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Union of Concerned Scientists

"Time for Action: Addressing the Environmental and Economic Effects of Climate Change"

House Committee on Energy & Commerce,

Subcommittee on Environment and Climate Change

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Thank you, Chairman Tonko, Ranking Member Shimkus, and Members of the Subcommittee for providing me the opportunity to testify here today. I am Director of Climate Science at the Union of Concerned Scientists and served as a co-author of the Fourth National Climate Assessment released last November. Before I share with you advances in our understanding of climate from the latest climate assessments, I will turn to a recent example of the high cost of climate change.

During the recent outbreak of extreme cold weather that gripped large parts of the nation, a University of Iowa student and a University of Vermont student were counted among at least 21 people who perished from consequences likely related to the dangerous cold temperatures and wind chill.[1][2] Although it may seem counterintuitive, recent studies indicate that the warming climate can cause unusually cold temperatures at mid-latitudes by disrupting the normal winter- season polar vortex in the stratosphere.[3] A good analogy to this disruption is a weak seal on a freezer door that periodically allows frigid air to flood into the room while warmer air rushes into the freezer. At the end of January, a cold blast spilled out of the Polar Regions and into the Midwest and eastern US – breaking wind chill records. Yet Alaska experienced a warmer-than-normal season, where above-freezing temperatures and rainfall forced the cancellation of mid-distance dog sled races that mushers use to qualify for long-distance races such as the Iditarod.[4] Evidence is growing that warmer-than-normal

[1] Iowa City Press-Citizen Feb 2, 2019 by Aimee Breaux https://bit.ly/2Gk6feW
[2] BBC News, Feb 1, 2019 https://bbc.in/2Sn104s
[3] Polar vortex and Sudden Stratospheric Warming defined: https://www.aer.com/glossary/#P
[4] KTUU Jan 29, 2019 by Jill Burke https://bit.ly/2Bnkdt7

periods in the Arctic are associated with a greater chance for extreme winter weather in the eastern US.[5] This deadly cold snap is just the most recent example of the changing nature of extreme events that scientists are studying. One goal is to provide earlier warning so local officials have more time to take precautionary measures to improve safety.

Climate assessments provide the public and policy makers the most advanced warnings through summary and evaluation of the most recent research. I will briefly share some findings with you today from the Intergovernmental Panel on Climate Change Special Report on Global Warming of 1.5 degrees Celsius and the Fourth National Climate Assessment.

Intergovernmental Panel on Climate Change Special Report Global Warming of 1.5°C

Nearly all countries have agreed to the goals of the Paris Climate Agreement, "Holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels."[6] The Intergovernmental Panel on Climate Change was invited to issue a special report on the climate impacts of 1.5 degrees Celsius and different pathways that could limit the temperature increase. Human-induced warming reached approximately 1°C (1.8 °F) above pre-industrial levels in around 2017.[7] What has this 1°C warmer world already brought us? Research indicates that this warming has changed the behavior and severity of extreme events. For example, scientists found that global warming made the precipitation around 15% (8-19%) more intense for Hurricane Harvey that brought devastating flooding to Houston, and around three (1.5-5) times more likely.[8]

At the present rate, global temperatures would reach 1.5°C around 2040 and 2°C around 2065.[9] Every half-degree of global temperature increase can have major consequences. Coral reefs have an immense variety of species and support fisheries that help feed many around the world. The IPCC special report assessed that coral reefs

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[5] Cohen, Pfeifer, and Francis, 2018, Nature Communications; https://www.nature.com/articles/s41467-018-02992-9

[6] UNFCCC https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

[7] IPCC SR15 SPM: "Human activities are estimated to have caused approximately 1.0°C of global warming5 above pre-industrial levels, with a likely range of 0.8°C to 1.2°C. https://www.ipcc.ch/sr15/

[8] van Oldenborgh, G.J., van der Wiel, K., Sebastian, A., Singh, R., Arrighi, J., Otto, F.E.L., Haustein, K., Li, S., Vecchi, G. and Cullen, H. (2017) Attribution of extreme rainfall from Hurricane Harvey, August 2017. *Environmental Research Letters*, **12:**124009. doi: 10.1088/1748-9326/aa9ef2

[9] IPCC SR15 2018: "Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate. (high confidence) {1.2, Figure SPM.1}" https://www.ipcc.ch/sr15/

are projected to decline by a further 70-90% at 1.5 degrees Celsius with larger losses of nearly all coral reefs at 2 degrees Celsius above pre-industrial levels.[10] As temperatures rise, so does the sea level. If the temperature rise were held to 1.5°C versus 2°C, the lower sea level could mean that up to **10 million fewer people** would be exposed to related risks, based on population in the year 2010 and assuming no adaptation.[11]

To avoid surpassing 1.5°C, global carbon dioxide emissions would have to drop around 45% below 2010 levels by 2030 and reach net zero emissions by around 2050 (Figure 1). This would also include deep reductions in methane and black carbon (or soot) as well as nitrous oxide (such as from agriculture). The special report asserts that to hold increasing temperatures to 1.5°C would require "rapid and far reaching transitions in energy, land, urban and infrastructure" at "unprecedented scale" with "significant upscaling of investments in options."[12] Given the scale of the changes needed and the time to lay the framework, this is the "make or break" decade to make the capital investments needed to reduce the carbon dioxide levels or the Paris Climate goals cannot be attained.

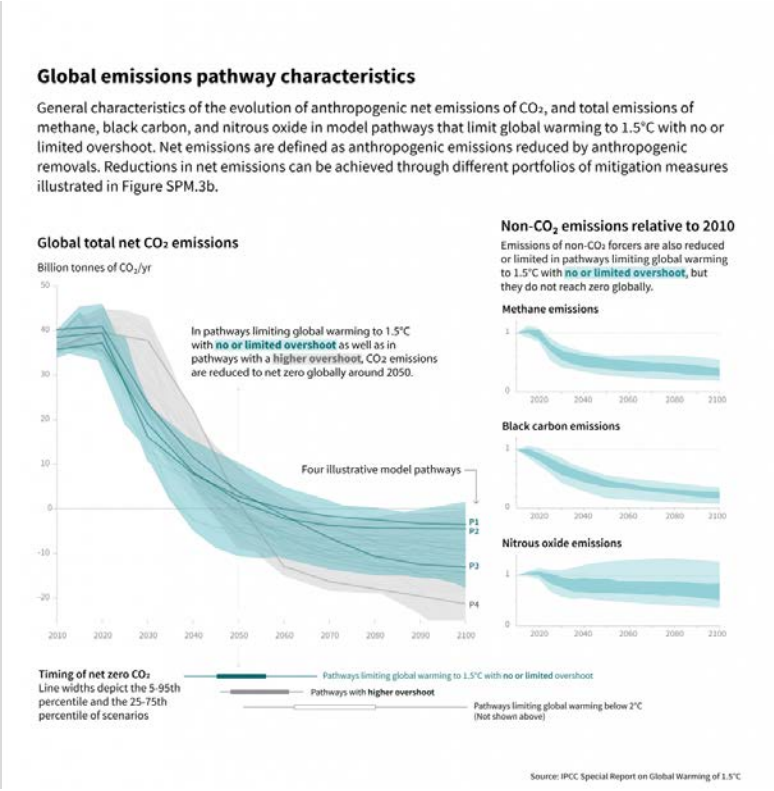


Figure 1: IPCC SR 15 SPM Figure 3a.

[10] IPCC SR15 2018
[11] IPCC SR15 2018
[12] IPCC SR15 2018

The Fourth National Climate Assessment

The Fourth National Climate Assessment, Volume II, was released in November 2018 in accordance with the legal mandate of the 1990 Global Change Research Act.[13] Major themes emerge from the findings. Increasingly U.S. residents recognize the consequences of climate change in their daily lives, their communities and livelihoods.[14] Social and economic inequities can be exacerbated with climate change through the increased exposure and sensitivity to extreme weather and other climate-related events or changes.[15] Actions taken to address the causes and impacts can affect disadvantaged populations unless equity dimensions are factored in. Cities and states are already deploying a mix of solutions to reduce emissions[16] and the iterative process of adaptation has progressed[17] since the third national assessment.

Increasingly U.S. residents already recognize the consequences of climate change. Midwest forest products industry has experienced over the past 70 years a 2-3 week shorter frozen ground season suitable for winter harvests.[18] Great Lakes ice cover decreased on average 71% from 1973 to 2010, with a recent rebound to higher ice years during 2014 and 2015.[19] Meanwhile, during the 2012 and 2017 winters in Lake Ontario and southern Lake Michigan, the temperatures never dropped below 39 °F, the critical temperature threshold for seasonal mixing.[20] Without the winter or spring seasonal mixing, the chances increase for low oxygen conditions that prove toxic for aquatic species. In another case, an extreme flooding event in Thailand caused a U.S.-based company to lose around half of its hard drive shipments during the last quarter of 2011. This temporarily doubled global hard drive prices and drove up costs for Apple, HP, and Dell.[21]

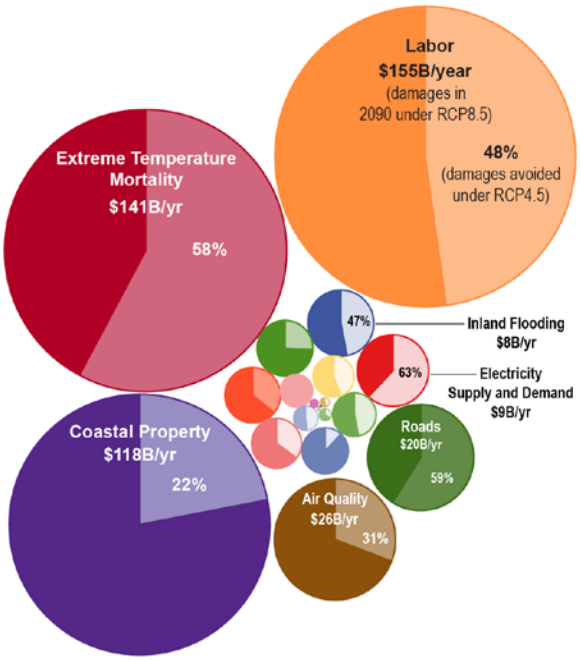
Climate Change can exacerbate historical inequities unless decision makers identify solutions that consider these factors. Low-income communities, children, older adults, and people of color are often at greater risk. Low-income communities are often located in areas that may be more prone to flooding (e.g. the Lower Ninth Ward during Hurricane Katrina). Extra attention must be paid to ensure that the vulnerabilities of frontline communities are identified and addressed. The health impacts of Climate

[13] NCA4 2018 https://nca2018.globalchange.gov/chapter/appendix-1/
[14] NCA4 2018 https://nca2018.globalchange.gov/chapter/1/
[15] Ibid.
[16] NCA4 2018 https://nca2018.globalchange.gov/chapter/29/
[17] NCA4 2018 https://nca2018.globalchange.gov/chapter/28/
[18] NCA4 2018 https://nca2018.globalchange.gov/chapter/21/
[19] Ibid.
[20] Ibid.
[21] NCA4 2018 https://nca2018.globalchange.gov/chapter/16/

Change can be mitigated to some degree. Adults can protect children from extreme heat through hydration and exertion monitoring. Arizona and California have a spike in cases of a fungus that can lead to Valley Fever during dry winter and spring conditions conducive to its growth. Over 40% end up hospitalized and two-thirds can take weeks to months before patients can resume normal activities.[22] Other health consequences of dust related to droughts and links with asthma, allergens and respiratory issues were more negative when affecting household property and finances.[23]

One of the advances of the Fourth National Climate Assessment was the integrated assessment of damages to the United States from particular levels of projected global emissions. Damages at the highest emissions trajectories were compared with "avoided damages" at lower global emissions trajectories (Figure 2). I will share the findings for the top three sectors. Projected annual economic damages (in 2015 dollars) for the labor sector in 2090 under a higher global emissions scenario (RCP 8.5) was on average $155 ($87 - $221) billion per year. Under a lower global emissions scenario (RCP 4.5) around 48% (40%-60%) average damages can be avoided. Projected annual economic damages for extreme heat mortality in 2090 under a higher global emissions scenario was on average $141 ($82 - $201) billion per year. Under a lower global emissions scenario (RCP 4.5) around 58% (44%-69%) average damages can be avoided. Projected annual economic damages for coastal property in 2090 under a higher global emissions scenario was on average $118 billion per year. Under a lower global emissions scenario (RCP 4.5) around 22% average damages can be avoided.

[22] NCA4 2018 https://nca2018.globalchange.gov/chapter/14/
[23] Ibid



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%

Figure 2: NCA4 2018 Figure 29.2.

Climate Change is real and we are feeling its effects now. NOAA and NASA report that 2018 is among the top hottest years on record. According to UN population statistics, more than 60% of people in 2018 have experienced above average global temperatures every year of their lives while teenagers have experienced mostly record-breaking years.

These two reports demonstrate that the lives of many Americans are at stake. The IPCC Special Report predicts the significant damage we will inflict on ourselves if we follow the high CO2 emissions trajectories while highlighting the real benefits, in terms of dollars and lives saved, of a lower emissions trajectory. Over 455 cities and all States are employing a mix of strategies to reduce the carbon dioxide emissions at the root cause of climate change (Figure 3).[24] We need to step up these and new efforts to protect and preserve a livable environment for ourselves, our children and grandchildren.

Thank you for this opportunity to speak with you today. I look forward to your questions.

[24] NCA4 2018

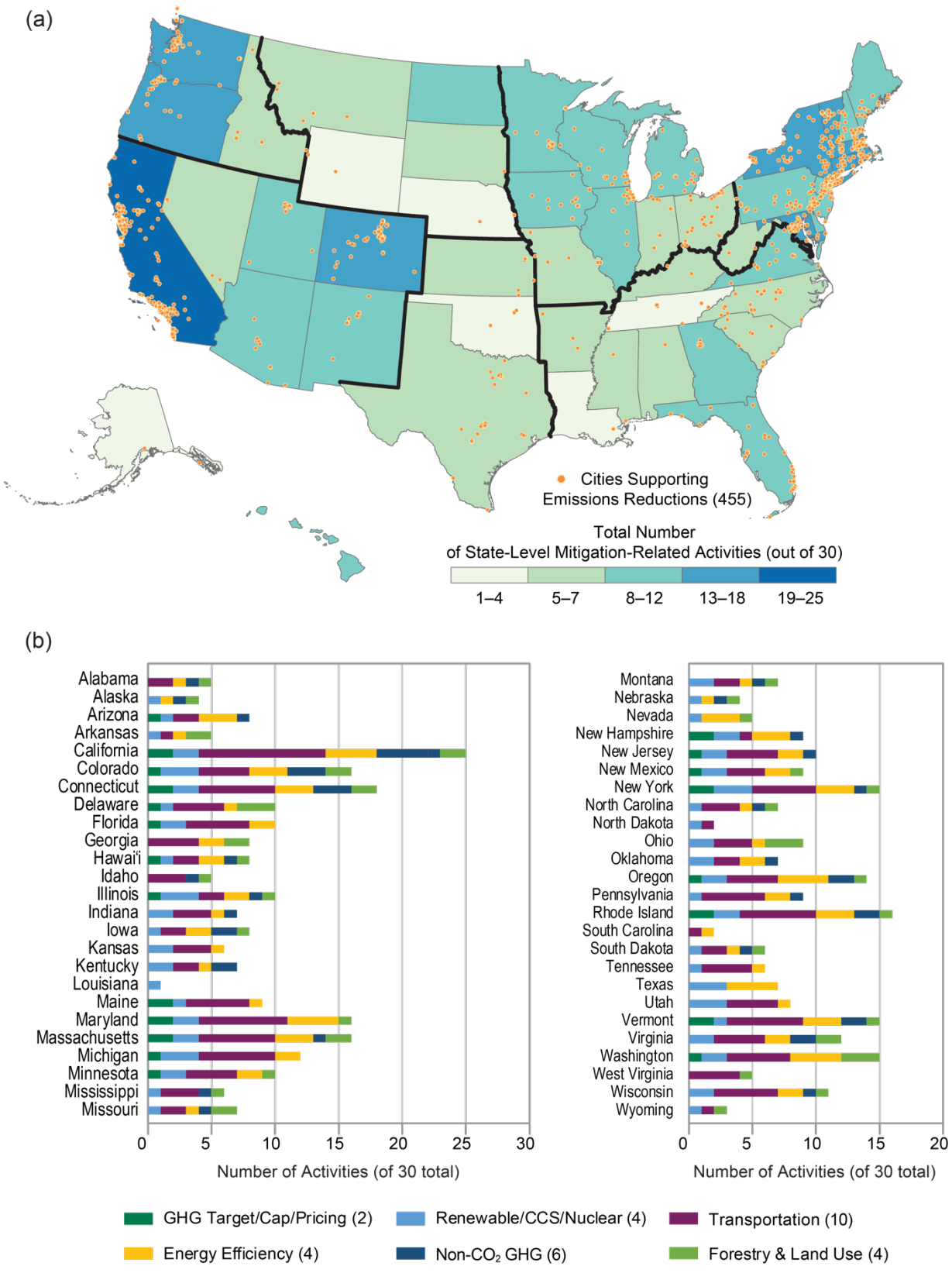

(a)
Cities Supporting
Emissions Reductions (455)
Total Number
of State-Level Mitigation-Related Activities (out of 30)
1–4
5–7
8–12
13–18
19–25
(b)
Alabama
Alaska
Arizona
Arkansas
California
Colorado
Connecticut
Delaware
Florida
Georgia
Hawai'i
Idaho
Illinois
Indiana
Iowa
Kansas
Kentucky
Louisiana
Maine
Maryland
Massachusetts
Michigan
Minnesota
Mississippi
Missouri
0
5
10
15
20
25
30
Number of Activities (of 30 total)
Montana
Nebraska
Nevada
New Hampshire
New Jersey
New Mexico
New York
North Carolina
North Dakota
Ohio
Oklahoma
Oregon
Pennsylvania
Rhode Island
South Carolina
South Dakota
Tennessee
Texas
Utah
Vermont
Virginia
Washington
West Virginia
Wisconsin
Wyoming
0
5
10
15
20
Number of Activities (of 30 total)
GHG Target/Cap/Pricing (2)
Renewable/CCS/Nuclear (4)
Transportation (10)
Energy Efficiency (4)
Non-CO2 GHG (6)
Forestry & Land Use (4)

Figure 3: NCA4 Figure 29.1 (a) Map of mitigation-related activities at the state level and cities supporting emissions reductions; (b) type and number of activities by state. Several territories also have a variety of mitigation-related activities including American Samoa, the Federated States of Micronesia, Guam, Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands. Sources (a) EPA and ERT, Inc. and (b) adapted from America's Climate Pledge 2017.