

Adapt or Perish

Preparing for the Inescapable Effects of Climate Change

By [Alice Hill and Leonardo Martinez-Diaz](#)

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It's getting hot in here: a fire in Windsor, California, October 2019

Max Whittaker / The New York Times / Redux

Ever since climate change became a concern for policymakers and laypeople alike, the focus of public debate has largely been on mitigation: limiting greenhouse gas emissions, capturing carbon, and transitioning to renewable energy. Those efforts must continue if we hope to keep the planet hospitable. But it is also time to acknowledge that—no matter what we do—some

measure of climate change is here to stay. The phenomenon has already affected the U.S. economy, U.S. national security, and human health. Such costs will only grow over time. The United States must build resilience and overhaul key systems, including those governing infrastructure, the use of climate data, and finance.

Otherwise, the blow to the U.S. economy will be staggering. Assuming that current trends continue, coastal damage, increased spending on electricity, and lost productivity due to climate-related illness are projected to consume an estimated [\\$500 billion](#) per year by the time a child born today has settled into retirement. Other estimates suggest that the U.S. economy will lose about 1.2 percent of GDP per year for every degree Celsius of warming, effectively halving the country's annual growth.

Climate change also threatens to fray the United States' social fabric. Although no region will be spared, some parts of the country—especially the [South](#) and the [lower Midwest](#)—will likely suffer more from climate change, and poor and vulnerable people across the United States will feel the greatest pain. Hundreds of thousands of people will be forced from their homes by [coastal flooding](#). Against the backdrop of already high economic inequality, these effects will further deepen the United States' political and regional cleavages.

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The country is already getting a preview of the chaos to come. [Hurricanes](#) in the Atlantic and on the Gulf coast and [wildfires](#) in the West have intensified. Floods have [hampered agriculture](#) in the Midwest, even as droughts and heat waves have grown [longer and more common](#) across the Southwest. Once regarded as theoretical possibilities in the distant future, the impacts of climate change have become the stuff of daily headlines.

Yet much of this future damage is preventable. The best approach is also the most obvious: cutting greenhouse gas emissions to arrest rising temperatures. The 2015 Paris agreement on climate change established a global framework for governments to cut emissions, but in 2017, U.S. President Donald Trump announced his intention to [withdraw](#) the United States from the deal. (He began the formal exit process in 2019.) Washington should return to the Paris agreement and redouble its efforts to reduce carbon emissions.

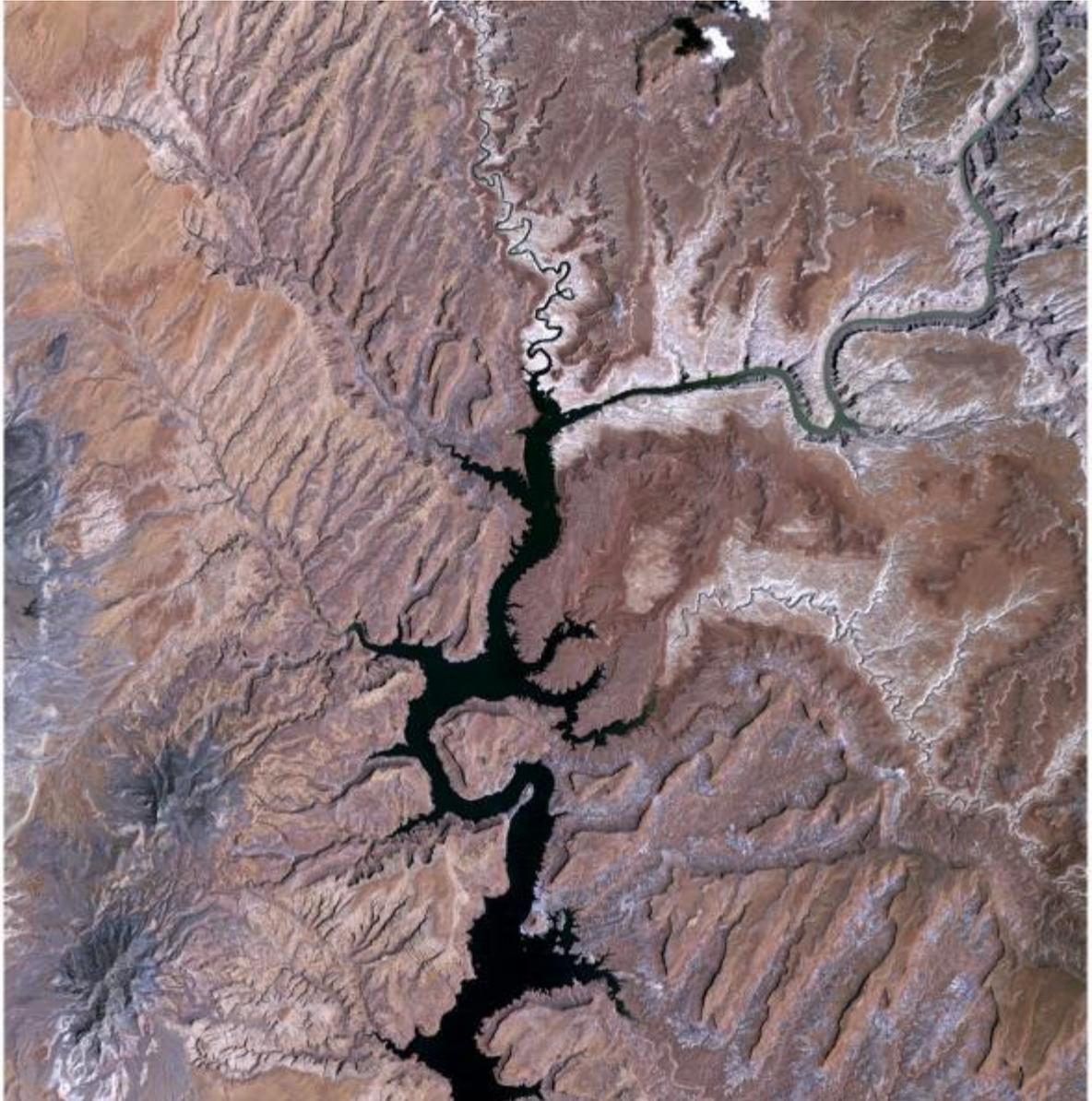
At the same time, the United States must prepare itself for the future effects of climate change. The country's industrial, commercial, and military infrastructure has been built to withstand historical weather extremes. But no matter what is done to slow it, climate change will push beyond historical boundaries, setting new records. The infrastructure, data systems, and financial policies of the United States must be upgraded in order for the country to survive.

FINDING SAFER GROUND

The road to preparedness begins with stronger regulations about where and how the country builds public infrastructure, as well as commercial and residential buildings. Today, building standards and practices assume that the climate is stationary, but climate change has rendered that assumption untenable.

Consider the Kwajalein atoll, a group of islands that is home to the U.S. Air Force's "space fence," a radar system that can track objects as small as a baseball through outer space to avert collisions with spacecraft. Before construction began on the \$1 billion project, the Department of Defense conducted a [risk assessment](#) based on historical data and concluded that neither tidal nor wave flooding would pose a threat. But four years later, once construction was already underway, the military commissioned [another study](#), this one informed by future projections. It found that flooding from rising sea levels could threaten the supply of freshwater used by military personnel living on the islands in the near future and that by 2055 a majority of the atoll could flood every year. The problem is not limited to this one facility. In 2019, the Government Accountability Office, an independent watchdog that works for Congress, found that most U.S. military installations [failed](#) to use climate projections in their master plans.

Civilian construction is also at risk. Unlike [many developed countries](#), the United States has no single, national building code. Private organizations—such as the International Code Council and the National Fire Protection Association—create their own standards. Then, state governments, local communities, and the military decide whether to adopt those regulations. As a result, some parts of the country have outdated codes in place. Others have none at all. Even in areas with strict standards, the building codes [do not yet account](#) for future risks from climate change.



Left to right: Lake Powell, on the border between Utah and Arizona, in 1991 and 2015

NASA / Reuters

This is not to suggest that the federal government should develop a mandatory national building code. (Such a code could well run contrary to the constitutional division of power between the federal government and the states.) But it could certainly create a standard for federally funded projects, which would allow it to redirect existing tax dollars to those investments that have been designed to withstand future climate impacts. The Obama administration took this approach when it created the Federal Flood Risk Management Standard to govern construction in floodplains. But in 2017, ten days before Hurricane Harvey dumped some four feet of rain on Houston, the Trump administration [rescinded](#) that standard.

Federal, state, and local governments must also work together to encourage people to move out of places that cannot be salvaged or protected at a reasonable cost. Typically, the federal government does this by providing funds to local governments to buy at-risk homes. In the past [30 years](#), the United States has bought more than 40,000 flood-prone properties. But

because such relocation programs remain voluntary, they often result in piecemeal change. To solve this, both the federal and state governments must implement strategies that target the most at-risk areas and encourage community-wide participation.

Another key obstacle is cost. The federal government has recently undertaken two experiments in relocating entire communities to safer ground. In 2016, it awarded a grant to move the approximately 80 residents of Isle de Jean Charles, an island off the coast of Louisiana that is [slipping into the sea](#). The bill came to \$48 million—a staggering \$600,000 per person. In 2018, the federal government paid the 350-odd residents of the tiny Alaskan village of Newtok \$15 million to move [farther inland](#). This is just a fraction of the full cost of that relocation, which is estimated to surpass \$100 million. For much larger communities, the relocation costs would soon become exorbitant. The government, working with academics and community leaders, must devise more cost-effective ways to facilitate community-scale relocation.

The government should also withdraw taxpayer dollars from new developments in risky areas. The problem is that the areas that are the fastest growing and most lucrative for developers are often also the most flood-prone, since the most coveted places to live are typically next to water along rivers or coastlines. In New Jersey, for example, developers have built almost three times as much housing in coastal flood areas as in less risky areas since 2009. By 2100, if such trends continue, an estimated 3.4 million homes nationwide could face [regular inundation](#). To avoid this, the federal government must phase out the insurance subsidies and federally backed mortgages that prop up communities knowingly built in risk-prone areas.

The U.S. government should consider creating a national relocation commission.

The story in wildfire-prone California is not any better. Within weeks of the 2018 Camp Fire—the deadliest and most destructive wildfire in the history of the state—the county of Los Angeles [approved](#) a 19,000-home development in areas designated by the state’s fire agency as being particularly vulnerable to fire. Those homes will add to the estimated 1.7 million residences across the country that have already been identified as being [at risk from wildfires](#).

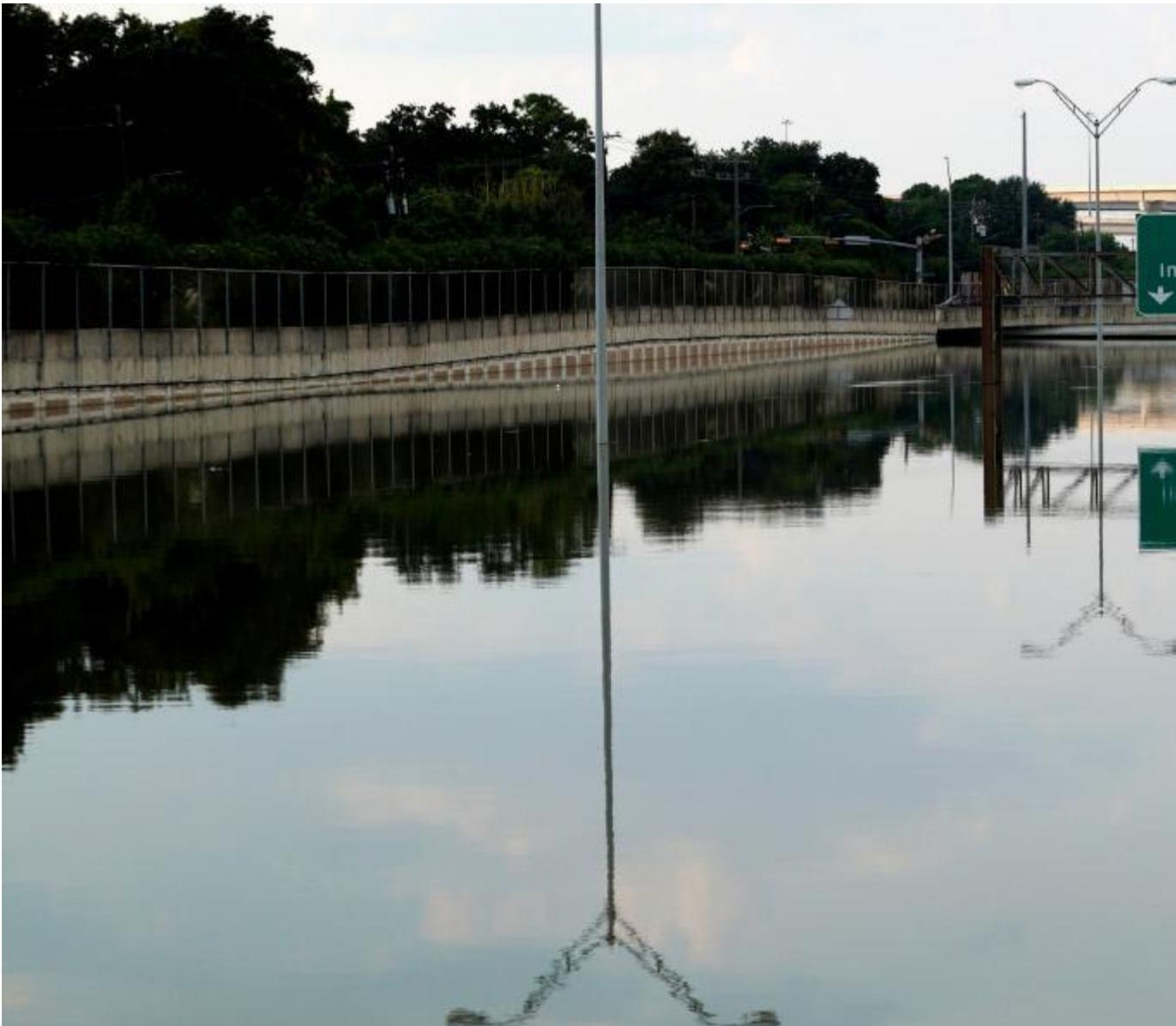
Even if some communities relocate successfully and new construction in dangerous areas declines, extreme weather events will still displace hundreds of thousands of Americans. Indeed, managing climate-related internal migration could become a major social and economic challenge, the likes of which the United States has seen only in miniature. In 2005, Hurricane Katrina turned [more than one million people](#) into migrants—in what was among the largest displacements of Americans in history. A quarter of a million of them ended up in Houston; about 150,000 were still there a year after the storm, increasing the total population of the city’s metropolitan area by almost four percent. After the Camp Fire in California, the city of Chico saw its population [swell](#) by 20 percent within a matter of hours. In the coming decades, hundreds of thousands of people may leave vulnerable cities such as Miami and New Orleans. Such large and sudden movements of people will likely put unprecedented economic and social pressure on the communities that take in the migrants.

To prepare for this challenge, federal, state, and local governments should set aside funds to assist communities that receive large numbers of migrants. They should also identify mechanisms that would facilitate the transit and resettlement of displaced people—providing, among other things, modest cash grants to help individuals with their initial moving expenses. Governments should also ease the transition by offering job training and placement assistance, as well as tax relief to cover resettlement expenses. And to shore up the infrastructure in cities

likely to be at the receiving end of internal migration, the public and private sectors should collaborate to create transitional housing units, develop additional capacity in schools and medical facilities, and strengthen social service provision. In other words, federal, state, and local governments need to consider how they will reconfigure themselves to deliver better support in the face of growing displacement, perhaps even creating a White House–led national relocation commission to coordinate federal efforts and strategy.

KNOW THY ENEMY

All these improvements will be tougher to make in the absence of reliable information about where climate change will likely hit the hardest, and how. In a warming world, a variety of activities, from purchasing a home to cultivating crops, will require highly localized climate and weather data. Thus, the quest for resilience will also demand greater access to such data—information that can enable governments, businesses, and households to understand the climate-related risks they face and how to manage them. Without that information, communities will be flying blind.



The floodwaters from Hurricane Harvey in Houston, September 2017

Rick Wilking / Reuters

Governments and the private sector collect and process more climate and weather data today than at any other time in history. Satellites, drones, land- and sea-based sensors, and even cell phones collect data about everything from soil moisture to ocean temperatures. And thanks to cloud computing and machine learning, governments and businesses can now use all this information to build ever more powerful models for visualizing and managing future risks.

Yet many of those who desperately need these tools and information cannot access them. Think, for example, of Perdido Beach, a small town on the coast of Alabama threatened by rising sea levels, floods, and hurricanes. During a 2014 meeting with government officials focused on building resilience to climate change, Patsy Parker, the town's part-time mayor, [explained](#) her predicament: "I don't have a big planning staff, grant writers, or any resources. So how can I even know the size of the threats we are facing—and what can I do to protect the people of my town?" Thousands of communities across the United States face the same quandary.

During the Obama administration, the federal government worked hard to make climate change data more widely available. But the result was less than ideal: a patchwork of partially overlapping data "hubs" run by separate government agencies, including the Department of the Interior, the Department of Agriculture, the National Oceanic and Atmospheric Administration, and the Federal Emergency Management Agency. To get the information they need, farmers, city planners, first responders, and others are forced to navigate this unwieldy system. Even federal policymakers have trouble. As the Government Accountability Office [warned](#) in 2015, the federal government's climate data system is so fragmented that "decision makers are vastly underserved."

Cost is another problem. Private-sector companies continue to develop powerful tools to help clients understand how climate impacts could affect individual industrial parks, farms, and other assets. But those tools remain proprietary and unaffordable for many communities and small businesses.

To remedy these problems, the federal government should consolidate the existing system into a network of "resilience hubs," each serving a different region of the country. Backed by the federal and state governments, these centers would provide localized climate and weather data to those who need the information most. They would also provide technical help and guidance to local governments, small businesses, and communities seeking to build resilience. The hubs should ensure that climate information collected with taxpayer money remains freely and openly available, along with basic tools for translating the information into useful formats. Academic and nonprofit institutions should also do their part by promoting the development of free, open-source climate and disaster models—simulations that local governments and small businesses could use to forecast and manage risks.

THE PRICE OF CHANGE

Building resilience on the scale required will be expensive—but not as expensive as trying to deal with the damage after it has occurred. The U.S. government must therefore fundamentally rethink the way it finances preparedness for and recovery from climate-induced disasters. The prevailing approach is to underinvest in resilience and then pay for the damage afterward, leaving taxpayers to foot the bill.

Already, the costs are significant. For example, in 2017, after devastating wildfires and the unprecedented destruction of Hurricanes Harvey, Irma, and Maria, Congress authorized nearly \$140 billion in emergency aid. It [borrowed](#) most of this money, adding to the growing national debt. This is neither smart nor sustainable. As natural disasters grow in frequency and intensity, they will only weaken the country's already deteriorating fiscal situation. Communities and businesses will need more and more money to rebound from the effects of extreme weather, especially if shortsighted building and land-use practices continue.



A horse statue during the fires in Windsor, California, October 2019

Stephen Lam / Reuters

The smarter way is to spend before disaster strikes. One review conducted by the National Institute of Building Sciences of several thousand federally funded projects over a period of 20 years concluded that every \$1 spent on preparation saves society an average of \$4. (An [update](#) to that study revised the savings upward, to \$6.) Similarly, the Global Commission on Adaptation, a group of public- and private-sector leaders from around the world, has

calculated that investing \$1.8 trillion on preventive and protective measures globally could generate as much as [\\$7.1 trillion](#) in net benefits.

But even if investing in resilience is cost effective, these measures will require new money. Prudent borrowing and higher taxes could fill the financing gap. In 2017, under a Republican mayor, voters in Miami approved a referendum to issue \$400 million in "[Miami forever bonds](#)," the proceeds of which will pay for coastal-protection infrastructure, new flood pumps, and upgraded storm drains. These investments will buy Miami valuable time to consider longer-term options as the water rises.

In general, however, tax hikes are unpopular, and bonds—although useful for funding specific projects—rarely generate the type of sustained, reliable revenue required for investments in climate resilience over the long haul. Governments will need to combine these tools with other approaches. For instance, they could use revenues from carbon taxes and cap-and-trade schemes designed to reduce emissions. But this hasn't happened yet. The Regional Greenhouse Gas Initiative, a cap-and-trade system run by a group of northeastern U.S. states, has raised at least \$2.6 billion through the sale of permits. Yet only Delaware appears to have used a portion of its share to build resilience; the other states have invested primarily in efforts to cut emissions or have returned the money back to taxpayers. Meanwhile, California's cap-and-trade mechanism generated \$4.5 billion between 2012 and 2016. Some of the revenue has been used to pay for activities related to resilience, but the state has not formally designated a share of the funds exclusively for that purpose.

Every \$1 spent on preparation saves society an average of \$6.

Businesses and homeowners will also need to be given incentives to embrace resilience in the first place. To provide those incentives, the government will have to fix the National Flood Insurance Program—the federal program that serves as the primary flood insurer in the United States. The program does not always charge insurance premiums that reflect the true risk of flooding. About 20 percent of the properties insured, typically those in risky floodplains, receive subsidized insurance, transferring the risk to the government and reducing incentives for homeowners to move to safer ground or to invest in retrofits to make their dwellings safer. The NFIP also continues to insure homes that have repeatedly flooded. Because its rates do not reflect actual risk, the program is now billions of dollars in debt.

Congress tried to fix the flood insurance system in 2012 by charging [actuarially sound](#) premiums, but a political backlash forced the proponents of the change into a swift retreat. The failed NFIP reform did not provide enough time and support for at-risk households to adjust to the increased costs. Congress must try again, but this time it should phase out the subsidies over a longer period of time and offer adequate assistance to affected homeowners, especially to low-income households.

WAKING UP TO THE TRUTH

If the effects of climate change are increasingly obvious, then why are the public and private sectors so unprepared for its consequences? One reason is that academic disciplines and government agencies often remain isolated from each other, and neither is particularly good at working with the private sector. Resilience will require unprecedented levels of collaboration among different kinds of experts and across different kinds of organizations. For example, public health officials will have to partner with geospatial analysts and biologists to anticipate how climate change may shift the geographic spread of mosquito-borne diseases,

such as dengue and Zika. Corporate risk managers will need to work with engineers to figure out how to protect industrial facilities from new weather extremes. And military planners will have to learn from climate modelers how to secure bases and supply chains.

The politics of the moment haven't helped, either. Out of a false belief that climate change is exaggerated, the Trump administration has taken a hatchet to Obama-era reforms designed to manage its risks. Meanwhile, local governments have largely been left to build climate resilience on their own, with inadequate support from an administration that has all but erased the term "climate change" from its strategic documents. But federal leadership is urgently needed. It seems likely that the country will have to wait for a new administration to provide it.

Besides politics, the other major obstacle to progress is psychological. For decades, both public officials and private citizens have underestimated the growing risks from climate change. Behavioral economists refer to this as "[availability bias](#)," the tendency to judge the likelihood of an event based on how easily a relevant example can be called to mind. The government commission charged with investigating the 9/11 attacks, for example, [singled out](#) "a failure of imagination"—the simple inability to conceive of hijackers flying planes into buildings—as a key reason the United States had let its guard down.

The 9/11 Commission therefore recommended "routinizing . . . the exercise of imagination." The same idea could help decision-makers with climate resilience. The Task Force on Climate-Related Financial Disclosures, an advisory group with backing from financial regulators, has recommended that all publicly listed corporations regularly discuss and disclose potential climate-related scenarios to understand how accelerating climate impacts could affect their businesses.

Climate change is here. Reducing its impacts on lives and livelihoods will demand a sustained, collective effort across the United States. Both the government and private actors will need to rethink where and how they build infrastructure, how they use climate and weather data, and how they mobilize financial resources to offset potential risks. The economic case for such a transformation is clear. But putting it into practice will require creativity and collaboration. Politicians, business leaders, and the public will have to envision a planet different from the one they have come to know and put in place new systems that can ensure survival, health, and prosperity in a warmer world.

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