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Union of Concerned Scientists

"Creating a Climate Resilient America"

House Select Committee on the Climate Crisis

May 23, 2019

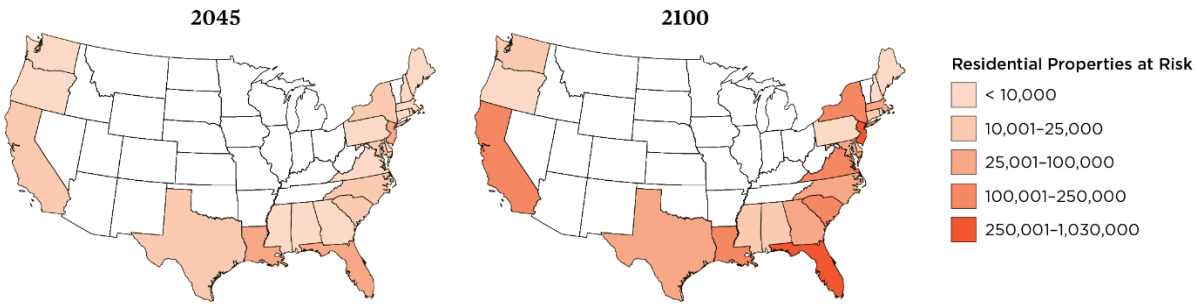
Hello and thank you, Chairwoman Castor, Ranking Member Graves, and Members of the Select Committee, for providing me the opportunity to testify here today. My name is Rachel Cleetus. I am the policy director and lead economist for the climate and energy program at the Union of Concerned Scientists. I am here today to share my perspectives on the impacts of climate change, particularly on coastal communities, and some vital, urgent steps our nation must take to limit the harms coming our way.

Impacts of sea level rise on coastal property:

I'd like to start with some research my colleagues and I have been doing on the impacts of sea level rise to coastal communities. Our research 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. Last year we released a report showing that, by the end of the century, under a high sea level rise scenario (which I will use throughout this testimony unless otherwise indicated),[1] 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. 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 1 and 2).

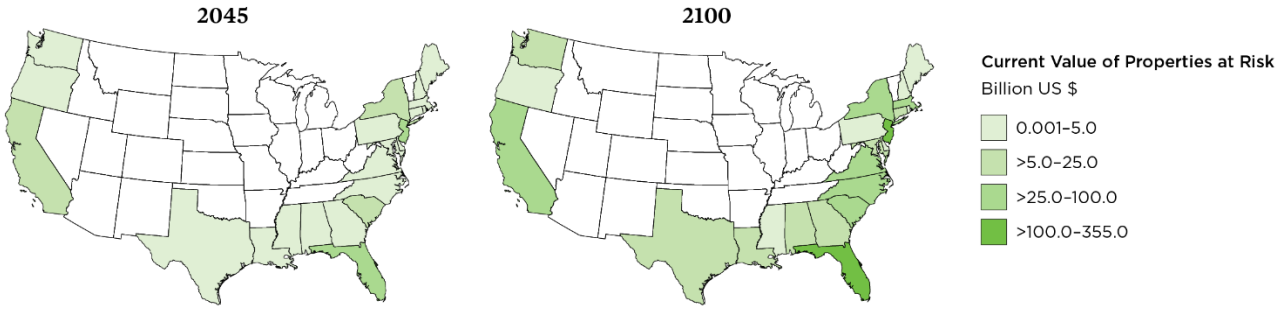
[1] The high scenario, which is drawn from the 2014 National Climate Assessment, assumes rapid ice sheet loss and projects a global average sea level rise of 6.6 feet (2.0 m) above 1992 levels by the end of this century. This scenario is considered most applicable in situations with a low tolerance for 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

Figure 1: Homes at risk of chronic inundation



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

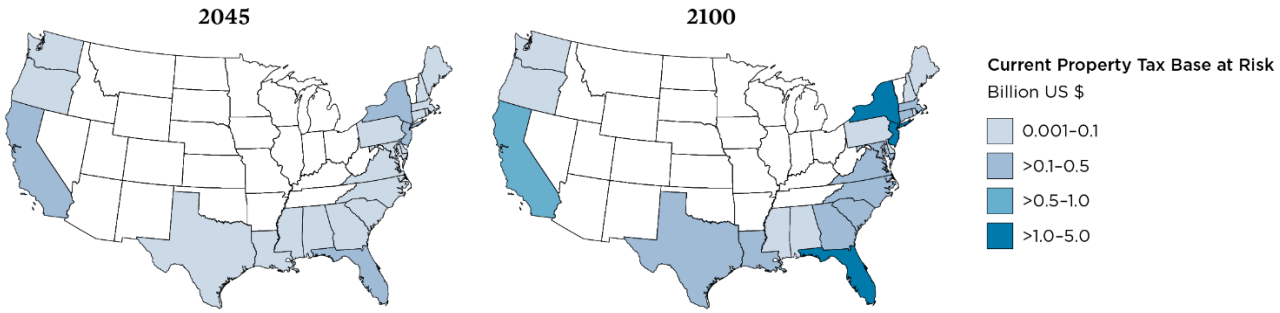
Figure 2: Value of homes at risk from chronic inundation



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

The properties at risk by 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 figure 3).

Figure 3: Property tax base at risk from chronic inundation



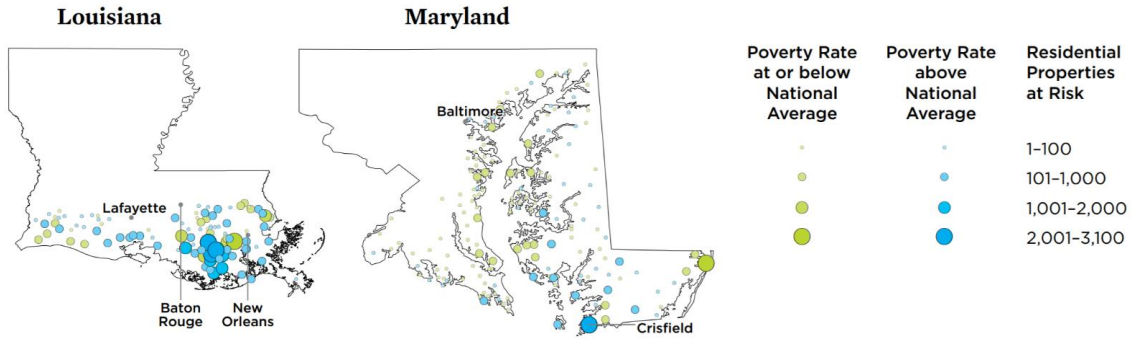
Credit: Union of Concerned Scientists. Data provided by third parties through the Zillow Transaction and Assessment Dataset (ZTRAX).

States with the most homes at risk by the end of the century are Florida, with about 1 million homes (more than 10% of the state's current residential properties); New Jersey, with 250,000 homes; and New York with 143,000 homes.

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. Falling property values mean reduced local tax revenue from those properties. Our calculations show that in about 120 communities along US coasts, the properties that would be at-risk in 2045 currently represent a full 20 percent or more of the local property tax base. Many coastal residents, whether they own homes or not, would be affected as property tax bases shrink, which typically leads to reduced services or tax hikes for remaining taxpayers. This could prevent cities and towns from fully funding schools, emergency services, and the maintenance and new construction of infrastructure—including critical adaptation measures that could help protect homes, businesses, and infrastructure itself from chronic flooding. Access to additional capital for such projects depends on a municipality's credit rating; its credit rating depends on its financial health and degree of risk exposure, both of which are compromised as chronic flooding worsens. Mortgages on homes that could be chronically flooded during the term of the loan are inherently riskier, exposing lenders to losses.

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. Nearly 175 communities nationwide can expect significant chronic flooding by 2045, with 10 percent or more of their housing stock at risk. Of those, nearly 40 percent—or 67 communities—currently have poverty levels above the national average. The largest share of these is in Louisiana, where there are 25 communities with above-average poverty rates and with 10 percent or more of the homes at risk by 2045. Louisiana is not the only state where poverty and exposure to chronic inundation intersect to create a hotspot of heightened risk. North Carolina, New Jersey, and Maryland also have significant numbers of highly exposed communities with above-average rates of poverty (see Figure 4). Within the next 30 years, about a dozen such communities along Maryland's eastern shore are projected to have one-third or more of their property tax base at risk.

Figure 4: Communities with high poverty rates at risk of chronic inundation in Louisiana and Maryland



These results do not include future development or new homes, nor do they include the impacts on critical infrastructure such as roads, bridges, power plants, airports, ports, public buildings, and military bases that will also be in harm's way. When all of these are taken together, the effects of chronic flooding could have staggering economic impacts.

UCS also developed an interactive map 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.[2] 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.

Impacts of sea level rise on Rail infrastructure:
We also used our 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*[3].

[2] 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
[3] https://www.bloomberg.com/graphics/2018-amtrak-sea-level/

Figure 5: Amtrak rail lines in Newark, NJ exposed to chronic flooding

Chronic flooding in the vicinity of Newark Liberty Airport in Newark, NJ, in 2060 (left) and 2100 (right). Chronically flooded areas are defined as flooding 26 times per year or more and are shown in orange. The Amtrak rail line, shown in black, cuts through the area exposed to chronic inundation highlighted by the green oval.

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 5). Current preparation efforts fall far short of these realities.

Impacts of sea level rise on U.S. military bases:

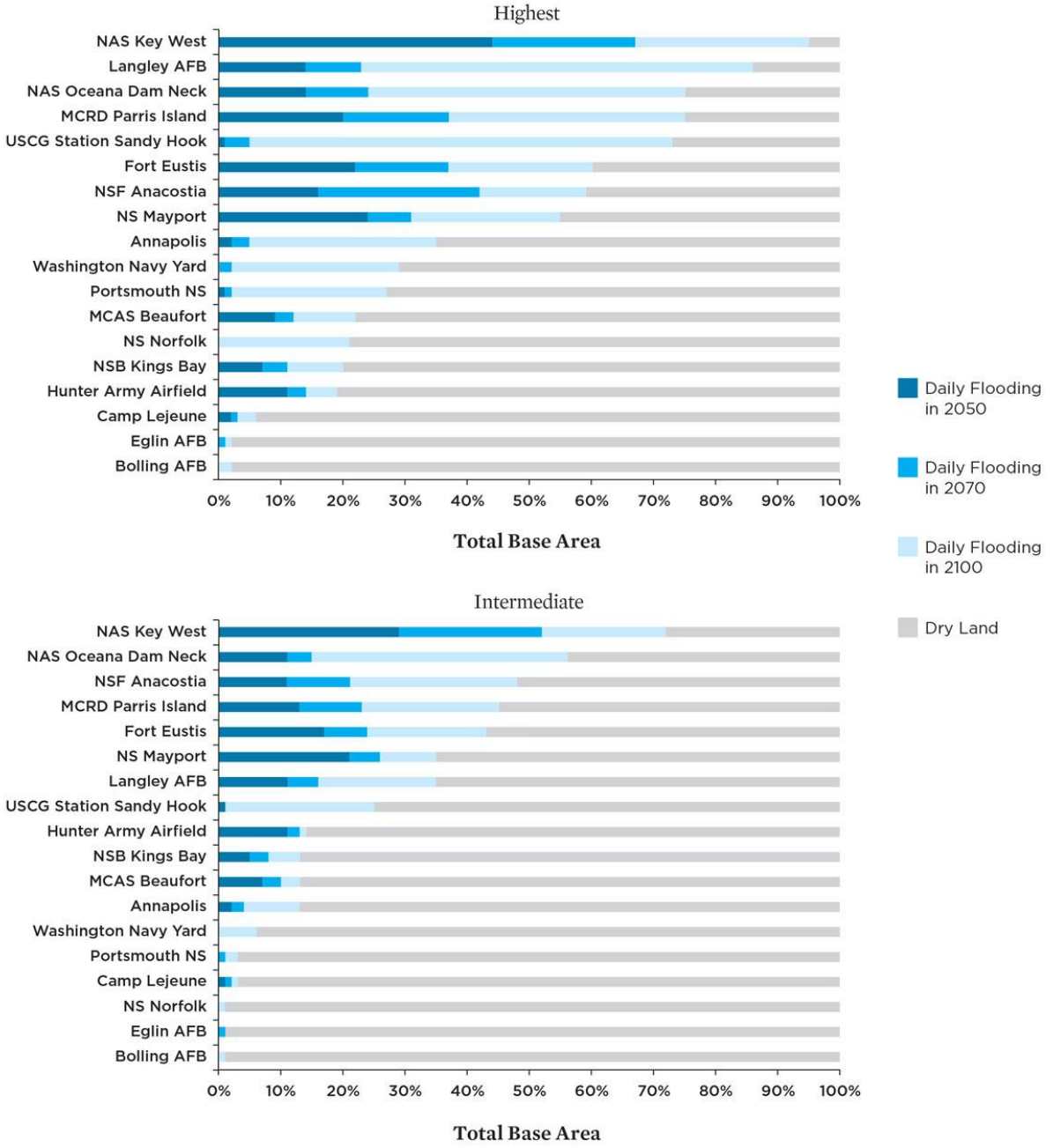
UCS has also analyzed the exposure of 18 military installations along the East and Gulf coasts to more frequent and extensive tidal flooding, land loss as some areas flood with daily high tides, and deeper and more extensive storm surge inundation.[4] In the absence of preventive measures, these sites, 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).

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

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

Land Loss across Bases



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.

Flooding and Exposure to Toxics during Hurricane Harvey:

Hurricane Harvey's unprecedented levels of rainfall—which scientists have linked to warmer air and oceans caused by climate change[5]—exacted a huge toll on the residents of Texas and Louisiana. In the wake of this storm, UCS analysis showed that more than 650 energy and industrial facilities may have been exposed to Hurricane Harvey's floodwaters.[6]

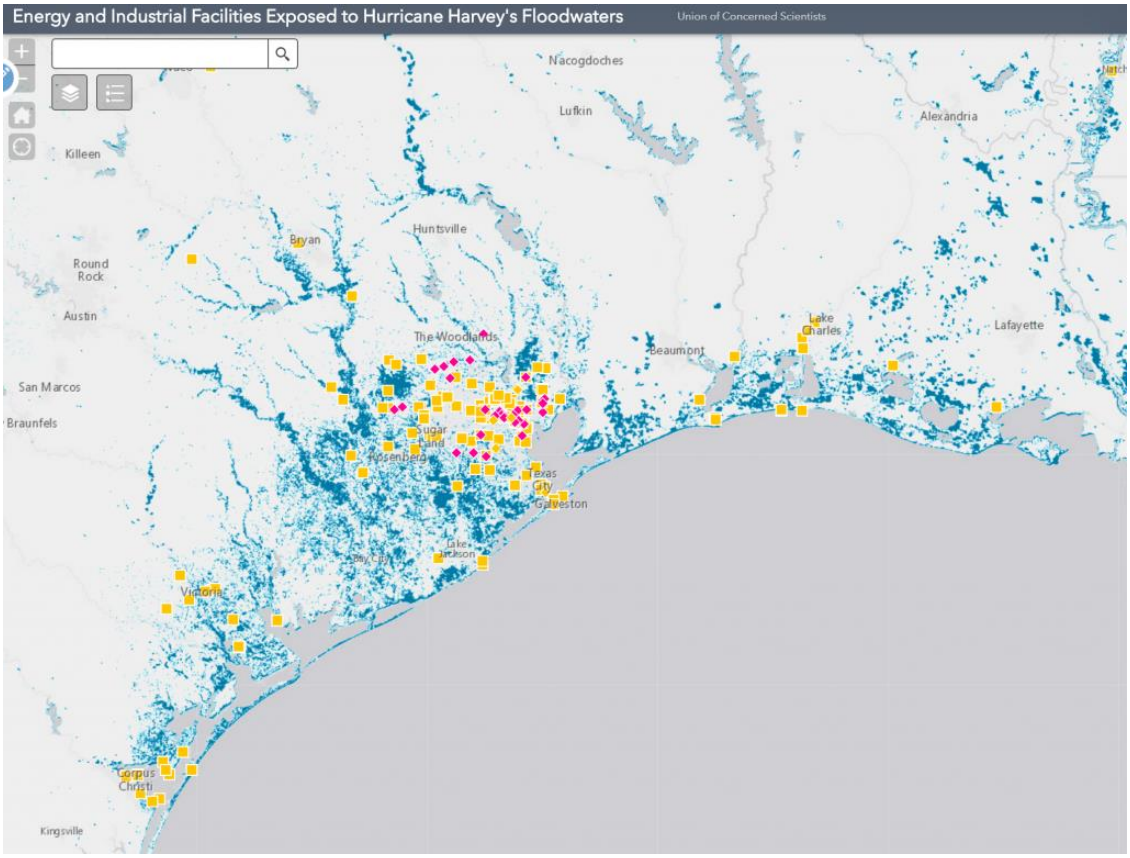
To highlight these facilities, the Union of Concerned Scientists developed an interactive tool showing affected sites. The tool relies on satellite data analyzed by the Dartmouth Flood Observatory to map the extent of Harvey's floodwaters, and facility-level data from the US Energy Information Administration and the Environmental Protection Agency.

The tool includes several types of energy infrastructure (refineries, LNG import/export and petroleum product terminals, power plants, and natural gas processing plants), as well as wastewater treatment plants and three types of chemical facilities identified by the EPA (Toxic Release Inventory sites, Risk Management Plan sites, and Superfund sites).

[5]Risser, M.D. and M. F. Wehner. 2017. Attributable Human-Induced Changes in the Likelihood and Magnitude of the Observed Extreme Precipitation during Hurricane Harvey. Geophysical Research Letters. Volume 44, Issue24 28 December 2017 Pages 12,457-12,464. https://doi.org/10.1002/2017GL075888
Trenberth, K. E., Cheng, L., Jacobs, P., Zhang, Y., & Fasullo, J. (2018). Hurricane Harvey links to ocean heat content and climate change adaptation. Earth's Future, 6. https://doi.org/10.1029/ 2018EF000825

[6] https://blog.ucsusa.org/kristy-dahl/flooded-by-hurricane-harvey-new-map-shows-energy-industrial-and-superfund-sites

Figure 7: Chemical facilities potentially exposed to flooding from Hurricane Harvey



Hurricane Harvey may have exposed to flooding more than 160 of EPA's Toxic Release Inventory sites, 7 Superfund sites, and 30 facilities registered with EPA's Risk Management Program.

The Gulf Coast is home to a vast chemical industry. The EPA's Toxic Release Inventory (TRI) program lists over 4,500 facilities in Texas and Louisiana alone that are required to report chemical releases to the environment.

Before the storm hit, many facilities shut down preemptively, releasing toxic chemicals in the process. In the wake of the storm, explosions at Arkema's Crosby facility highlighted the risks that flooding and power failures pose to the region's chemical facilities and, by extension, the health of the surrounding population.

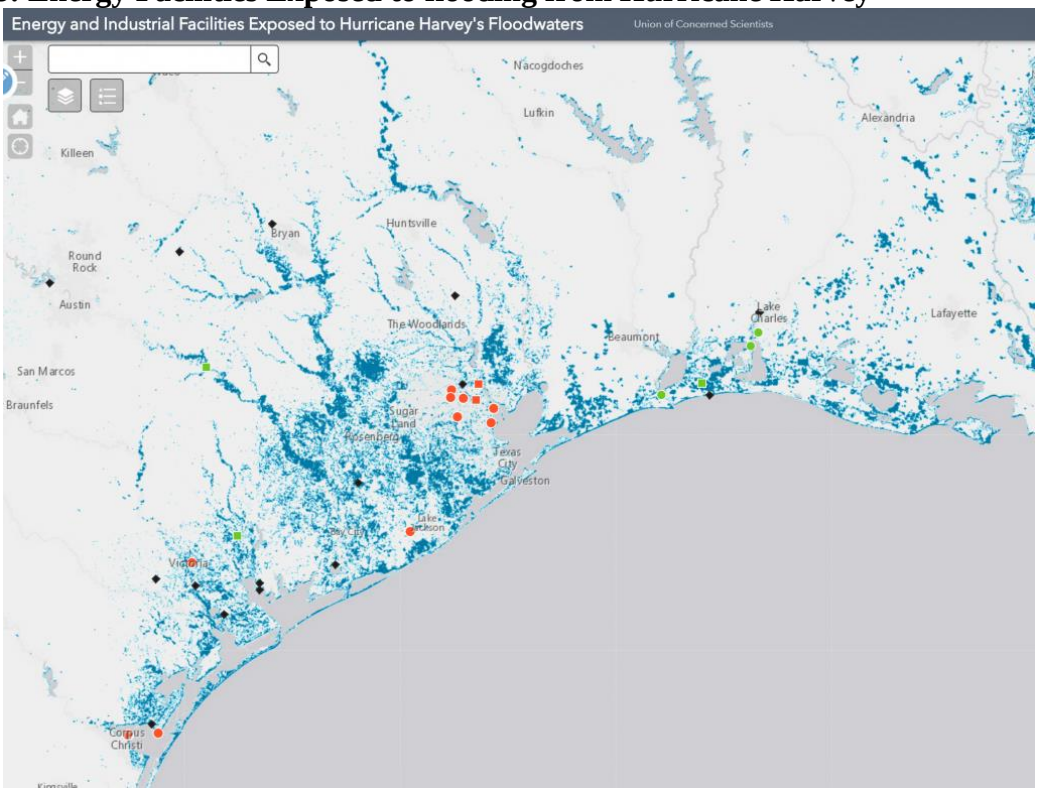
In the Houston area, low-income communities and communities of color are disproportionately exposed to toxic chemicals. Our analysis shows that over 160 TRI facilities, at least seven Superfund sites, and over 30 facilities registered with EPA's Risk Management Program were potentially exposed to floodwaters. The number of flooded Superfund sites may be even higher than the map shows, as indicated by preliminary reports from the EPA and other sources.

Though most of the impacts from this exposure remain unknown, the risks include compromised facilities and the release of toxins into the air and receding floodwaters.

Energy infrastructure

In the week after Hurricane Harvey reached the Texas coast, disruptions to the region's energy infrastructure caused gas prices to rise nationally by more than 20 percent. Our analysis found that more than 40 energy facilities may have been exposed to flooding, potentially contributing to disruptions in operations.

Figure 8: Energy Facilities Exposed to flooding from Hurricane Harvey



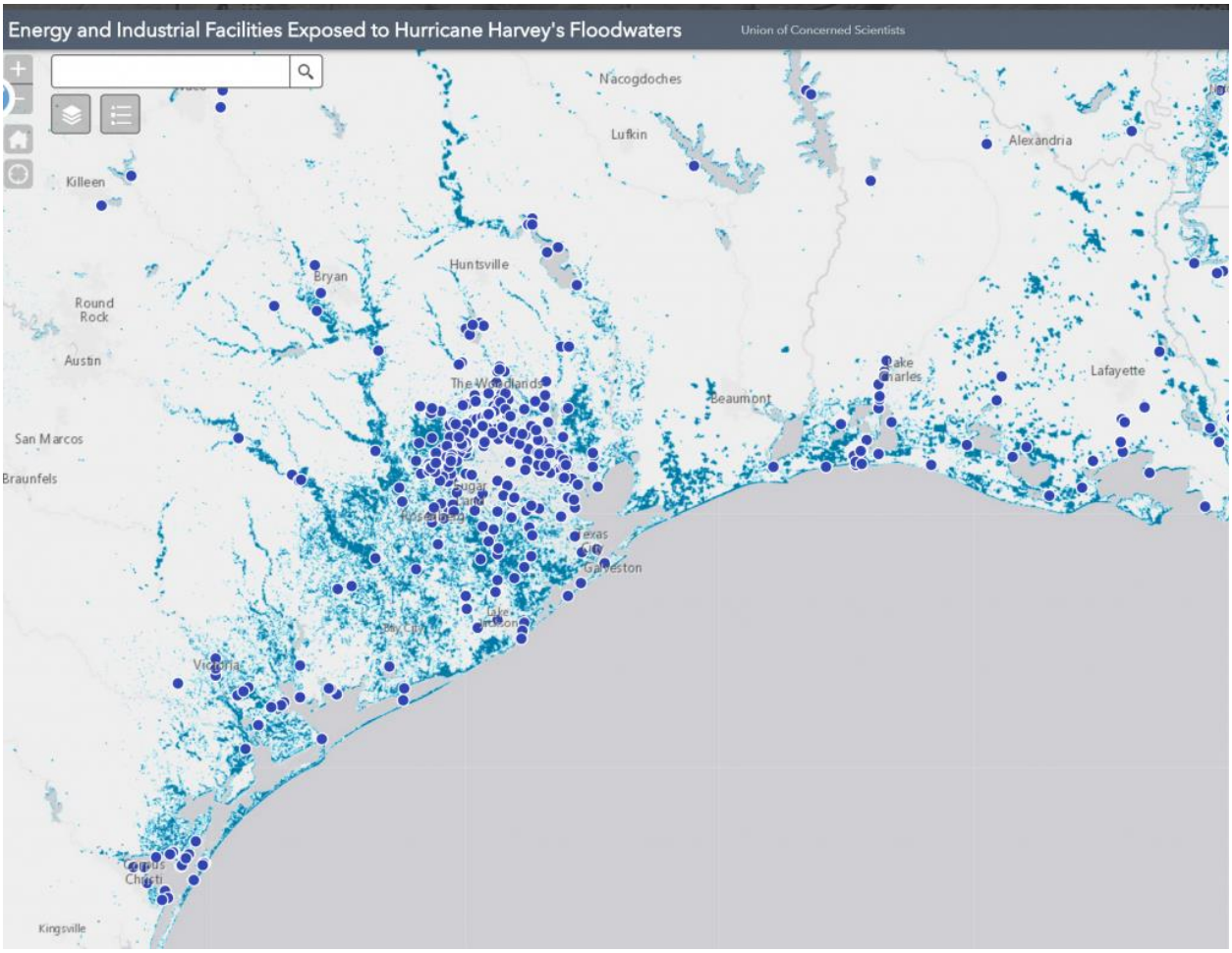
More than 40 energy facilities–including power plants and refineries–may have been exposed to Hurricane Harvey's floodwaters.

Wastewater treatment infrastructure

Wastewater treatment facilities comprised the bulk of the facilities (nearly 430) that we identified as potentially exposed to flooding. The EPA monitored the quality and functionality of water systems throughout the region and reported that more than half of the wastewater treatment plants in the area were fully operational as of September 3, roughly nine days after the storm made landfall.

With floodwaters widely reported as being contaminated with toxic chemicals and potent bacteria, wastewater treatment facilities were likely contending with both facility-level flooding and a heightened need to ensure the potability of treated water.

Figure 9: Wastewater Facilities Exposed to Flooding from Hurricane Harvey



Nearly 430 wastewater treatment facilities may have been exposed to flooding during Hurricane Harvey.

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. 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.[7]

This spring alone has 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 has just experienced the wettest 12 months on record.

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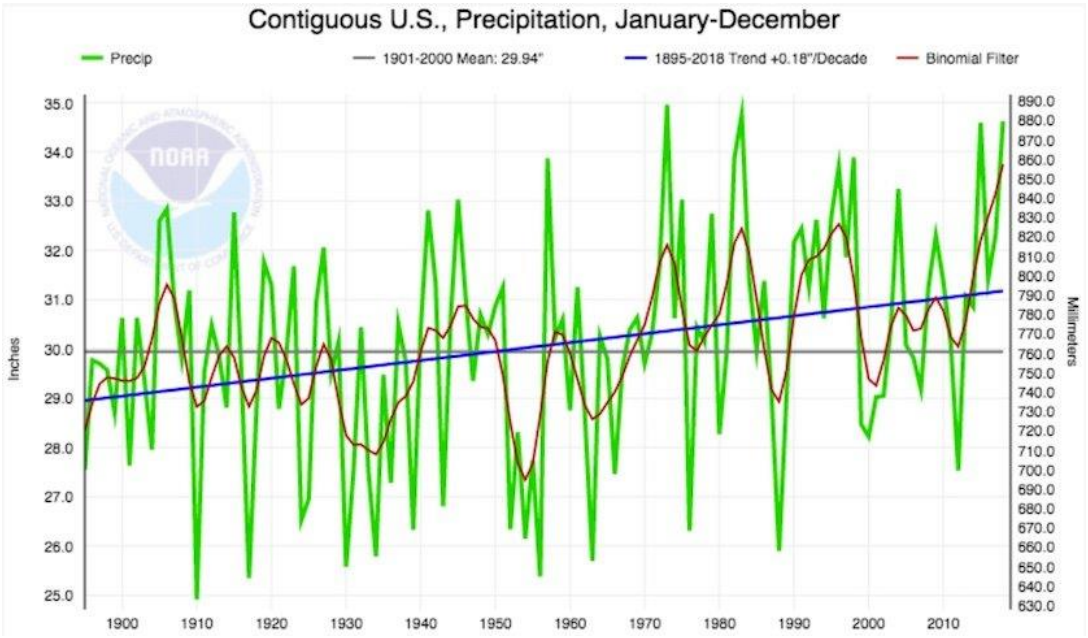
[7] https://www.ucsusa.org/sites/default/files/attach/2018/07/gw-fact-sheet-epif.pdf

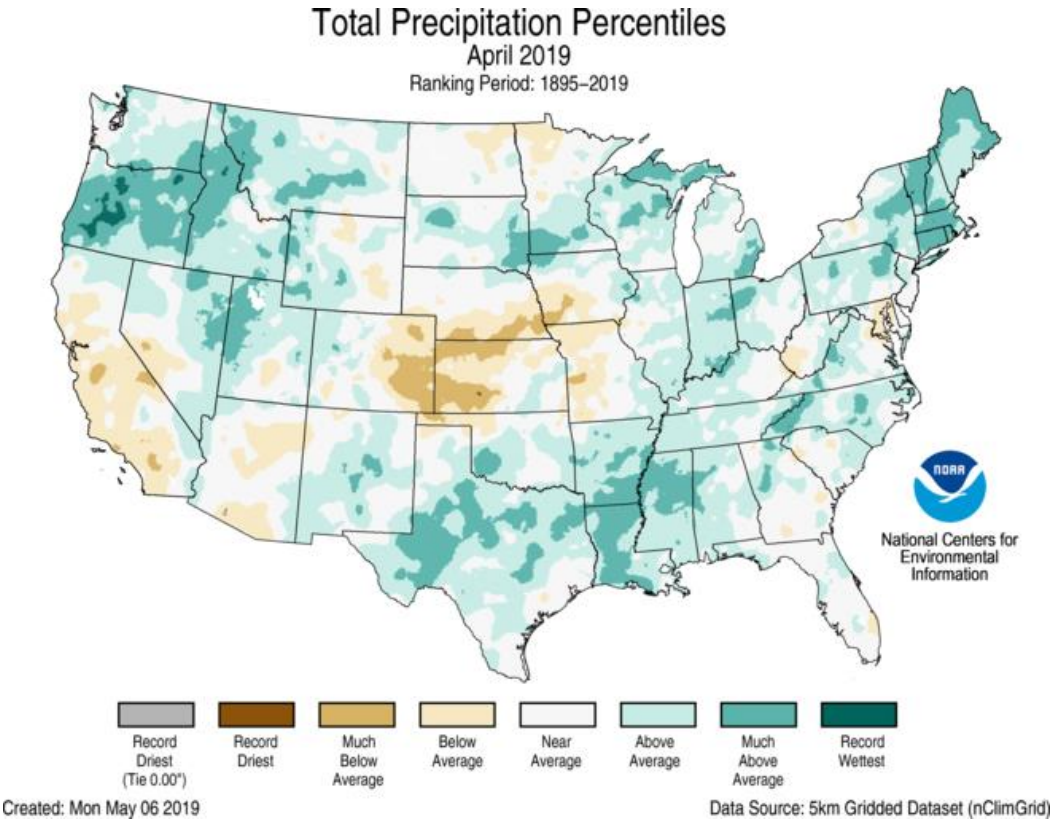
Figure 10: Precipitation in the Contiguous U.S.



While there is considerable variability from year to year and from decade to decade, total annual precipitation for the contiguous US as a whole has increased since 1900.

(NOAA data via https://www.wunderground.com/cat6/Wettest-12-Months-US-History?cm_ven=cat6-widget)

Figure 11: April 2019 Precipitation Relative to a Historical Baseline



April 2019 capped the wettest 12-months on record for the contiguous US. Above normal precipitation and the subsequent flooding across the central US lead to widespread disruption of transportation by road and rail.

Source: NOAA[8]

This record-breaking flooding has 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[9]. In Nebraska alone, the flooding caused an estimated $100 million in damage to the state's highway system[10].

[8] https://www.ncdc.noaa.gov/temp-and-precip/us-maps/1/201904#us-maps-select

[9] 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

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

Rail lines in Nebraska and Missouri were shut down for weeks[11]. Businesses that rely on safe and reliable transportation have also been affected[12].

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[13]. 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.[14] 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[15].

Water, Wastewater and Septic Systems at risk from climate change:

Rising sea levels and extreme storms are also making water, wastewater and septic tank systems more prone to damage or failure, including in coastal Florida, North Carolina, South Carolina and Maryland. Studies show that tidal flooding, storm surges, heavy rainfall, and saltwater

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

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

[13] 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.

[14] 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

[15] 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

intrusion pose risks to coastal infrastructure, human health and the environment, and efforts to address these challenges could cost billions of dollars.[16,17,18,19]

Public Health impacts of climate change:

Climate change will have profound effects on human health. See Figure 8 for a conceptual diagram from the National Climate Assessment illustrating the exposre pathways by which climate change could effect human health.

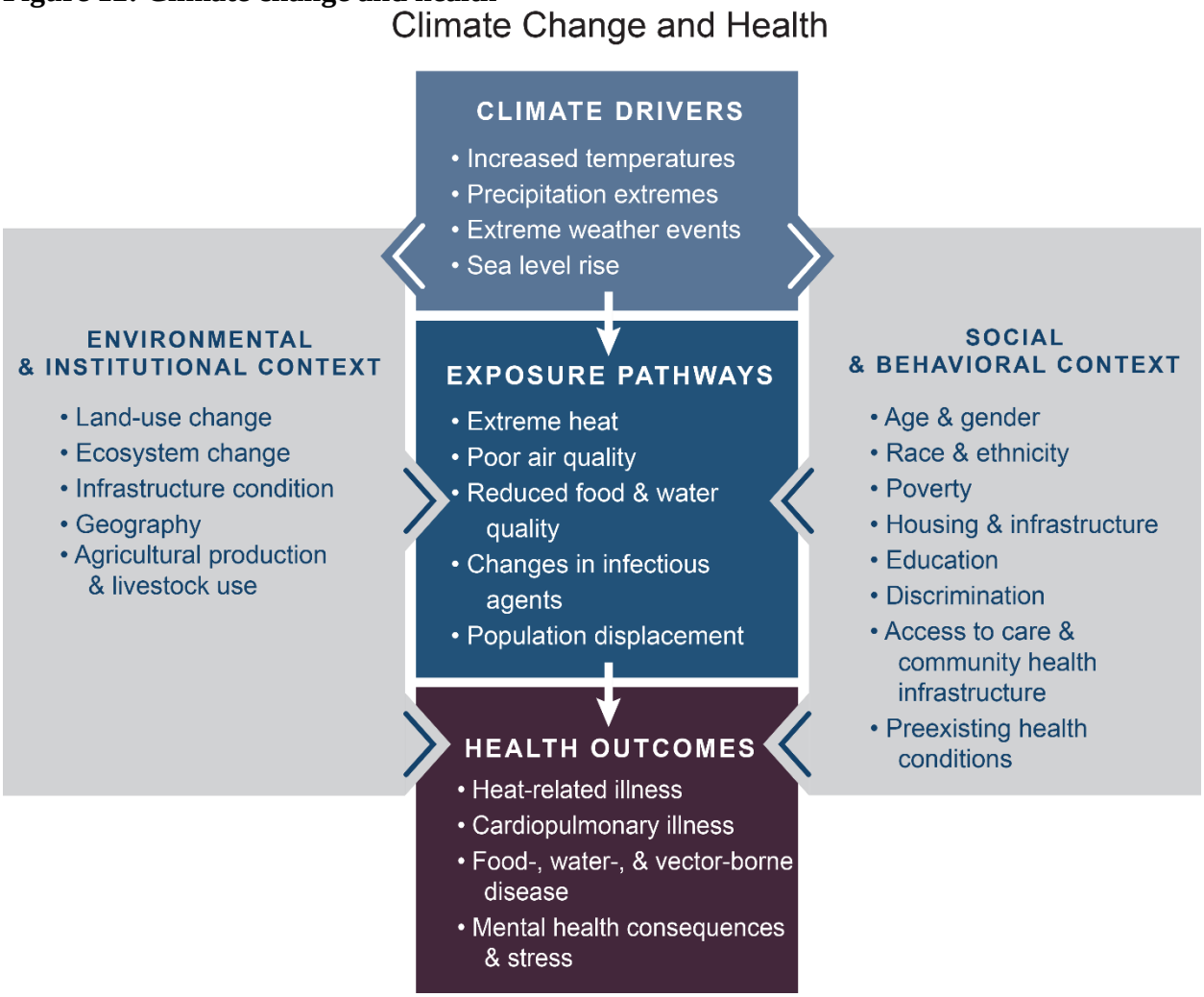
[16] T. R. Allen, T. Crawford, B. Montz. 2018. Linking Water Infrastructure, Public Health, and Sea Level Rise: Integrated Assessment of Flood Resilience in Coastal Cities. Public works management and policy. Vol 24, Issue 1, 2019. https://doi.org/10.1177/1087724X18798380

[17] Septic systems vulnerable to sea level rise. November 2018. Final Report in support of Resolution No. R-911-16. By the Miami-Dade County Department of Regulatory & Economic Resources, Miami-Dade County Water and Sewer Department & Florida Department of Health in Miami-Dade County.

[18] Mihaly, E. 2018. *Avoiding Septic Shock: How Climate Change Can Cause Septic System Failure and Whether New England States are Prepared.* Ocean and Coastal Law Journal Volume 23 | Number 1 Article 2 January 2018. https://digitalcommons.mainelaw.maine.edu/cgi/viewcontent.cgi?article=1359&context=oclj

[19] Harris, A. A $3 billion problem: Miami—Dade's septic tanks are already failing due to sea rise. Miami Herald, January 10, 2019. https://www.miamiherald.com/news/local/environment/article224132115.html

Figure 12: Climate change and health



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

Drawing from the National Climate Assessment, I highlight here **some major health implications of climate change**[20]**:**

- *High temperatures in the summer are conclusively linked to an increased risk of a range of illnesses and death, particularly among older adults, pregnant women, and children.* Studies show that other vulnerable populations include low-income households especially those in urban areas, outdoor workers, athletes, those with pre-existing health conditions, the homeless and the incarcerated.[21]

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

[21] 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

- *Climate change is expected to alter the geographic range, seasonal distribution, and abundance of disease vectors, exposing more people in North America to ticks that carry Lyme disease or other bacterial and viral agents, and to mosquitoes that transmit West Nile, chikungunya, dengue, and Zika viruses.*
- *Increasing water temperatures associated with climate change are projected to alter the seasonality of growth and the geographic range of harmful algae and coastal pathogens, and runoff from more frequent and intense rainfall is projected to increasingly compromise recreational waters and sources of drinking water through increased introductions of pathogens and toxic algal blooms.* Research has shown that a combination of warming waters and increased rainfall bringing excess nutrients into freshwater lakes and rivers could lead to an increase in algal blooms that pose threats to humans and marine life, as well as affect water supplies and recreational activities.[22] In the summer of 2018, a massive algal bloom affected over 100 miles along the Gulf Coast in southwestern Florida, and the widespread release of associated neurotoxins led to massive die offs of fish and other marine species. Algal blooms have also affected the Great Lakes.[23]
- *Projected increases in extreme precipitation and flooding, combined with inadequate water and sewer infrastructure, can contribute to viral and bacterial contamination from combined sewage overflows and a lack of access to potable drinking water, increasing exposure to pathogens that lead to gastrointestinal illness.*
- *Climate change, including rising temperatures and changes in some extreme weather and climate events, can adversely affect global and U.S. food security by, for example, threatening food safety (by altering exposures to certain pathogens and toxins), disrupting food availability, decreasing access to food, and increasing food prices. Food quality also is expected to be affected by rising CO_2 concentrations that decrease dietary iron, zinc, protein, and other macro- and micronutrients in crops and seafood.*
- *Mental health consequences, ranging from minimal stress and distress symptoms to clinical disorders, such as anxiety, depression, post-traumatic stress, and suicidality, can result from exposures to short-lived or prolonged climate- or weather-related events and their health consequences. These mental health impacts can interact with other health, social, and environmental stressors to diminish an individual's well-being. Some groups are more vulnerable than others, including the elderly, pregnant women, people with preexisting mental*

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[22] 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).

[23] 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

illness, the economically disadvantaged, tribal and Indigenous communities, and first responders.

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 includes a special brief for the United States.[24,25]

Responding to climate change:

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:

- The federal government must play a lead role in communicating risks to the public and incorporating those risks into its own policies and actions. Flood-risk disclosure in the marketplace is also vital to help individuals and businesses understand the risks to their investments and drive more resilient outcomes.
- We 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.
- 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 flood-proofing measures, particularly in low to middle income communities and as appropriate, a requirement for adequate insurance coverage.
- 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[26]—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.[27]
- The National Flood Insurance Program requires commonsense reforms to the program 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.[28]

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[24] 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

[25] 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 http://www.lancetcountdown.org/media/1426/2018-lancet-countdown-policy-brief-usa.pdf

[26] 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

[27] 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

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

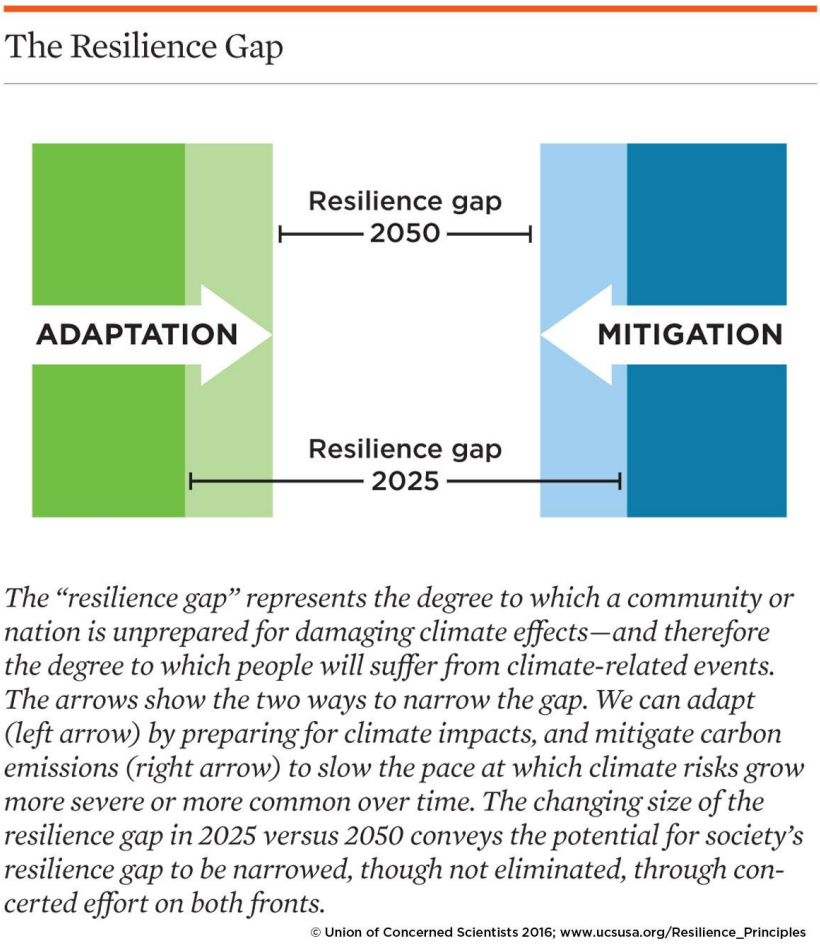
- A robust federal flood risk management standard would help protect vital federally funded infrastructure, ensure wise use of taxpayer dollars, and set a valuable guidepost for communities.
- Federal, state and local resources will be necessary to cope with and prepare for the health impacts of climate change.
- Congress should set up a diverse and inclusive expert advisory body to provide guidance on infrastructure that not only accounts for climate change but historic injustices as well, by targeting investments in underserved and marginalized communities.[29]
- 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 for voluntary home buyout programs administered by FEMA and HUD can also help homeowners move to safer locations. 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 in their business models, thus better serving the long-term economic interests of their clients.

Most importantly, we must make deep cuts in heat-trapping emissions to contribute to global efforts to limit climate change. Adaptation is costly, and there are limits to how much change we can adapt to, so we need to do our utmost to also mitigate carbon emissions with the goal of limiting the resilience gap for communities (see figure 13). 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 carbon emissions by mid-century would not only help address climate change, it will deliver tremendous near-term public health and economic benefits.[30] Contributing to global efforts, including by helping developing countries make a low-carbon energy transition and cope with and build resilience to the impacts of climate change, is also vital.

[29] 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

[30] 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

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.

Closing:

In closing, I am here today both as an expert who has studied these issues for a long time, and as a Mom. I have two young children who are 11 and 13 years old. Like many of you with young people in your lives, I am acutely aware that the choices we make today—choices that you in Congress are uniquely empowered to help make—will be deeply consequential to their future. I hope we will seize the opportunity to leave our children and grandchildren a world where they can prosper without fear of runaway climate change. Thank you for this opportunity to testify and for your leadership on climate action.