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"Climate Change, Part IV: Moving Towards a Sustainable Future"

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Hello and thank you, Chairman Rouda, Ranking Member Green, and Members of the Committee, for providing me the opportunity to testify remotely before you today. My name is Rachel Cleetus. I am the policy director and lead economist for the climate and energy program at the Union of Concerned Scientists (UCS). I am here today to share my perspectives on the threat climate change poses to our economy and our well-being, including disproportionate harms to low-income communities, communities of color and Indigenous communities. I also want to highlight some vital, urgent steps the federal government must take to limit these harms by cutting heat-trapping emissions and investing in climate resilience, working alongside states, businesses, and communities in the US and with other nations.

Our nation faces multiple crisis right now—the COVID-19 pandemic, an economic crisis, the climate crisis and a long-standing crisis of systemic racism—and we must respond with bold, multi-faceted and just solutions. These solutions can help our nation recover and rebuild from the current crises while also setting us on a path to a fairer, healthier, more prosperous and climate-safe economy for the long term.

Introduction

Just this week, the US passed the tragic milestone of 200,000 deaths from COVID-19 and nearly 6.9 million cases since the pandemic first began. The public health crisis in our country remains dire, with a worrying recent rise in cases. The closely connected and worsening economic crisis also demands careful attention, with millions of people out of work and many facing a loss in unemployment benefits, potential eviction from their homes, hunger, loss of health insurance and other hardships. Additionally, many small businesses are failing.

Meanwhile the climate crisis continues unabated. We are seeing a relentless rising trend in global average temperatures, with 2019 coming in as the second warmest year on record.[1] The summer of 2020 was the warmest on record for the Northern Hemisphere and the year is on track to be the first or second warmest on record for the planet.[2,3] According to NOAA, five of the warmest

[1] https://www.noaa.gov/news/2019-was-2nd-hottest-year-on-record-for-earth-say-noaa-nasa
[2] https://www.noaa.gov/news/northern-hemisphere-just-had-its-hottest-summer-on-record
[3] https://www.carbonbrief.org/state-of-the-climate-2020-set-to-be-first-or-second-warmest-year-on-record

years have occurred since 2015 and nine of the 10 warmest years have occurred since 2005. Along with rising temperatures, we are also seeing an increase in frequency or severity of heat waves, coastal flooding, droughts, wildfires and extreme precipitation.

We are now in the midst of devastating hurricane and wildfire seasons, worsened by climate change. With Tropical Storm Beta making landfall in Texas earlier this week—the 9th named storm to make landfall in the US this year—2020 is now tied with the 1916 Atlantic hurricane season for the most named storms to make landfall in the continental US on record.[4] (And we still have over two months of the hurricane season to go!) Growing scientific evidence shows a trend of hurricanes intensifying faster, and becoming wetter, slower and more destructive—which is linked to climate change.[5,6,7,8] Wildfires have burned over 7 million acres in the US thus far, with 75 active large wildfires burning right now across 11 states. California is experiencing a particularly terrible season, with four of the state's largest wildfires on record having started since August.[9] At nearly 880,000 acres, the largest California wildfire on record—the currently burning August Complex fire—is more than 400,000 acres larger than the second largest on record. Hotter, drier conditions in the western US are driving longer and more intense wildfire seasons.[10] A history of mismanagement of forests and wildfires, along with growing development in wildfire prone areas, is also raising risks to people, property and ecosystems.

Communities are experiencing compound risks from the overlap of the COVID-19 pandemic, the economic crisis it triggered, and ongoing climate and extreme-weather related disasters.[11,12] Unfortunately, the future is likely to bring more of these types of situations. The current crises also are laying bare all the fundamental inequities in our society, including racism, the wealth and income gap, unaffordable healthcare, and economic disparities faced by rural communities. Recent studies and CDC data show that COVID-19 is inflicting a disproportionately deadly toll on African-Americans, Latinos and Indigenous communities, for

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[4] Credit Philip Klotzbach for this statistic. https://twitter.com/philklotzbach/status/1308257402588856321

[5] Holland, G., Bruyère, C.L. Recent intense hurricane response to global climate change. *Clim Dyn* **42,** 617–627 (2014). https://doi.org/10.1007/s00382-013-1713-0

[6] Patricola, C.M., Wehner, M.F. Anthropogenic influences on major tropical cyclone events. *Nature* **563,** 339–346 (2018). https://doi.org/10.1038/s41586-018-0673-2

[7] Hall, T.M., Kossin, J.P. Hurricane stalling along the North American coast and implications for rainfall. *npj Clim Atmos Sci* **2,** 17 (2019). https://doi.org/10.1038/s41612-019-0074-8

[8] Aslak Grinsted, Peter Ditlevsen, Jens Hesselbjerg Christensen. Normalized US hurricane damage estimates using area of total destruction, 1900−2018.Proceedings of the National Academy of Sciences Nov 2019, 116 (48) 23942-23946; DOI: 10.1073/pnas.1912277116.

[9] CAL FIRE data. https://www.fire.ca.gov/media/11416/top20_acres.pdf

[10] UCS Infographic: Wildfires and Climate Change. https://www.ucsusa.org/resources/infographic-wildfires-and-climate-change

[11] Phillips, C.A., Caldas, A., Cleetus, R. *et al.* Compound climate risks in the COVID-19 pandemic. *Nat. Clim. Chang.* **10,** 586–588 (2020). https://doi.org/10.1038/s41558-020-0804-2

[12] Sen Pei, Kristina A. Dahl, Teresa K. Yamana, Rachel Licker, Jeffrey Shaman. Compound risks of hurricane evacuation amid the COVID-19 pandemic in the United States. medRxiv 2020.08.07.20170555; doi: https://doi.org/10.1101/2020.08.07.20170555

example.[13,14] We also know that climate change and the economic crisis are exacerbating these inequities.[15,16]

We know that we can limit the costs and harms of climate change by investing in a just and equitable transition to a low-carbon climate-resilient economy and setting science-based goals for emissions reductions. The IPCC 1.5°C special report[17] indicated that limiting the global average temperature increase to 1.5°C will require global net CO_2 emissions to reach net zero by midcentury. The US can and must exceed these global goals to contribute its fair share, achieving net zero emissions no later than 2050 and cutting its emissions by at least half by 2030. We must also make sure that local, state, and federal disaster response agencies have the resources they need to respond and help protect people from the multiple, simultaneous crises we face right now. And we have to do much more to get out ahead and make investments that will build true climate resilience in the face of worsening climate impacts. States, cities, businesses and ordinary people are leading the way in implementing solutions to get us on this path. But unfortunately, the federal government has been lagging far behind.

We can't fix the climate crisis—or any other major societal problem—if we don't build justice and equity into our solutions from the outset. Our efforts to cut emissions and ramp up clean energy and build climate resilience must center the needs of communities that have long been marginalized, discriminated against, and left behind. Addressing the cumulative burden of toxic and harmful pollution in overburdened communities and ensuring that these communities benefit directly and equitably from investments in clean energy must be part of the climate justice agenda, as detailed in the *Just and Equitable National Climate Platform.*[18] Developed by environmental justice advocates and national environmental organizations, the platform advances the goals of economic, racial, climate, and environmental justice to improve the public health and well-being of all communities, while tackling the climate crisis.

Communities need safe, affordable housing, adequate nutrition, good jobs, and affordable healthcare, and our nation must address long-standing racial and socioeconomic inequities, to ensure that all can thrive in a low-carbon climate-resilient future. That's why UCS supports the Transform, Heal, and Renew by Investing in a Vibrant Economy (THRIVE) Agenda and the Environmental Justice for All Act.[19,20]

A fair clean energy transition must also center the needs of working people—powerfully detailed in the BGA Solidarity for Climate Action platform and the National Economic Transition

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[13] Yancy CW. COVID-19 and African Americans. *JAMA.* 2020;323(19):1891–1892. doi:10.1001/jama.2020.6548. https://jamanetwork.com/journals/jama/fullarticle/2764789

[14] https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/hospitalization-death-by-race-ethnicity.html

[15] https://blog.ucsusa.org/adrienne-hollis/african-americans-are-disproportionately-exposed-to-extreme-heat

[16] https://blog.ucsusa.org/rachel-cleetus/economic-recovery-depends-on-controlling-the-covid-19

[17] Intergovernmental Panel on Climate Change (IPCC). 2018. Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emissions pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty

[18] https://ajustclimate.org/

[19] H. Res. 1102. https://www.congress.gov/bill/116th-congress/house-resolution/1102/text

[20] H. R. 5986. https://www.congress.gov/bill/116th-congress/house-bill/5986/text

Platform.[21,22] The *Solidarity for Climate Action Platform* was developed by The BlueGreen Alliance and its labor and environmental partners to help address the dual crises of climate change and increasing economic inequality, and advance solutions that put working people front and center.

UCS is a signatory to the platforms mentioned above and we call on Congress to draw upon these resources and engage directly and meaningfully with a diverse range of stakeholders as it crafts legislation to address climate change. The recent Majority staff report from the House Select Committee on the Climate Crisis has put forth an important foundation for this work that Congress must now act upon.[23]

As with the global COVID-19 pandemic, solutions for climate change have to scale up from the local to the global. Our ability to solve these complex interdependent challenges depends on working in cooperation with other countries and multilateral institutions such as the World Health Organization (WHO) and the United Nations Framework Convention on Climate Change (UNFCCC).

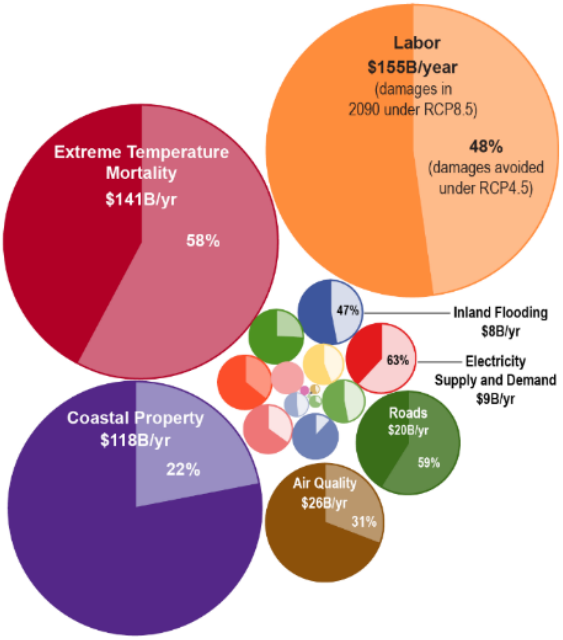
The U.S. Fourth National Climate Assessment

The US Fourth National Climate Assessment —a quadrennial report mandated by Congress since 1990—was released in November 2018.[24] Drafted by thirteen federal agencies and drawing on the best available science, the report emphasized that climate change is not about some distant future; communities around our nation are already coping with record-breaking heat, flooding, wildfires and accelerating sea level rise. The report's stark conclusion is that these climate-related impacts will only get worse and their costs will mount dramatically if carbon emissions continue unabated. Under high emissions scenarios with little or no adaptation, annual losses in some sectors are projected to exceed $100 billion by the end of the century and surpass the gross domestic product of many states.

Some of the most consequential impacts the report highlights include premature mortality due to extreme temperatures and poor air quality, loss in labor productivity with rising temperatures and loss in the value of coastal property due to accelerating sea level rise. Critical infrastructure—including roads and bridges, water and stormwater, and power—is also at risk. However, making swift and deep cuts in global emissions can help limit climate change and significantly curtail the magnitude of these impacts (see figure 1).

[21] https://www.bluegreenalliance.org/work-issue/solidarity-for-climate-action/
[22] https://nationaleconomictransition.org/
[23] https://climatecrisis.house.gov/report
[24] US Global Change Research Program (USGCRP). 2018. Fourth national climate assessment: Impacts, risks, and adaptation in the United States, volume 2. Washington, DC. Online at https:// nca2018.globalchange.gov.
See also: US Global Change Research Program (USGCRP). 2017. Fourth national climate assessment: Climate Science Special Report, volume 1. Washington, DC. Online at https://science2017.globalchange.gov/

Figure 1: Projected damages and potential for risk reduction by sector



Annual Economic Damages in 2090			
	Sector	Annual damages under RCP8.5	Damages avoided under RCP4.5
	Labor	$155B	48%
	Extreme Temperature Mortality◊	$141B	58%
	Coastal Property◊	$118B	22%
	Air Quality	$26B	31%
	Roads◊	$20B	59%
	Electricity Supply and Demand	$9B	63%
	Inland Flooding	$8B	47%
	Urban Drainage	$6B	26%
	Rail◊	$6B	36%
	Water Quality	$5B	35%
	Coral Reefs	$4B	12%
	West Nile Virus	$3B	47%
	Freshwater Fish	$3B	44%
	Winter Recreation	$2B	107%
	Bridges	$1B	48%
	Munic. and Industrial Water Supply	$316M	33%
	Harmful Algal Blooms	$199M	45%
	Alaska Infrastructure◊	$174M	53%
	Shellfish*	$23M	57%
	Agriculture*	$12M	11%
	Aeroallergens*	$1M	57%
	Wildfire	−$106M	−134%

Source: Fourth National Climate Assessment,[25] adapted from EPA 2017[26]

The total area of each circle represents the projected annual economic damages (in 2015 dollars) under a higher scenario of climate change (RCP8.5) in 2090 relative to a no-change scenario. The decrease in damages under a lower scenario (RCP4.5) compared to RCP8.5 is shown in the lighter-shaded area of each circle. Adaptation was shown to reduce overall damages in sectors marked by the diamond symbol. Asterisks denote sectors with annual damages that may not be visible at the given scale.

The Economic Risks and Costs of Climate Change

The climate extremes our nation and the world are experiencing are very costly. NOAA data show that 2019 was the fifth consecutive year when the US experienced ten or more billion-dollar weather and climate disasters, and 2020 is already on track continue that trend.[27,28] In 2019, the nation experienced 14 such events including three major inland floods, eight severe

[25] Fourth National Climate Assessment, Chapter 29: Reducing risks through emissions mitigation. https://nca2018.globalchange.gov/chapter/29/

[26] EPA. 2017. Multi-Model Framework for Quantitative Sectoral Impacts Analysis: A Technical Report for the Fourth National Climate Assessment. U.S. Environmental Protection Agency, Washington, D.C. https://cfpub.epa.gov/si/si_public_record_Report.cfm?Lab=OAP&dirEntryId=335095

[27] https://www.climate.gov/news-features/blogs/beyond-data/2010-2019-landmark-decade-us-billion-dollar-weather-and-climate

[28] https://www.ncdc.noaa.gov/billions/

storms, two tropical cyclones (Hurricane Dorian and Tropical Storm Imelda), and one wildfire event. Hurricanes Harvey, Irma, Maria and Sandy, all of which occurred in the last decade, are four of the five costliest billion-dollar disasters. The last four years have also brought three of the most destructive and costly wildfire seasons in U.S. history, with California suffering the most harm.

Globally, the economic costs of disasters in 2019 topped $150 billion, dominated by huge losses from tropical cyclones in Asia, widespread flooding in India and China and severe storms in the US.[29] The Global Risks Report 2020 released at the World Economic Forum in Davos in January identified 'extreme weather events' and 'failure of climate change mitigation and adaptation' as the top two risks by likelihood that the world faces in the next ten years.[30] The top risk by severity of impact was 'failure of climate change mitigation and adaptation.'

Earlier this month, the Commodity Futures Trading Commission (CFTC), released a new report titled "*Managing Climate Risk in the Financial System*."[31] The first-of-its-kind CFTC report sends another clear signal that climate change poses a significant risk to our economy and financial system. If left unaddressed, these risks—which include flooding exacerbated by sea level rise and heavy rainfall, extreme heat, and worsening wildfires—will escalate untenably and harm our prosperity and well-being today and into the future. Markets for agricultural commodities, real estate, insurance and mortgages are among those highly exposed to these risks, as are the supply chains of many companies. Liability risks for fossil fuel companies, whose products are the main drivers of climate change, are mounting as cities, counties and states file lawsuits against these companies, including ExxonMobil and Chevron, to recover the costs of climate damages and fraud.

Major banks including JP Morgan, Goldman Sachs, Bank of America and Citigroup have all made recent regulatory filings noting that climate change poses a material risk to their businesses. JP Morgan's annual report to the SEC[32] states that its worldwide operations could be disrupted by climate impacts such as flooding and wildfires, and that "*climate driven changes could have a material adverse impact on asset values and the financial performance of JPMorgan Chase's businesses, and those of its clients and customers."*

Separately, news articles citing research from economists at JP Morgan indicates that they, too, see runaway climate change as a grave threat to the world economy, human health, water stress and the survival of species. The JP Morgan report goes on to say, "We cannot rule out catastrophic outcomes where human life as we know it is threatened."[33]

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[29] https://www.munichre.com/topics-online/en/climate-change-and-natural-disasters/natural-disasters/natural-disasters-of-2019-in-figures-tropical-cyclones-cause-highest-losses.html

[30] https://www.weforum.org/reports/the-global-risks-report-2020

[31] See https://www.cftc.gov/PressRoom/PressReleases/8234-20

[32] https://jpmorganchaseco.gcs-web.com/node/315401/html

[33] https://www.theguardian.com/environment/2020/feb/21/jp-morgan-economists-warn-climate-crisis-threat-human-race and https://www.bbc.com/news/business-51581098

A recent report from McKinsey & Company notes that the physical risks of climate change are increasing, spatial in how they manifest, non-stationary, nonlinear, systemic and regressive.[34] The report notes that climate impacts are already evident around us and that climate change is already having measurable socioeconomic impacts. The range of impacts going forward could include impacts on livability and workability, food systems, physical assets, infrastructure services and natural capital. Key findings from the report include:

- By 2050, under an RCP 8.5 scenario, the number of people living in areas with a nonzero chance of lethal heat waves would rise from zero today to between 700 million and 1.2 billion (not factoring in air conditioner penetration).
- Certain regions, for example, parts of the Mediterranean region and parts of the United States and Mexico, are projected to see a decrease in mean annual surface water supply of more than 70 percent by 2050.
- Statistically expected damage to capital stock from riverine flooding could double by 2030 from today's levels and quadruple by 2050.
- Countries and regions with lower per capita GDP levels are generally more at risk.
- Almost every country will see some risk of biome shift by 2050, affecting ecosystem services, local livelihoods, and species' habitat

Last December the Federal Reserve Bank of San Francisco hosted its first-ever conference on the 'Economics of Climate Change.' Reporting on the meeting, a bulletin from the Bank[35] says:

- Climate change will have sweeping effects on our economy and financial system (Network for Greening the Financial System 2018, hereafter NGFS; USGCRP 2018). Climate-related shifts in the physical environment can slow economic growth, increase volatility, and depreciate the value of business and household assets and property. Avoiding further climate change will involve a substantial transformation of the economy. Consequently, climate change appears increasingly relevant to central bankers and financial supervisors for achieving their macroeconomic, inflation, and financial stability mandates (NGFS 2018, Rudebusch 2019).
- Climate change has long-term macroeconomic implications for worker productivity and the composition and profitability of business investment. Solomon Hsiang (U.C. Berkeley) presented research on how warmer temperatures make exposed workers less productive. This is particularly important for outdoor workers, as in agriculture and construction. Over time, the higher temperatures may result in significant losses for the overall economy and notable shifts in the occupations workers choose.
- There are wide differences in how climate change affects various areas of the world. Moreover, regional disparities in resources, policies, and technology only exacerbate these differences. Still, changes in one region of the world can have consequences

[34] https://www.mckinsey.com/business-functions/sustainability/our-insights/climate-risk-and-response-physical-hazards-and-socioeconomic-impacts

[35] https://www.frbsf.org/economic-research/publications/economic-letter/2019/december/economics-climate-change-first-fed-conference/

elsewhere, including people migrating to avoid adverse climate developments and extreme natural events disrupting international trade.

- As economies adapt to climate change and gradually switch from carbon-based, so-called brown, energy to greener energy alternatives, the value of assets associated with brown technologies will decline and, in the extreme, assets may become "stranded."

The Government Accountability Office's (GAO's) High Risk report series have repeatedly flagged climate change as a key area of fiscal exposure for the federal government, including in its most recent 2019 report. [36] It calls for limiting this exposure by better managing climate risks, including through proactive steps to reduce risks ahead of disasters as part of a comprehensive resilience investment strategy.

Zillow and Freddie Mac, two influential giants in the real estate sector, have both released reports in the last few years examining the impact of future sea level rise on coastal real estate.[37,38] Freddie Mac finds that sea level rise could "destroy billions of dollars in property and displace millions of people," with the resulting social and economic impacts "greater in total than those experienced in the housing crisis and Great Recession." The credit rating agencies Moody's and Standard & Poor's have begun to evaluate and communicate how to account for climate risks in their credit ratings.

Many US businesses increasingly understand that climate change is an economic threat and that there are significant economic opportunities in the transition to a low-carbon economy. And most forward-thinking companies recognize that addressing climate change will require robust federal action.

The threat to coastal real estate:

UCS research on the impacts of sea level rise to coastal communities shows that long before rising seas permanently submerge properties, millions of Americans living in coastal communities will face more frequent and disruptive high-tide flooding. By the end of the century, under a high sea level rise scenario,[39] approximately 2.5 million US coastal homes and commercial properties currently worth more than $1 trillion would be at risk from chronic flooding—a threshold we defined as flooding that occurs 26 times per year or more.[40] By 2045, within the lifetime of a typical mortgage issued today, about 325,000 coastal properties worth $136 billion will be at risk of chronic flooding (see figures 2 and 3). The properties at risk by

[36] https://www.gao.gov/assets/700/697245.pdf

[37] https://www.zillow.com/research/climate-change-underwater-homes-12890/ and https://www.zillow.com/research/climate-change-underwater-homes-2-16928/

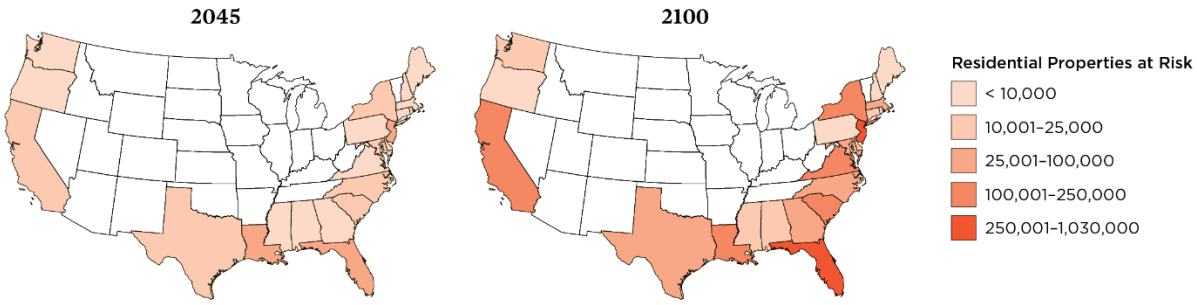
[38] http://www.freddiemac.com/research/insight/20160426_lifes_a_beach.page

[39] The high scenario, which is drawn from the 2014 National Climate Assessment, assumes rapid ice sheet loss and projects a global average sea level rise of 6.6 feet (2.0 m) above 1992 levels by the end of this century. This scenario is considered most applicable in situations with a low tolerance for risk. This makes it most suitable for estimating the scale of risk to residential properties, which typically represent a homeowner's greatest single asset. For more on our data and methodology, please see: https://www.ucsusa.org/sites/default/files/attach/2018/06/underwater-analysis-full-report.pdf and https://www.ucsusa.org/sites/default/files/attach/2018/06/underwater-analysis-technical-backgrounder.pdf

[40] https://www.ucsusa.org/resources/underwater

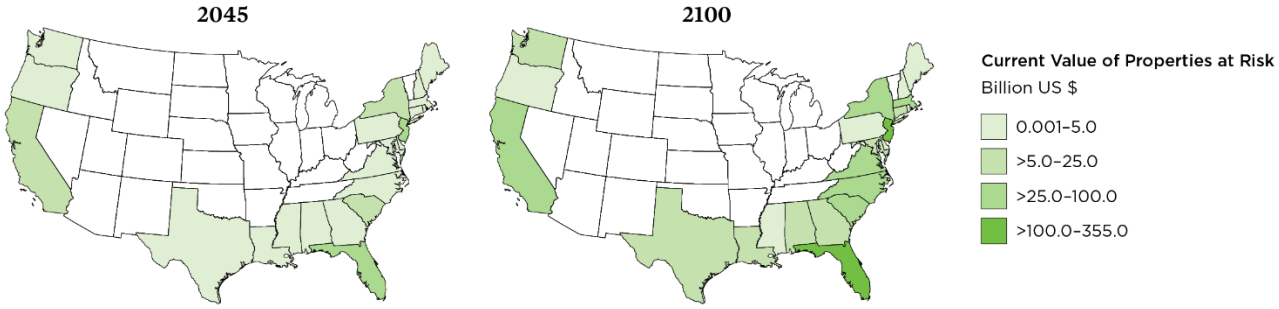
2045 currently house 550,000 people and contribute nearly $1.5 billion toward today's property tax base. Those numbers jump to about 4.7 million people and $12 billion by 2100 (see fig 4).

Figure 2: Homes at risk of chronic inundation



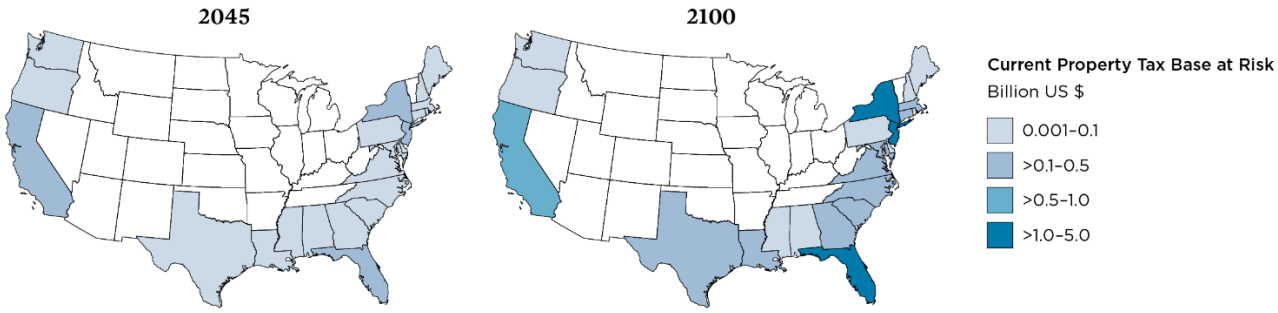
Credit: Union of Concerned Scientists. Data provided by third parties through the Zillow Transaction and Assessment Dataset (ZTRAX).

Figure 3: Value of homes at risk from chronic inundation



Credit: Union of Concerned Scientists. Data provided by third parties through the Zillow Transaction and Assessment Dataset (ZTRAX).

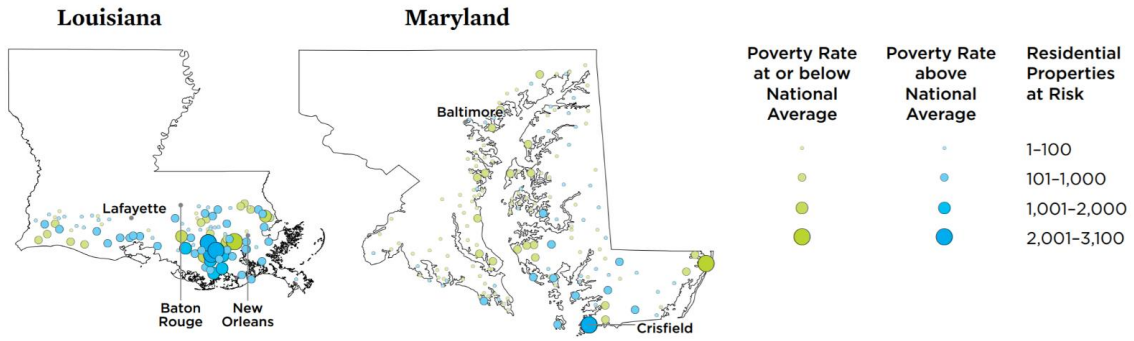
Figure 4: Property tax base at risk from chronic inundation



Credit: Union of Concerned Scientists. Data provided by third parties through the Zillow Transaction and Assessment Dataset (ZTRAX).

The declining value of coastal homes will be damaging, even devastating, to individual homeowners. It will also have more widespread consequences, including for affected communities, lenders, investors, and taxpayers. Communities with fewer resources to start with, or that are otherwise disadvantaged, will likely be most heavily affected by chronic flooding and its accompanying financial losses (see Figure 5).

Figure 5: Communities with high poverty rates at risk of chronic inundation in Louisiana and Maryland



UCS also developed an interactive mapping tool that lets you explore the risk sea level rise poses to homes in your congressional district and provides district-specific fact sheets about those risks.[41] What our maps show is that rising seas will begin to reshape many coastal communities in the coming decades, in some cases quite drastically. Communities need representatives in Congress who will advocate for the research, funding, and policies needed to help them cope with sea level rise and coastal flooding head-on. In some cases, that will include help with relocation to safer ground.

Our research also points to the choices we face: If the global community adheres to the primary goal of the Paris Agreement of capping warming below 2°C, and with limited loss of land-based ice, by the end of the century the United States could avoid losing residential properties that are currently valued at $780 billion, contribute $10 billion annually in property tax revenue, and house 4.1 million people.

Threat to rail infrastructure:

We also used our sea level rise data and methodology to assess the risks of chronic flooding to Amtrak's Northeast corridor route between Boston and Washington, one of the most heavily travelled rail routes in our nation. Our maps were used in a Bloomberg story on this subject, *Rising Waters Are Drowning Amtrak's Northeast Corridor.*[42] Many parts of the Northeast Corridor rail route are at risk of chronic flooding starting by 2060, including sections near Wilmington, Delaware, and throughout Connecticut, New Jersey, and New York (see figure 7). Current preparation efforts fall far short of these realities.

Threat to U.S. military bases:

UCS has also analyzed the exposure of 18 military installations along the East and Gulf coasts to more frequent and extensive tidal flooding, land loss as some areas flood with daily high tides,

[41] Interactive map, data and fact sheets for all coastal Congressional districts in the lower 48 states available here: https://ucsusa.maps.arcgis.com/apps/MapJournal/index.html?appid=b53e9dd7a85a44488466e1a38de87601

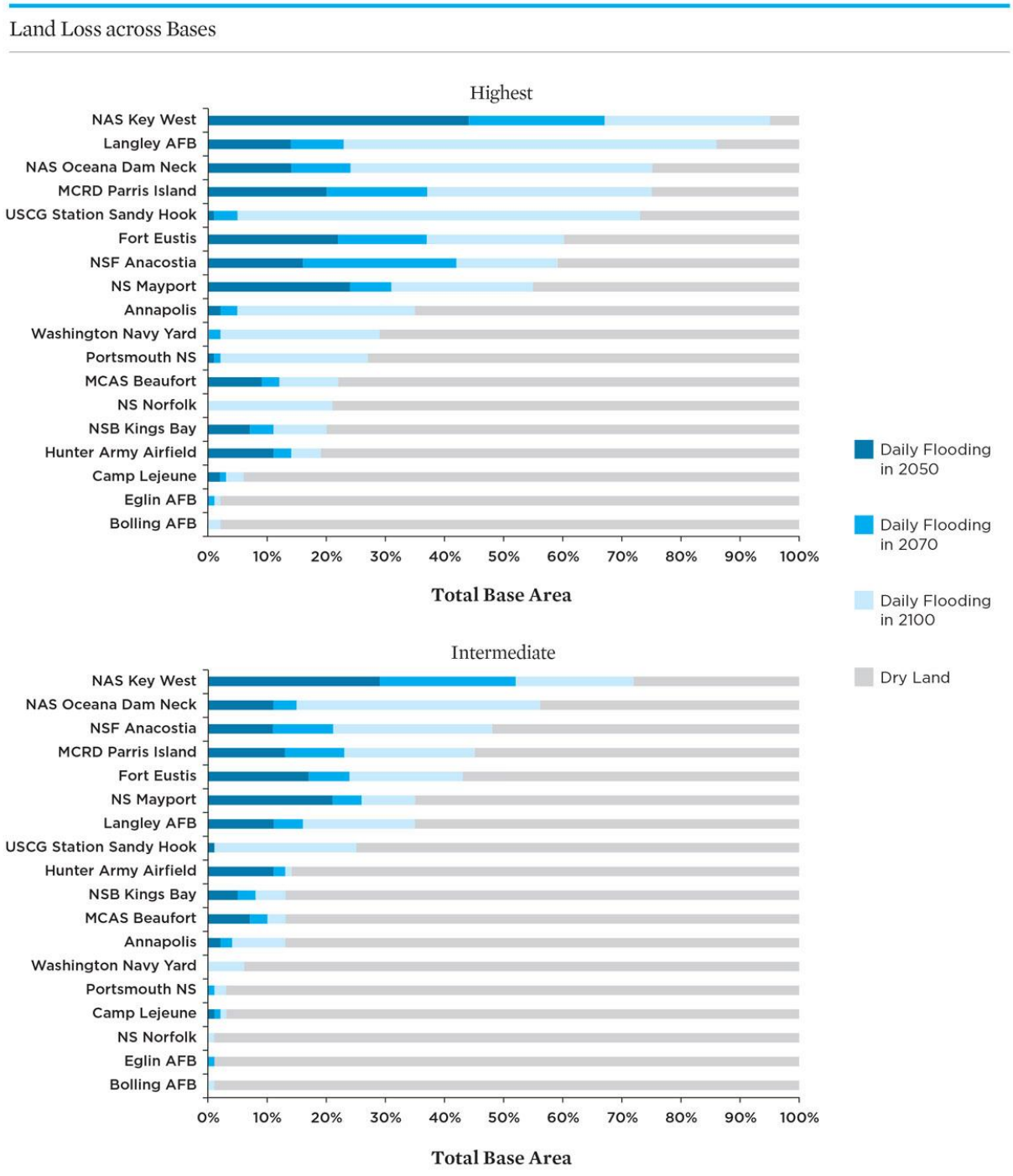
[42] https://www.bloomberg.com/graphics/2018-amtrak-sea-level/

and deeper and more extensive storm surge inundation.[43] In the absence of preventive measures, these sites, including bases in Virginia, Georgia and Florida face major risks:

- By 2050, most of the installations we analyzed will see more than 10 times the number of floods they experience today.
- By 2070, half of the sites could experience 520 or more flood events annually—the equivalent of more than one flood daily.
- By 2100, eight bases are at risk of losing 25 percent to 50 percent or more of their land to rising seas.
- Four installations—Naval Air Station Key West, Joint Base Langley-Eustis, Dam Neck Annex, and Parris Island—are at risk of losing between 75 and 95 percent of their land by the end of this century (see figure 6).

[43] https://www.ucsusa.org/global-warming/science-and-impacts/impacts/sea-level-rise-flooding-us-military-bases

Figure 6: US military bases exposed to chronic inundation and land loss



As high tide reaches farther inland, significant land loss is possible, in both the intermediate and highest scenarios, at many of the installations analyzed. Dark blue represents the percentage of total base area that floods with daily high tides in 2050; such land is conservatively considered a loss in this analysis. Medium blue represents the additional area that is inundated with high tide by 2070; light blue represents additional area inundated by 2100. Gray represents the percentage of the total base area that remains above the high tide line at the end of the century. Affected land can include developed and undeveloped areas and even wetlands that reside above the current high tide mark. This analysis finds that installations projected to see major land loss will also see substantial loss of currently developed and utilized areas.

The public health threat of extreme heat

Extreme heat is one of the most harmful and deadly hazards we face. A 2019 analysis from UCS provides a detailed view of how extreme heat events caused by dangerous combinations of temperature and humidity are likely to become more frequent and widespread in the United States over this century as a result of climate change (see Table 1 and figure 7).

Without global action to reduce heat-trapping emissions, the number of days per year when the heat index—or "feels like" temperature—exceeds 100 degrees Fahrenheit would more than double from historical levels to an average of 36 across the country by midcentury and increase four-fold to an average of 54 by late century. The number of days per year when the heat index exceeds 105 degrees Fahrenheit would quadruple from historical levels (1970-2000) such that more than 150 of our larger cities across the country (cities with a population greater than 50,000) would experience an average of 30 or more days per year with a heat index above 105. That is compared to 3 such cities today.

By the end of the century, with no action to reduce global emissions, parts of Florida and Texas would experience the equivalent of at least five months per year on average when the "feels like" temperature exceeds 100 degrees Fahrenheit, with most of these days even surpassing 105 degrees. By late century, areas that today are home to 180 million people (~60% of the current population) would experience >30 days / year on average with HI conditions >105 degrees (compared to <1 million people historically). By late century about 120 million people across the US—more than one-third of today's population—would experience the equivalent of a week or more of conditions so hot they exceed the upper limit of the National Weather Service's current heat index scale and a heat index would be incalculable. Such "off-the-charts" conditions could pose unprecedented health risks.

Among those most vulnerable to the impacts of extreme heat include the elderly, the very young, outdoor workers, those with pre-existing health conditions, low or fixed-income households that may not have access to air conditioning or may not be able to afford paying higher electric bills to run it, people living in urban areas where the heat island effect can exacerbate extreme heat, the homeless, and incarcerated people.

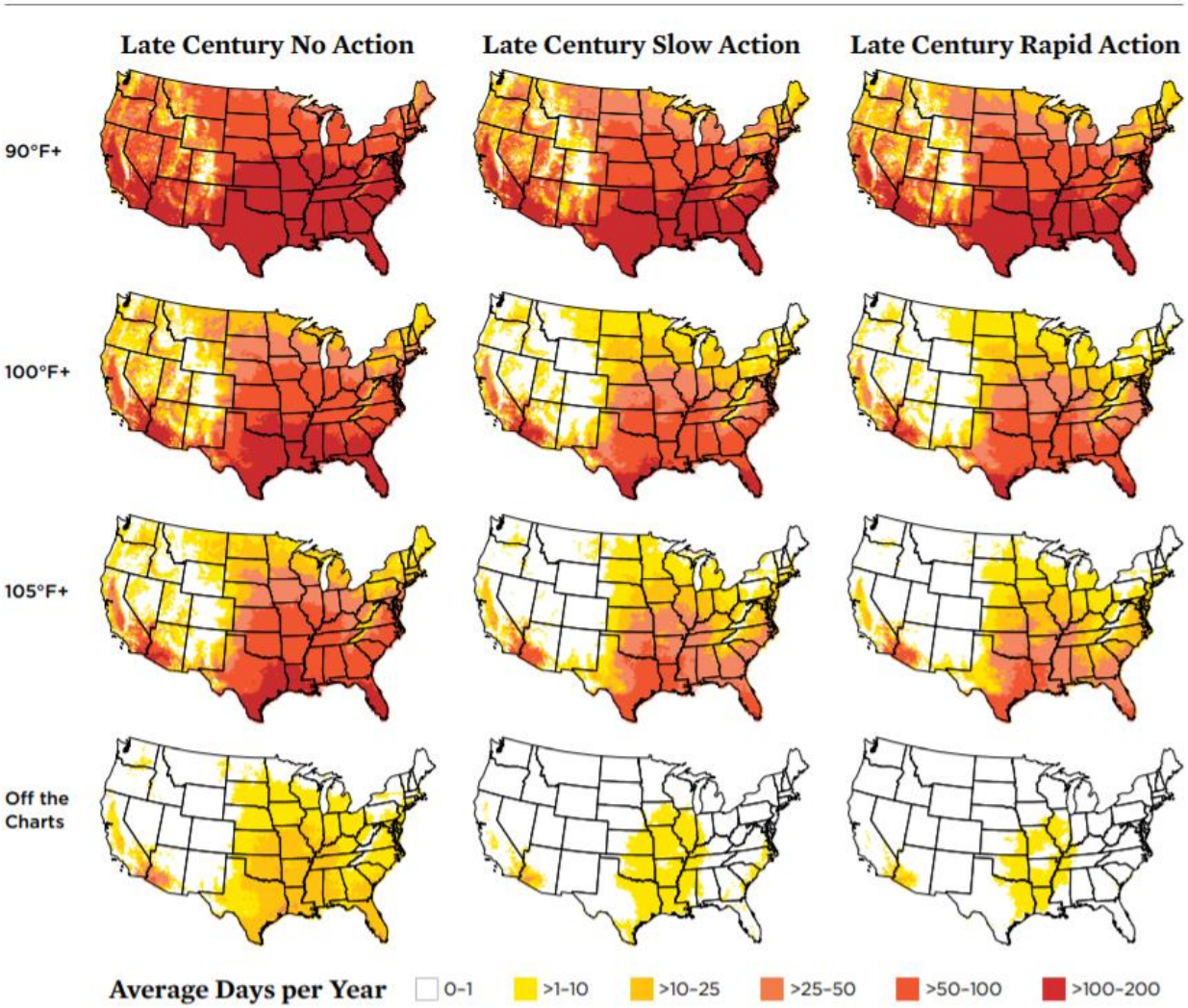
Table 1: Extreme heat will become more severe and frequent in every region of the country

Time Period	Scenario	Heat Index Threshold	Mid-west	North-east	N. Plains	North-west	South-east	S. Plains	South-west	US
Historical	-	90°F	25	13	13	6	69	71	37	41
Midcentury	No Action	90°F	62	40	36	20	113	109	60	69
Midcentury	Slow Action	90°F	54	32	31	16	105	102	54	63
Late Century	No Action	90°F	90	70	57	37	140	134	84	93
Late Century	Slow Action	90°F	63	39	37	21	113	109	60	70
-[9]	Rapid Action	90°F	56	34	32	17	107	104	56	65
Historical	-	100°F	6	3	3	1	15	21	23	14
Midcentury	No Action	100°F	30	14	12	4	65	61	24	36
Midcentury	Slow Action	100°F	22	10	8	3	51	51	22	30
Late Century	No Action	100°F	53	32	24	11	96	88	35	54
Late Century	Slow Action	100°F	27	12	10	4	60	57	24	34
-	Rapid Action	100°F	22	10	8	3	52	52	22	31
Historical		105°F	3	2	2	0	4	7	13	5
Midcentury	No Action	105°F	17	8	6	2	40	39	17	24
Midcentury	Slow Action	105°F	12	5	4	1	27	30	17	18
Late Century	No Action	105°F	38	20	14	5	73	66	22	40
Late Century	Slow Action	105°F	15	7	5	2	34	35	17	22
-	Rapid Action	105°F	12	5	4	1	27	30	18	19
Historical	-	Off the Charts	0	0	0	0	0	0	2	0
Midcentury	No Action	Off the Charts	2	1	1	1	3	3	8	3
Midcentury	Slow Action	Off the Charts	2	1	1	0	2	2	6	2
Late Century	No Action	Off the Charts	7	3	3	2	12	12	10	9
Late Century	Slow Action	Off the Charts	2	1	1	1	2	3	7	3
-	Rapid Action	Off the Charts	2	1	1	0	2	2	7	2

As heat-trapping emissions rise, each region of the country is projected to experience an increase in the average number of days per year with heat above the thresholds analyzed in this study.

The report also shows how actions taken, or not taken, within the next few years to reduce global emissions will help determine how hot and humid our future becomes. If the goal of the Paris Agreement is met and future global average warming is limited to 2 degrees Celsius, by late century the United States would see half the number of days per year, on average, with a heat index above 105 degrees Fahrenheit, and almost 115 million fewer people would experience the equivalent of a week or more of "off-the-charts" heat days. The longer the U.S. and other countries wait to drastically reduce emissions, the less feasible it will be to realize the "rapid action scenario" analyzed.

Figure 7: Frequency of extreme heat depends on the choices we make



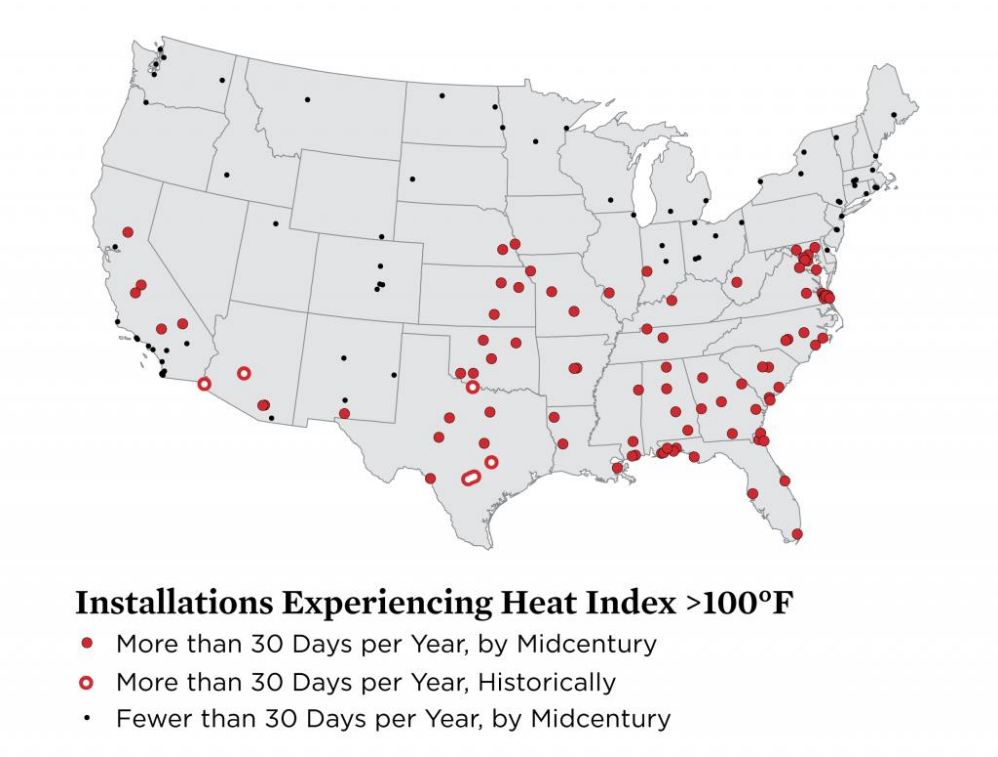
The emissions choices we make in the coming decades will profoundly shape the frequency and severity of extreme heat later this century. With no action to reduce global emissions, the contiguous United States would face an average of twice as many days with a heat index above 105°F in late century as it would with rapid action.

UCS also used its data and methodology for extreme heat projections to analyze how the frequency of days with dangerous heat at sizable Air Force, Army, Marine Corps, and Navy installations in the contiguous US is projected to change in the coming decades (See figure 8).[44] Our results show that with no action to reduce global heat-trapping emissions, on average**,** by midcentury US installations would experience nearly five times as many days with a heat index above 100°F as they have historically**.** These results imply that living, working, and training at US military bases is poised to become increasingly risky for servicepeople and their families over the course of the next few decades and in every branch of the armed forces.

[44] https://blog.ucsusa.org/kristy-dahl/military-extreme-heat

We found that by midcentury, with no action to reduce global emissions, sizable military installations in the US would, on average, experience an additional 33 days per year with a heat index above 100°F. For some bases, however, the increase is much larger. Fort Sill in Oklahoma, for instance, is projected to experience an additional 53 days per year of dangerous heat by midcentury. Fort Campbell in Kentucky would experience an additional 51 days per year with a heat index above 100°F. And in cases like Luke Air Force Base in Arizona, the heat would be much more extreme: an additional 17 days per year with a heat index above a scorching 120°F.

Figure 8: Projections of extreme heat at US military installations by mid-century



Historically, only nine major military installations in the US have experienced 30 or more days per year with a heat index above 100°F. By midcentury, with no action to reduce emissions, 100 installations would experience such conditions.

Growing Risks from Inland Flooding:

Climate change is also shifting rainfall patterns, making heavy rain heavier and more frequent in many areas of the country (see figure 9). With human alteration of the land—like the engineering of rivers, the destruction of natural protective systems, increased construction on floodplains, and increased area of impermeable surface—many parts of the United States are at greater risk of experiencing destructive and costly floods.[45]

[45] https://www.ucsusa.org/sites/default/files/attach/2018/07/gw-fact-sheet-epif.pdf

Spring 2019 brought extended flooding to many parts of the country, including Louisiana, Texas, the Midwest and the central part of the country along the Mississippi and Missouri rivers. NOAA data confirm that at the end of April 2019 the US had experienced the wettest 12 months on record. The 2019 record-breaking flooding was devastating for farmers.[46] It also washed out roads and bridges in many places, sometimes for days on end, making it difficult for people to travel safely to work and school[47]. In Nebraska alone, the flooding caused an estimated $100 million in damage to the state's highway system[48]. Rail lines in Nebraska and Missouri were shut down for weeks[49]. Businesses that rely on safe and reliable transportation were also affected[50].

Spring 2020 also brought another year with extreme flooding, including in the Pacific Northwest, Mississippi, Tennessee, Texas and the Carolinas. The upper Mississippi and Missouri River basins including Nebraska, Minnesota and Iowa, experienced widespread flooding. Parts of some states along the Mississippi and Red Rivers received precipitation 200 percent above their normal levels.[51]

[46] https://blog.ucsusa.org/juan-declet-barreto/record-2019-precipitation-in-midwest-financially-crushed-farmers

[47] https://www.washingtonpost.com/nation/2019/05/10/really-genuinely-scary-torrential-rain-houston-strands-cars-leaves-thousands-without-power/?utm_term=.9612e14621c9
https://kfor.com/2019/05/08/odot-several-highways-closed-due-to-flooding-across-the-state/

https://www.wxyz.com/getting-around-metro-detroit/flooding-across-metro-detroit-closes-several-roads-highways

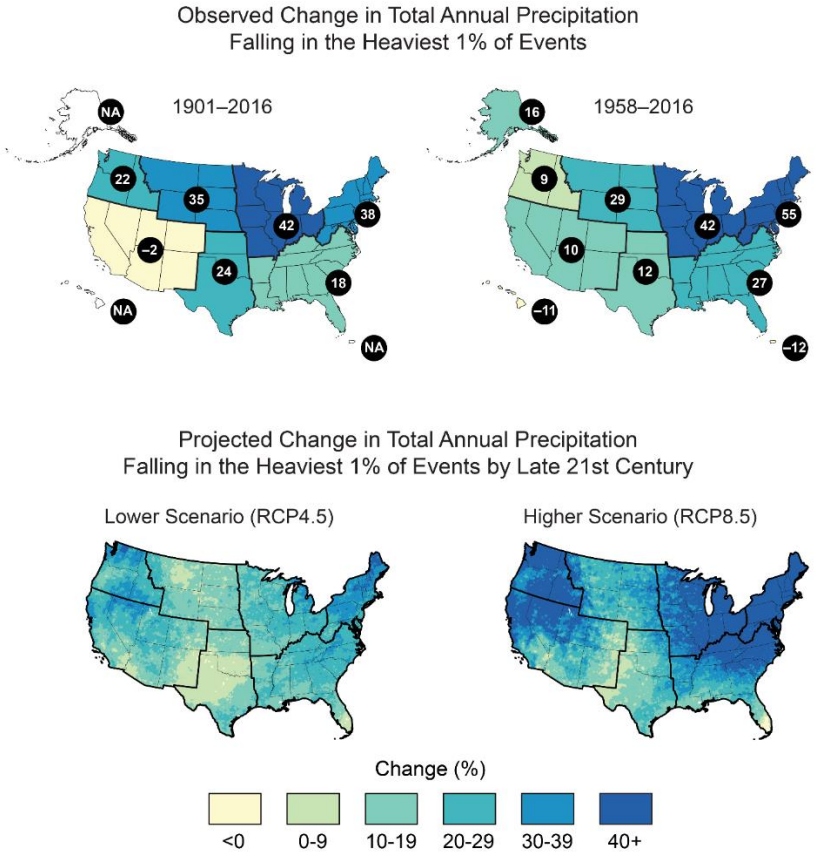
[48] https://dot.nebraska.gov/news-media/nebraska-flood-2019/

[49] https://www.grainnet.com/article/166508/transportation-impacts-of-midwest-flooding
https://www.freightwaves.com/news/railroad/rail-volumes-drop-for-march-30

[50] https://www.mprnews.org/story/2019/04/21/flooding-roundup-communities-weary

[51] https://www.noaa.gov/media-release/spring-outlook-historic-widespread-flooding-to-continue-through-may

Figure 9: Observed and projected changes in extreme precipitation



Heavy precipitation is becoming more intense and more frequent across most of the US, particularly in the Northeast and Midwest, and these trends are projected to continue in the future.

Source: Fourth National Climate Assessment

A growing body of evidence has linked specific extreme rainfall events to human-caused climate change. The record-breaking rainfall during Hurricane Harvey that brought devastating flooding to Houston, for example, was made about three (1.5-5) times more likely and around 15% (8-19%) more intense because of human-caused climate change[52]. Human-caused climate change also made the devastating rains in Louisiana in 2016—in which more than two feet of rain fell in a two-day period—more likely. A study of that particular event concluded that such downpours are expected to occur 40 percent more often and be 10 percent more intense now than they were before the Industrial Revolution.[53] Researchers from the World Weather Attribution partnership found that "the extreme rainfall and flooding caused by Tropical Storm Imelda was made more likely and intense due to global warming" and that "two-day extreme precipitation events along

[52] van Oldenborgh, G.J., K. van der Wiel, A. Sebastian, R. Singh, J. Arrighi, F. Otto, K. Haustein, S. Li, G. Vecchi, and H. Cullen. 2017a. Attribution of extreme rainfall from Hurricane Harvey, August 2017. Environmental Research Letters 12(12):1–11. doi:10.1088/1748-9326/aa9ef2.

[53] van der Weil, K., S. B. Kapnick, G. J. van Oldenborgh, K. Whan , S. Philip, G. A. Vecchi, R. K. Singh, J. Arrighi , and H. Cullen. 2017. Rapid attribution of the August 2016 flood-inducing extreme precipitation in south Louisiana to climate change. Hydrol. Earth Syst. Sci., 21, 897–921, 2017 www.hydrol-earth-syst-sci.net/21/897/2017/ doi:10.5194/hess-21-897-2017. Online at https://www.hydrol-earth-syst-sci.net/21/897/2017/hess-21-897-2017.pdf

the Gulf Coast as intense as observed on 19–20 September 2019 or higher have become 1.6 to 2.6 times more likely due to anthropogenic climate change, or 9% to 17% more intense."[54] Projections of future climate suggest that the frequency and intensity of extreme precipitation events will continue to increase across much of the United States in the coming decades[55].

Public Health impacts of climate change:

Climate change will have profound effects on human health. See Figure 10 for a conceptual diagram from the National Climate Assessment illustrating the exposure pathways by which climate change could effect human health. Drawing from the National Climate Assessment and other research, some major health implications of climate change include impacts on heat-related illnesses, vector-borne diseases, water-borne pathogens, water supplies and water quality, food security, health impacts of pollution from wildfire smoke, health impacts of climate-related disasters including impacts on mental health.[56,57, 58,59] Additionally, the Lancet Countdown on health and climate change provides an independent, global monitoring system dedicated to tracking the health dimensions of the impacts of, and the response to, climate change and

[54] https://www.worldweatherattribution.org/rapid-attribution-of-the-extreme-rainfall-in-texas-from-tropical-storm-imelda/

[55] Easterling, D.R., K.E. Kunkel, J.R. Arnold, T. Knutson, A.N. LeGrande, L.R. Leung, R.S. Vose, D.E. Waliser, and M.F. Wehner. 2017. Precipitation change in the United States. In Climate science special report: Fourth national climate assessment, volume 1, fourth edition, edited by D.J. Wuebbles, D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock. Washington, DC: US Global Change Research Program, 207–230. doi:10.7930/J0H993CC.
Intergovernmental Panel on Climate Change (IPCC). 2012. Summary for policymakers. In Managing the risks of extreme events and disasters to advance climate change adaptation: Summary for policymakers, edited by C.B. Field, V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley. Cambridge, UK, 1–19. Online at http://www.ipcc.ch/pdf/special-reports/srex/SREX_FD_SPM_final.pdf

[56] See Chapter 14: Human Health in the Fourth National Climate Assessment, and references therein. Online at https://nca2018.globalchange.gov/chapter/14/

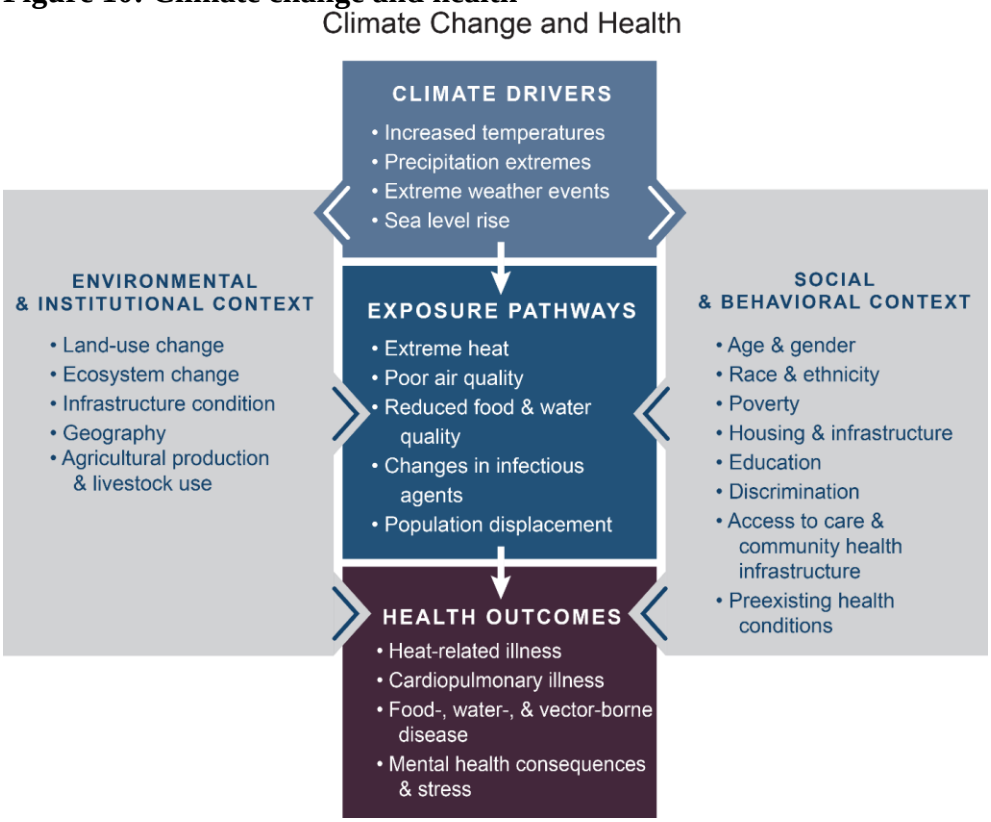
[57] See Union of Concerned Scientists. 2018. Heat Waves and Climate Change: What the Science Tells us about extreme heat Events. Online at https://www.ucsusa.org/sites/default/files/attach/2018/08/extreme-heat-science-fact-sheet.pdf; Union of Concerned Scientists. 2018. Health Risks and Impacts of Extreme Heat. Online at https://www.ucsusa.org/sites/default/files/attach/2018/08/extreme-heat-impacts-fact-sheet.pdf

[58] https://www.climate.gov/news-features/event-tracker/harmful-algal-blooms-linger-parts-southern-florida-july-and-august-2018
Chapra, S.C.; Boehlert, B.; Fant, C.; Bierman Jr., V.J.; Henderson, J.; Mills, D.; Mas, D.M.L.; Rennels, L.; Jantarasami, L.; Martinich, J.; Strzepek, K.M.; & Paerl, H.W. (2017). "Climate change impacts on harmful algal blooms in U.S. freshwaters: a screening level assessment." *Environmental Science and Technology* **51**, 8933-8943 (2016).
Paerl, Hans W., and Valerie J. Paul. "Climate change: Links to global expansion of harmful cyanobacteria." *Water res.* 46, 1349-1363 (2012).

[59]See, for example: https://www.washingtonpost.com/news/capital-weather-gang/wp/2018/08/14/how-climate-change-is-making-red-tide-algal-blooms-even-worse/?utm_term=.820a42b60d02

includes a special brief for the United States.[60,61] Some groups are more vulnerable than others, including the elderly, the very young, pregnant women, people with preexisting health conditions, the economically disadvantaged, communities of color, Indigenous communities, the homeless and incarcerated, and first responders.

Figure 10: Climate change and health



Source: https://nca2018.globalchange.gov/chapter/14/

Risks of Climate Tipping Points

Scientists are also warning of the potential risks of unleashing abrupt or irreversible tipping points as global average temperatures continue to rise. These include the risk of collapse of the West Antarctic ice sheet and/or the Greenland ice sheet, which would lock in multi-meter sea level rise over centuries; irreversible permafrost loss in the Arctic that could release large

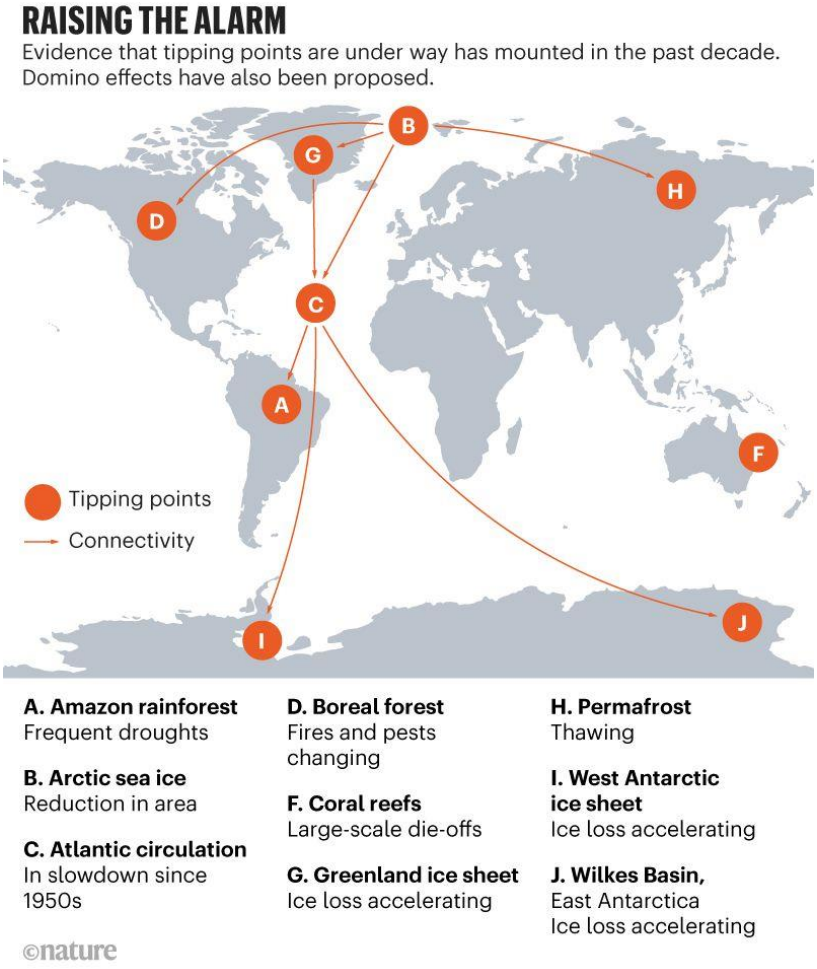
[60] Watts, N. et al. 2018. The 2018 report of the Lancet Countdown on Health and Climate Change: Shaping the health of nations for centuries to come. Online at https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)32594-7/fulltext

[61] Lancet Countdown, 2018: 2018 Lancet Countdown on Health and Climate Change Brief for the United State of America. Salas RN, Knappenberger P, Hess JJ. Lancet Countdown U.S. Brief, London, United Kingdom, 32 pp Online at https://storage.googleapis.com/lancet-countdown/2019/11/ANJ-USA-Lancet-Countdown-2019-Policy-brief_13Nov_without-back-page.pdf

quantities of methane and carbon dioxide; die-off of corals, the Amazon forests and the Boreal forests; and changes in the Atlantic Meridional Overturning Circulation (AMOC) which could disrupt monsoon patterns.[62]

Unfortunately, at the approximately 1˚C of warming the earth has experienced, we are already starting to see warning signs that we may be on the verge of crossing some significant thresholds (see figure 11 below).

Figure 11: Climate tipping points



Source: T. M. Lenton *et al.*[63]

These non-linear risks pose profound challenges to our economy and the planet and should compel us to take serious action now to help limit them as much as possible. The late great economist Professor Marty Weitzman's groundbreaking work characterizing the consequences of these "fat tail" risks led him to the clear conclusion that "it is only common sense that climate

[62] https://www.nature.com/articles/d41586-019-03595-0

[63] Lenton, T. M. *et al. Proc. Natl Acad. Sci. USA* **105**, 1786–1793 (2008).

change policy implications should depend on the treatment of low-probability, extreme-impact outcomes."[64]

Climate Solutions: Deep decarbonization

Decarbonizing the global economy is vital to help limit the risks of climate impacts. Done right, the investments we make in a transitioning to a low-carbon economy can also help jump start our economy. At this inflection point in our nation's history, the question is, will our federal government use this opportunity to build a clean, climate-resilient economy in a just and equitable way? Or will it default to business-as-usual thinking that reinforces current social inequities and fossil fuel dependence, and threatens our children's health and economic well-being?

Transitioning to a low-carbon economy—by investing in renewable energy, energy efficiency and other low-and zero-carbon energy options—and reaching net zero emissions no later than 2050 would not only help address climate change, it will deliver tremendous near-term public health and economic benefits.[65] This must ultimately be about a just and equitable socioeconomic transition, not simply technological changes. If we do this right, we can help ensure that *all* communities—especially fenceline communities that have borne a disproportionate burden of the health impacts of our dependence on fossil fuels—directly benefit from the transition to clean energy. We must also ensure a just and fair transition for coal-dependent workers and communities.

Decarbonizing the economy will not be easy and it will require a sustained effort over decades. But it is both a necessary and achievable goal for the US.

The IPCC 1.5°C special report,[66] released in October 2018, synthesized the latest science on the impacts of global warming of 1.5°C and 2°C and highlighted that impacts including heat waves, droughts, floods, wildfires, and ecosystem damages will worsen considerably, and often non-linearly, as temperatures rise. The report also laid out GHG emissions pathways that would help limit temperature increase (see figure 12). To limit temperature increase to 1.5°C will require global net CO_2 emissions to be reduced by about 45 percent from 2010 levels by 2030, reaching net zero by 2050.[67] Deep cuts in non-CO_2 heat-trapping emissions, such as methane and nitrous oxide, will also be necessary. The report points out that we will also need to deploy so-called "negative emissions" options.[68] Options for these carbon dioxide removal technologies and practices include afforestation and reforestation; enhanced land management practices; direct air

[64] https://scholar.harvard.edu/files/weitzman/files/fattaileduncertaintyeconomics.pdf

[65] Watts, N. et al. 2018. The 2018 report of the Lancet Countdown on Health and Climate Change: Shaping the health of nations for centuries to come. Online at https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)32594-7/fulltext

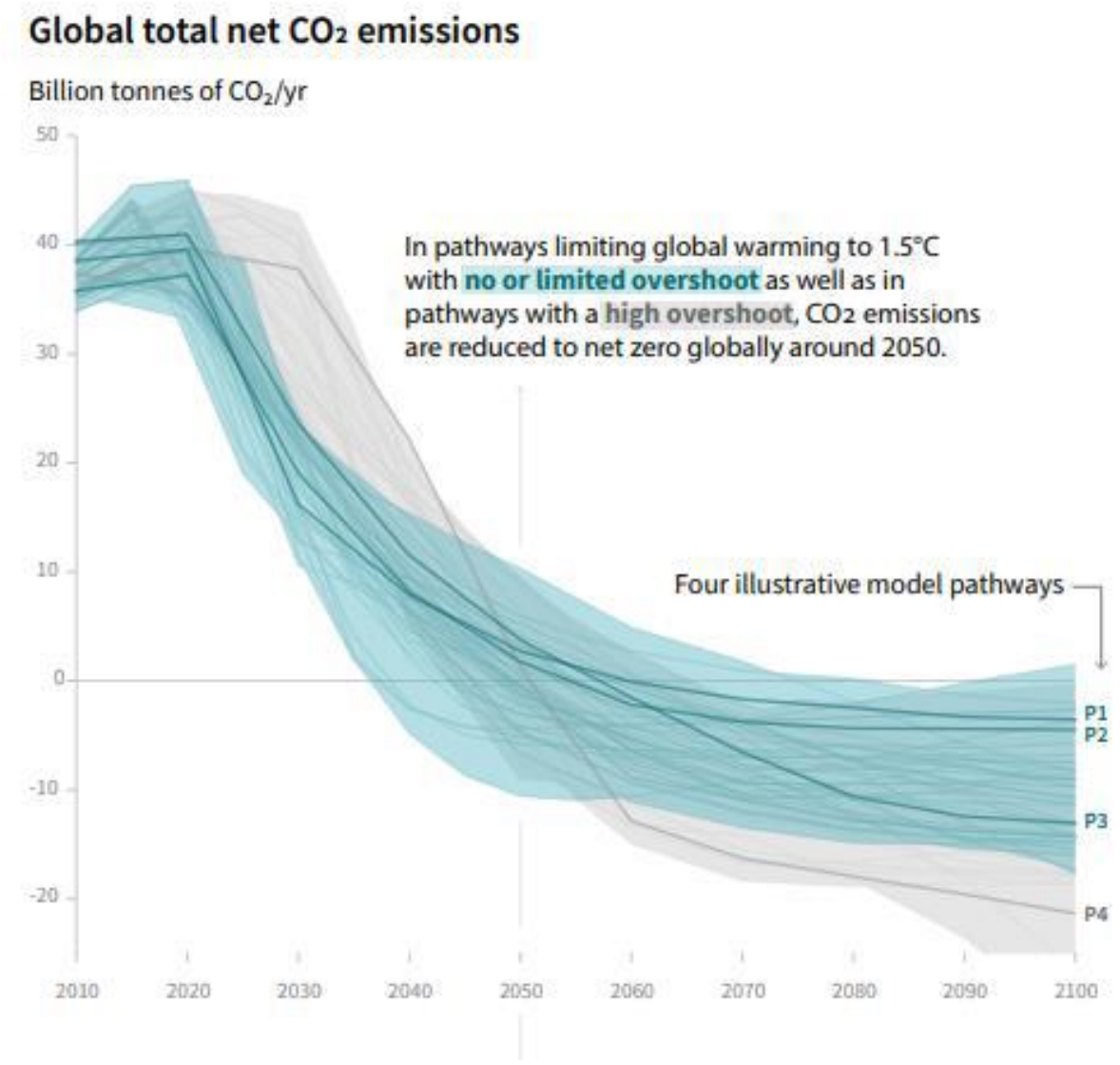
[66] Intergovernmental Panel on Climate Change (IPCC). 2018. Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emissions pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty

[67] In model pathways with no or limited overshoot of 1.5°C, global net anthropogenic CO_2 emissions decline by about 45% from 2010 levels by 2030, reaching net zero around 2050.

[68] All pathways that limit global warming to 1.5°C with limited or no overshoot project the use of CDR on the order of 100–1000 GtCO2 over the 21st century.

capture; and bioenergy with carbon capture and storage (BECCS). Equity, social and environmental criteria must play a key role in our choices for whether and how to deploy these technologies.

Figure 12: IPCC modeled pathways for limiting temperature increase to 1.5C



The science is clear: we need to get to net zero global carbon emissions by 2050. The world's remaining carbon budget to stay below a 1.5ºC or 2ºC temperature increase is rapidly being depleted, and we're far off track of where we need to be as the 2019 UNEP Emissions Gap report points out.[69]

The US can and must play a leading role in charting the path to net zero emissions no later than 2050 and be firmly on this path—at least halving its emissions—by 2030. In light of this, it's sobering to see the *Annual Energy Outlook 2020* reference case which projects that US CO2

[69] https://www.unenvironment.org/resources/emissions-gap-report-2019

emissions remain roughly at current levels in 2050 (just a 4 percent decline by 2050), which is a far cry from the deep reductions needed.[70]

UCS analyses, along with research from many other experts and real world data, show the incredible success of policies like state renewable electricity standards, energy efficiency standards and federal renewable energy tax credits; dramatic decreases in the costs of renewable power; and the faltering market economics of coal-fired power—which have all contributed to a steep drop in power sector carbon emissions of about 30 percent over the last decade (and, however, created risks of an overreliance on natural gas). Renewable electricity is now about 20 percent of our electricity mix and, combined with nuclear power, we are now at about 40 percent carbon-free power in 2020. The EIA forecasts that wind and solar power will be the fastest growing sources of power in 2020.

The costs of renewable energy are falling steeply. According to a recent report by Bloomberg New Energy Finance (BNEF), globally, the costs for onshore wind, solar photovoltaics and offshore wind have fallen by 49 percent, 84 percent and 56 percent respectively since 2010.[71] The costs of lithium ion batteries has decreased 76 percent since 2012.

A recent study from University of Berkeley and Gridlab shows it is technically and economically feasible to get up to 90 percent of the way to a carbon-free power sector by 2035.[72] A policy brief from Energy Innovation lays out some of the key policies that would be needed to achieve this goal.[73]

Led by California, New York, and most recently Virginia, nine states (plus Washington, DC and Puerto Rico) have already set aggressive goals or mandates for getting to 100 percent clean energy, with different target dates, and we are seeing more and more interest from states, cities, utilities and businesses level for these types of appropriately ambitious goals.[74] In 2018, wind energy contributed 6.5% of the nation's electricity supply, more than 10 percent of total electricity generation in fourteen states, between 20 percent and 30 percent of the electricity in three states (North Dakota, South Dakota and Maine), and more than 30 percent in four states—Iowa, Kansas, Oklahoma, and South Dakota.[75,76] Texas leads the nation in installed wind power and jobs in the wind industry.[77] The US has sped past the two million mark in solar photovoltaic systems.[78] Offshore wind is poised to take off, with new targets being set by

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[70] https://www.eia.gov/todayinenergy/detail.php?id=38773

[71] As measured by the levelized cost of electricity (LCOE) per megawatt-hour across 46 countries. Data from Bloomberg New Energy Finance. See https://about.bnef.com/blog/battery-powers-latest-plunge-costs-threatens-coal-gas/

[72] https://www.2035report.com/

[73] https://energyinnovation.org/wp-content/uploads/2020/06/90-Clean-By-2035-Policy-Memo.pdf

[74] More than 100 US cities have adopted 100% RE targets. See https://www.sierraclub.org/ready-for-100/commitments. 189 companies have made 100% RE commitments http://there100.org/companies

[75] U.S. Department of Energy (DOE). 2018.Wind Technologies Market Report. Online at https://emp.lbl.gov/publications/2017-wind-technologies-market-report

[76] https://nawindpower.com/awea-u-s-wind-grew-8-last-year-with-texas-leading-the-way

[77] https://nawindpower.com/awea-u-s-wind-grew-8-last-year-with-texas-leading-the-way

[78] https://www.woodmac.com/news/feature/the-united-states-surpasses-2-million-solar-installations/

multiple states, including Connecticut, Massachusetts, Maine, Maryland, New Jersey and New York and Virginia.[79]

The four pillars of economywide deep decarbonization include:

- Ramping up energy efficiency
- Switching to low and zero-carbon electricity
- Electrification of as many energy end uses as possible, for example in the transportation, buildings and industrial sectors
- Investing in protecting and enhancing carbon storage in soils, vegetation and wetlands, and, potentially, other negative emissions technologies

We need a robust and comprehensive suite of policies to drive a diverse set of zero-carbon solutions economywide. The federal government has a crucial role to play in enacting policies to cut emissions and enhance natural and technological solutions for carbon storage. Unfortunately, there has been a sore lack of leadership at the federal level, leaving states, local jurisdictions, businesses and others to take up the mantle of leadership. While these subnational actions are substantial and important, we simply will not be able to reach our appropriately ambitious climate goals without federal policies.[80]

A comprehensive suite of policies to address emission reduction opportunities throughout the economy should include:

- Power sector policies such as a low-carbon electricity standard; tax incentives for zero-carbon technologies and energy storage; investments in a modern grid that can help integrate high levels of renewable energy; energy efficiency policies; and investments in R&D for low-carbon power technologies.
- Transportation sector policies, including increasing fuel economy and heat-trapping emissions standards for vehicles, increased investments in low-carbon public transportation systems, such as rail and other mass transit systems; replacing gas-powered public bus fleets with electric bus fleets; incentivizing deployment of more electric vehicles, including through investments in charging infrastructure; and research on highly efficient conventional vehicle technologies, batteries for electric vehicles, cleaner fuels and emerging transportation technologies;
- Policies to cut emissions from the buildings and industrial sectors, including efficiency standards and electrification of heating, cooling, and industrial processes;
- Policies to increase carbon storage in vegetation and soils, including through climate-friendly agricultural and forest management practices;
- An economywide limit or price on carbon
- Investments in research, development, and deployment of new low-carbon energy technologies and practices;

[79] https://blog.ucsusa.org/john-rogers/raising-the-bar-on-offshore-wind-massachusetts-connecticut-new-jersey-new-york-maine-maryland-virginia

[80] https://www.bbhub.io/dotorg/sites/28/2019/12/Accelerating-Americas-Pledge.pdf and https://rhg.com/research/taking-stock-2019/

- Measures to cut emissions of methane, nitrous oxide, and other major non-CO_2 heat-trapping emissions; and
- Policies to help least developed nations make a rapid transition to low-carbon economies. Investing in just and equitable policies to ensure that the benefits of a clean energy economy are shared by all is also critical.

Our nation's infrastructure is desperately in need of investments to upgrade and modernize it. According to the American Society of Civil Engineers, failing to upgrade deteriorating infrastructure could cost an estimated $3.9 trillion between now and 2025.[81] Meanwhile, many communities—particularly underserved and marginalized communities—face growing challenges from climate change impacts for which they are largely unprepared.[82] We must invest in infrastructure to better withstand those impacts that are already unavoidable. Done properly, infrastructure investments can help jump start our economic recovery, while helping create more prosperous, equitable, and resilient communities that also benefit from our transition to a modern clean energy economy.

Priorities include updating and expanding our nation's high-voltage transmission infrastructure, expanding charging infrastructure for electric vehicles, accelerating infrastructure to help electrify energy use in the transportation, industrial and buildings sectors, accelerating offshore wind development, accelerating battery storage deployment, upgrading and modernizing public housing with attention to climate-resilience and energy-efficiency, and investing in workforce training. These investments should be made in a climate-resilient way, informed by the best available science. And they must prioritize equitable outcomes by targeting investments and opportunities that directly benefit historically underserved and marginalized communities.[83]

The extension of clean energy tax credits for renewable energy, energy storage and electric vehicles are also under active consideration and should be expedited through Congress.[84] This is one of the most impactful near-term opportunities Congress has right now to take meaningful action. Other recent encouraging proposals in Congress include the CLEAN Future Act, clean energy standards and carbon pricing policies.[85,86]

Responding to Climate Change: Building Climate Resilience

The grave risks climate change poses to our nation require an urgent response from federal, state and local policymakers, as well as market actors, to help protect communities and build resilience. Important priorities for resilience include:

[81] https://www.infrastructurereportcard.org/the-impact/failure-to-act-report
[82] https://nca2018.globalchange.gov/chapter/11/
[83] https://www.ucsusa.org/sites/default/files/attach/2019/03/climate-resilient-infrastructure-fact-sheet.pdf
[84] See the Growing Renewable Energy and Efficiency Now (GREEN) Act of 2020. https://www.congress.gov/bill/116th-congress/house-bill/7330/text
[85] https://energycommerce.house.gov/newsroom/press-releases/ec-leaders-release-draft-clean-future-act-legislative-text-to-achieve-a-100
[86] See H.R. 2597, the Clean Energy Standard Act of 2019. https://www.congress.gov/bill/116th-congress/house-bill/2597

- The federal government must play a lead role in researching and communicating a full range of climate risks to the public and incorporating those risks into its own policies and actions. [87] Federal investments are needed to ensure robust datasets, modeling and weather prediction efforts.[88]
- Mandating climate risk disclosure in the marketplace is vital to help individuals and businesses understand the risks to their investments and drive more resilient outcomes.[89] Financial regulators and market actors must live up to their responsibilities to the public. This includes strengthening the Securities and Exchange Commission's requirements for disclosure of climate risks by publicly traded companies, calling on regulators to review the administration's attempt to forbid retirement managers from considering climate change and other environmental concerns in investment decisions, improving financial regulation and oversight of climate risks by federal and state authorities, and putting a price on carbon. Better data and tools for assessing and managing market related climate risks are also needed.
- Congress must fund post-disaster recovery adequately and in an expeditious way so that aid can flow to hard-hit communities quickly and equitably, and in a way that helps build resilience to future events. [90]
- Post-disaster investments should be made with a view to reducing future risks through a range of protective measures, including home buyouts and investments in risk mitigation measures and access to adequate insurance coverage, particularly for low to middle income communities. Congress must give FEMA the authority to establish a flood insurance affordability program to ensure that low-income communities are protected by affordable flood insurance and have access to grants to reduce their flood risks.[91]
- We have to get out ahead of risks and not just respond in the aftermath of disasters, by ramping up investments in FEMA's pre-disaster hazard mitigation grants—including the Building Resilient Infrastructure and Communities (BRIC) program[92]—and flood mitigation assistance programs, and the community development block grant program administered by the US Department of Housing and Urban Development (HUD). Research shows that every $1 invested can save the nation $6 in future disaster costs.[93]

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[87] See H.R.4823 - FEMA Climate Change Preparedness Act, https://www.congress.gov/bill/116th-congress/house-bill/4823

[88] *See* S.4462 - A bill to establish a national integrated flood information system within the National Oceanic and Atmospheric Administration, and for other purposes *and* H.R.2462 - Flood Mapping Modernization and Homeowner Empowerment Pilot Program Act of 2019

[89] *See* H.R.3623 - Climate Risk Disclosure Act of 2019 and S.2075 - Climate Risk Disclosure Act of 2019.

[90] The "Reforming Disaster Recovery Act of 2019" (S.2301) and the Reforming Disaster Recovery Act of 2018 (H.R. 4557) would permanently authorize the CDBG-DR Program to ensure the disaster recovery funds are distributed more efficiently and fairly.

[91] *See* https://crsreports.congress.gov/product/pdf/IN/IN11050 and https://www.nap.edu/read/21709/chapter/8

[92] Under the recently passed Disaster Recovery Reform Act (DRRA), this grant program will be funded through the Disaster Relief Fund as a six percent set aside from estimated disaster grant expenditures

[93] Multihazard Mitigation Council. 2018. Natural Hazard Mitigation Saves: 2018 Interim Report. Principal Investigator Porter, K.; co-Principal Investigators Scawthorn, C.; Huyck, C.; Investigators: Eguchi, R., Hu, Z.; Reeder, A; Schneider, P., Director, MMC. National Institute of Building Sciences, Washington, D.C. www.nibs.org

- The National Flood Insurance Program requires overdue, commonsense reforms to ensure that it more effectively maps and communicates all types of current and future flood risks, protects and insures communities in an equitable way, and promotes better floodplain management to limit future exposure to risk.[94]
- A robust federal flood risk management standard would help protect vital federally funded infrastructure, ensure wise use of taxpayer dollars, and set a valuable guidepost for communities and businesses.
- A National Climate Bank to advance adaptation and mitigation can help drive investments on a scale commensurate with the climate crisis.[95] Holistic coastal resilience measures, including investments in nature-based solutions are vital.[96]
- Congress should set up a diverse and inclusive expert advisory body to provide guidance on infrastructure investments that not only accounts for climate change projections but historic injustices as well, by targeting investments in underserved and marginalized communities.[97]
- Federal, state and local resources will be necessary to help communities cope with and prepare for the health impacts of climate change.[98,99]
- Strengthened state and local building and zoning regulations—as well as coastal zone management regulations that protect wetlands, barrier islands, and other natural systems that reduce flood impacts—are needed to ensure flood-smart development
- Increased funding and financial mechanisms for voluntary flood risk reduction measures such as home buyout programs and floodplain easements administered by FEMA, HUD and USDA can also help homeowners move to safer locations and keep floodplains in open space permanently.[100] Communities in high-risk areas may also increasingly need relocation grants and technical assistance. Correspondingly, communities receiving an influx of new residents may need financial resources.
- Banks, insurers, real estate investors, developers, and other major financial actors in coastal areas should establish guidelines and standards to incorporate the risks of sea level rise and other climate risks in their business models, thus better serving the long-term economic interests of their clients. Widespread adoption of industry standards and best practices for disclosing flood and other climate-related risks is needed. In the wake of the 2015 Paris Agreement, the Financial Stability Board—an international body that

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[94] https://blog.ucsusa.org/rachel-cleetus/congress-must-extend-and-reform-the-national-flood-insurance-program

[95] See H.R. 5419,National Climate Bank Act https://www.congress.gov/bill/116th-congress/house-bill/5416

[96] See H.R. 1317, Coastal Communities Adaptation Act

[97] Union of Concerned Scientists. 2019. Building Equitable, Clean, and Climate-Safe Infrastructure. Online at https://www.ucsusa.org/sites/default/files/attach/2019/03/climate-resilient-infrastructure-fact-sheet.pdf

[98] See H.R.3668 - Asuncion Valdivia Heat Illness and Fatality Prevention Act of 2019, which would require the Department of Labor to establish an occupational safety or health standard on prevention of exposure to excessive heat.

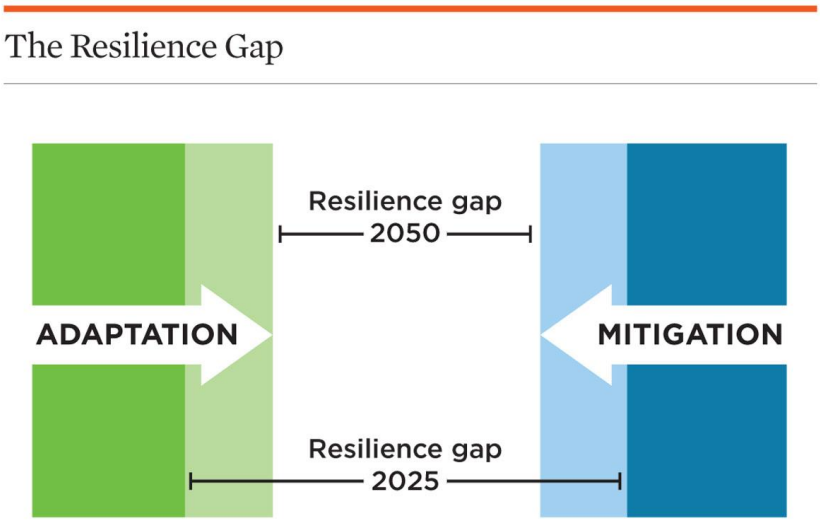
[99] *See* H.R.4347 - PREPARE Act of 2019 *https*://www.congress.gov/bill/116th-congress/house-bill/4347/text?q=%7B%22search%22%3A%5B%22The+Prepare+act%22%5D%7D&r=8&s=1

[100] *See* the State Flood Mitigation Revolving Fund Act. https://www.congress.gov/bill/116th-congress/house-bill/1610/related-bills?q=%7B%22search%22%3A%5B%22HR+1610%22%5D%7D&r=1&s=5

monitors and makes recommendations about the global financial system—launched the Taskforce on Climate-Related Financial Disclosures. The taskforce has released a set of recommendations on governance, strategy, risk management, and metrics and targets for financial-sector companies to support more accurate pricing of climate-related risks and thereby more informed investment decisions (TCFD 2017). These recommendations and the taskforce's five-year climate disclosure implementation pathway have the support of more than 250 major corporations, including banks, insurers, and investors. Credit rating bodies also must start reflecting climate risks in their ratings, while rewarding proactive adaptation measures to limit those risks.

Adaptation is costly, and there are limits to how much climate change we can adapt to, so we need to do our utmost to also cut carbon emissions sharply with the goal of limiting the resilience gap for communities (see figure 13).

Figure 13: Closing the Resilience Gap



The "resilience gap" represents the degree to which a community or nation is unprepared for damaging climate effects—and therefore the degree to which people will suffer from climate-related events. The arrows show the two ways to narrow the gap. We can adapt (left arrow) by preparing for climate impacts, and mitigate carbon emissions (right arrow) to slow the pace at which climate risks grow more severe or more common over time. The changing size of the resilience gap in 2025 versus 2050 conveys the potential for society's resilience gap to be narrowed, though not eliminated, through concerted effort on both fronts.

Contributing to global efforts, including by helping least developed nations make a low-carbon energy transition and cope with and build resilience to the impacts of climate change, is also vital. The federal government must make a reinvigorated commitment to the US doing its fair share to meet the goals of the Paris Agreement, including by ramping up its Nationally

Determined Contribution (NDC) to cutting emissions and increasing its contributions to climate finance for least developed countries. Just this week, China announced that it will aim to enhance its climate action and target carbon neutrality before 2060. The European Union is currently negotiating a 55 to 60 percent reduction in its emissions by 2030. The US simply must join the global community and step up and demonstrate climate leadership.

Closing:

In closing, I want to emphasize the unique and powerful responsibility the federal government has in addressing the many crises we face today, including the challenge of climate change.

First and foremost, Congress must swiftly pass a new robustly funded COVID-19 emergency relief package to protect people's health and their economic well-being. Families and communities are in crisis and desperately need help.

In addition, strong federal action to make the deep cuts in heat-trapping emissions is necessary to limit worsening climate risks. Communities around the nation and the world are reeling from the impacts of heat waves, flooding, droughts, wildfires, storms and other significant climate-related disasters. A swift, just and equitable clean energy transition can drive tremendous economic and public health benefits, especially for communities that are overburdened by pollution and face dire economic challenges today.

The choices we make now will determine the kind of future we leave our children and grandchildren and the fate of other species and ecosystems that share our planet. The stakes could not be higher or clearer, and we must rise to meet the grave responsibility we bear.

Thank you for your leadership on these important issues, and for the opportunity to testify before this committee today.