop](#) on [federal infrastructure investments](#) in the Gulf of Mexico region for Gulf-based experts and federal agencies. It was viewed as highly successful, and we plan to rerun the "serious game" in the Gulf region this spring.

The more we all can connect the resources and authorities of the federal agencies with the needs, expertise, and capacity at the regional and local scales, the easier it will be to bend the climate arc toward equity and resilience.

#### **THE FIERCE URGENCY OF NOW**

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*We have a window of opportunity to make investments today that will create a more prosperous, healthy, and equitable future for all Americans.*

Dr. Martin Luther King, Jr. spoke of the “fierce urgency of now” in his famous “I Have a Dream” speech; in his Nobel Peace Prize acceptance speech he added, "... Our very survival depends on our ability to ... adjust to new ideas, to remain vigilant and to face the challenge of change." When we talk about climate, equity and resilience, Dr. King’s words from a generation ago ring prophetic now. The climate is changing, and the future looks grim and the challenges are mounting. The IPCC report warns that our window of time to act is closing, but it is still open. The time to act is now. The generations of the future depend on our actions today, and they will know what we knew, when we knew it, and how we chose to act.

The good thing is that we are positioned to start this work: we have information, resources, and motivation to make sure we avoid the worst of the predicted changes. The scientific community has generated rich data that describe and explain how physical and natural environments are changing, economic and other forces that drive those changes, and consequences of those changes. Models exist to help us understand how dynamics shift in future scenarios under different conditions. Social scientists have quantified ways that social inequity is entrenched in many of our laws, policies, and allocation of resources. They have given voice and an evidence base to the acute vulnerabilities faced by the elderly, poor, ethnic and racial minorities, and disenfranchised people in communities around the country and around the world. Federal, state, and local governments are embarking on long and sometimes uncomfortable investigations into how their policies affect people unevenly, as some policies can benefit one set of people, have no effect some, and can even bring harm to others. Reports like the IPCC Working Group II Report, the National Academies’ reports on Urban Flooding (NASEM 2019) or Community Resilience (NASEM 2019), and numerous peer reviewed journal articles help frame these issues in a holistic, connected way. We cannot say we do not know.

The key is to start with the fierce urgency of now. The Gulf region is a good place to start. The Gulf of Mexico region faces acute and costly risks, sea-level rise, climate change that produces more intense hurricanes, and aging or abandoned infrastructure both on- and off-shore. The communities most at risk are those that are least equipped to withstand the current and future challenges they face. With the bipartisan Infrastructure Investment and Jobs Act, we have the promise of a once-in-a-generation infusion of funds to improve critical infrastructure. These funds are designed to reach communities through existing federal programs, layered with the Justice40 Initiative to ensure that 40 percent of these funds benefit disadvantaged communities that have been historically marginalized<sup>4</sup>. Examples of funds that could be used to make a real difference in how communities approach climate risks include: HUD's Community Development Block Grants (CDBG) series; FEMA's Hazard Mitigation Grants and Building Resilient Infrastructure and Communities programs; Army Corps of Engineers' Climate Preparedness; NOAA's coastal resilience programs, and many others. The GRP aims to work in a small number of pilot communities around the Gulf region to connect the local capacity, expertise, and priorities; scientific information; and federal resources to build equitable and resilient infrastructure for communities to withstand and thrive in the face of climate change. GRP brings expertise in physical sciences, engineering, environment, health, and social justice and acts as a neutral convener. As such, we engage communities, facilitate plans, and work with federal agencies and local communities together to build resilience, support the economy, reduce inequities to withstand expected effects from climate change.

The past few years have previewed what living with climate change could be, and it portends a difficult and expensive future. Billion dollar price tags have accompanied fires in the west, a crippling ice storm in Texas, deadly heat in the Pacific Northwest, and, of course, record hurricane seasons, all while the

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<sup>4</sup> On January 27, 2021, President Biden signed Executive Order (EO) 14008, *Tackling the Climate Crisis at Home and Abroad*, creating the government-wide Justice40 Initiative.

world was under the vice-grip of COVID-19. One option: we could wait to take action, or we could start now. We can use our 2022 situated knowledge to create smart approaches that bend our future arc towards equity and resilience. Developing a coherent and robust response to the challenges and threats posed by climate change is within our grasp. The work of this committee demonstrates that there is necessary common ground for constructive action to effectively prepare for an uncertain future. We can use the best science and predictions to design infrastructure, energy options, and development for the future so that, in the words of General Thomas Bostick, 53<sup>rd</sup> Chief of Engineers of the USACE, “in 100 years, people will look back on what we did today, and say we did the right thing.”

I thank you again for this opportunity to appear before you and all of the members of the Committee today on this panel.

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## REFERENCES

- Hill, Alice C. 2021. *The Fight for Climate After COVID-19*. Oxford University Press.
- Madni, Azad & Erwin, & Sievers, Michael. (2020). Constructing Models for Systems Resilience: Challenges, Concepts, and Formal Methods. *Systems*. 8. 3. 10.3390/systems8010003.
- National Academies of Sciences, Engineering, and Medicine. 2012. Disaster Resilience: A National Imperative. Washington, DC: The National Academies Press. <https://doi.org/10.17226/13457>.
- National Academies of Sciences, Engineering, and Medicine. 2018. *Understanding the Long-Term Evolution of the Coupled Natural-Human Coastal System: The Future of the U.S. Gulf Coast*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/25108>.
- National Academies of Sciences, Engineering, and Medicine. 2019. *Building and Measuring Community Resilience: Actions for Communities and the Gulf Research Program*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/25383>.
- National Academies of Sciences, Engineering, and Medicine. 2019. Framing the Challenge of Urban Flooding in the United States. Washington, DC: The National Academies Press.  
<https://doi.org/10.17226/25381>
- Monica Vidill, March 7, 2018. <https://blogs.worldbank.org/sustainablecities/why-engaging-women-and-children-disaster-risk-management-matters-and-how-it-makes-difference>