



Is the United States Underplaying the Threat of Climate Change?
Reevaluating the *National Climate Assessment*

CSL White Paper

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Introduction

The [National Climate Assessment](#) (NCA) is the U.S. government's official report on the science of climate change. Published in 2018, the Fourth NCA synthesizes a vast quantity of complex data gathered from 13 federal agencies and departments. Its authors should be proud of the massive scientific coordination it represents. But as the Fifth NCA is prepared for publication in 2023, we argue there is room to improve.

For all the NCA's comprehensiveness, its [Summary Findings](#) don't frame climate threats forcefully enough. The underlying *data* can often be found somewhere in the full NCA, but the Summary does not adequately convey the *implications* for American lives. It contains few numbers, making it hard for readers to gauge scale and urgency. Impacts are discussed in high-level terms that don't always capture the basic ways in which American lives will be fundamentally altered. And it doesn't explain how even small increase could have catastrophic effects, especially if they trigger "tipping points" in the Earth's climate.

It's one thing to write broadly about increased temperatures. It's another to show how many days will be fatal for humans outdoors because it will be too hot and humid to sweat; to specify how many American jobs will be lost to drought and heat exhaustion; to forecast how many American homes will destroyed by heat wave-driven fires; to tally the American childhoods radically reined in and the American lives cut short. These examples illustrate the multiple impacts of just one aspect of climate change – increased temperature – and there are many others. In every area the

report covers, from flooding and disease to infrastructure and agriculture, each high-level trend has intensely personal impacts that deserve to be communicated.

The NCA does *not* need to champion particular policy responses. But it *does* need to explain, in clear and relevant terms, what's at stake if we fail to act.

In this white paper, we show how the existing Summary Findings directed at policymakers and technical audiences might be improved, and how a new public-facing "Summary for American Families" could help the NCA communicate its results more broadly. This new section can draw on the same science the NCA is already charged with collecting, while expressing it in terms that are relevant to regular people.

Implications for Americans' Everyday Lives

First, we lay out the kind of projections that we think might be of particular interest to the public. Collectively, they give a sense of how America will change if we fail to pursue ambitious mitigation and adaptation. Below each example, we also highlight how the impacts can already be seen today.

The examples rely on conservative modelling assumptions, showing that even lower-bound estimates should be concerning to the American people.¹ We also focus on near-term impacts over the next 30 years, to emphasize how climate change's dangers will affect most Americans living today. The actual NCA will be able to employ better estimates as the science continues to improve, but these examples (based on climate projections at the low end of negative impacts) show how specific numbers can add power to general summaries.

To implement these changes across the NCA, and especially in the Summary Findings, it would help to add more public communications experts to its author teams.² Increased use of appropriate metaphors, graphics, and examples would also help drive home its conclusions.³ The NCA should not just summarize scientific results but translate them into terms relevant to Americans' lives.

Dangerous Air & Early Deaths

Americans will have to live more of their lives indoors as temperatures rise and air quality worsens. By 2050, thousands of Americans will die each year from intense heat and pollution. Thousands of Americans will contract diseases like West Nile Virus.

Asthma attacks and allergens will send thousands more to the hospital, especially children and the elderly.⁴ These impacts will be particularly severe for Black Americans, who are more likely to live in neighborhoods exposed to extreme heat and pollution.⁵

What would once have been a 1-in-60,000-year heatwave will now happen every 15 years.⁶ The destruction of whole towns by wildfires that we saw in 2020 and 2021 will only become more common.

Premature Births & Higher Infant Mortality

Within the next 30 years, thousands more American babies will be born premature and underweight because of extreme heat, increasing their risk of death, renal failure, malnutrition, and disease. High temperatures will accelerate delivery by up to two weeks, damaging fetal health.⁷ The danger will be especially high for black mothers, whose risk of dying from pregnancy is already more than triple that of white mothers.⁸

The impact of rising temperatures on maternal health is already visible: excess heat in 2018 sent American mothers to the hospital more than 2,000 times, at a cost of more than \$23 million.⁹

Lower Incomes & Lost Wages

Between today and 2050, millions of American workers will lose hours and wages because of extreme temperatures. Even young and healthy people will be in physical danger trying to work outside. By 2050, Americans working in sectors like

construction, farming, mining, and manufacturing will lose hundreds of millions of hours and tens of billions of dollars in income every year.¹⁰ Hispanic, Latino, and Indigenous Americans are much more likely to live in areas hit by these costs.¹¹

Phoenix temperatures are already exceeding 115°F degrees, forcing construction workers to start before dawn.¹² In Maricopa County, extreme heat was involved in at least 123 deaths between January and August 2021.¹³

Smaller Harvests & Higher Grocery Bills

All Americans will pay higher grocery bills as climate change disrupts agriculture around the globe.¹⁴ Farmers, ranchers, and fishers will have to sweat more while earning less, losing billions of dollars every year to changing temperatures, droughts, soil erosion, and pests by 2050.¹⁵ Parts of Texas will see corn and soy harvests—key foods for both humans and livestock—drop by more than half.¹⁶

California normally produces more than a quarter of America's food supply, but the 2021 "megadrought" has left most of its counties without enough water to support agriculture or wildlife.¹⁷

Flooded Homes & Underwater Mortgages

By 2050, the Union of Concern Scientists expects half a million Americans will see their homes chronically flooded every year, with water pouring in every two weeks on average.¹⁸ Flooded homes will grow moldy, the air more difficult to breath. Furniture and belongings will be irreparably damaged. And as people become more aware of

the risks, these homes will be difficult to sell, trapping people in debt and unsafe buildings.

In California, more than a million homes are already at high risk of flooding, but less than half have flood insurance.¹⁹ Nationally, less than a third of American homes in flood risk zones are insured against flooding.²⁰ In the face of climate disasters insurers aren't only raising premiums in some locations, they're refusing to insure homes altogether.²¹

Closed Roads & Broken Bridges

Without major new investments, roads, bridge, and rail lines that Americans rely on daily will be compromised by disasters and temperature extremes. Drainage systems will be overwhelmed by flooding. By 2050, fixing this damage will cost taxpayers billions of dollars each year.²²

When temperatures in Portland, Oregon reached 115°F in July 2021, asphalt roads cracked open, streetcar cables melted, and the risk of track warping shut down train lines.²³

Bigger Blackouts & Higher Bills

Unless major upgrades are made to the electricity grid, Americans will experience more frequent blackouts, as extreme temperatures damage the grid and demand overwhelms capacity. Repairs from disasters will cost billions.²⁴ Even if the grid continues to function, high temperatures will force Americans to pay higher energy

bills to keep cool, at a cost of billions of dollars each year.²⁵ Non-white communities tend to lose power first and get reconnected last.²⁶

Weather-driven power outages have already increased by more than two-thirds since 2000.²⁷ A severe cold snap in 2020 caught Texas' grid unprepared, leaving 10 million people without power, causing \$130 billion in damage, and killing 111 people.²⁸

Weaker Security & Dangerous Deployments

American military personnel will be called to perform more missions under more dangerous conditions. U.S. troops are at a much higher risk for heat-related illness than civilians.²⁹ And the U.S. military is often on the front lines of disaster response: if climate change leads to instability, conflict, and humanitarian crises, the U.S. military could be deployed abroad more frequently.³⁰ Some of our bases in the U.S. and elsewhere are acutely vulnerable to climate change impacts like increased temperature, sea level rise, and more frequent disasters.³¹

In 2018, the Marine Corps' Camp Lejeune sustained \$3.6 billion of damage from Hurricane Florence.³² A month later, Tyndall Air Force base sustained \$4.5 billion of damage from Hurricane Michael.³³ Every dollar spent on this reconstruction is money that could have been spent improving American lives and security.

Lost Pastimes & Risky Summers

Traditional American pastimes will be cut short. Within 30 years, the toxins and harmful bacteria released by algal blooms will cancel more than a million swimming

visits to lakes annually.³⁴ By 2050, dying fish will cost Americans tens of millions of fishing trips each year.³⁵ As the number of “danger days” above 105°F triples by 2050, simply playing sports will put kids and adults at risk of heat cramps, heat exhaustion, and heat stroke.³⁶

In late 2021, every national forest in California closed while 6,800 wildfires ravaged the state.³⁷ From 2000 to 2013, heat stroke deaths among American high school and college football players doubled.³⁸

Improving the NCA’s *Summary Findings*

The Summary Findings are the part of the NCA that’s most likely to be read by policymakers, the press, and the public. In this section, we show how more tangible implications could be woven into the Summary’s “lead sentences” without sacrificing brevity. Rather than trying to be comprehensive, our version of these sentences zero in on particular impacts. Even if we don’t have one singular estimate for an impact, that doesn’t mean we can’t express its general magnitude.

Health

Our first example uses the NCA's current summary of health impacts:³⁹

Original Text

Impacts from climate change on extreme weather and climate-related events, air quality, and the transmission of disease through insects and pests, food, and water increasingly threaten the health and well-being of the American people, particularly populations that are already vulnerable.

Proposed Revision

Over the next 30 years, thousands more Americans will die from extreme heat and pollution, particularly people of color; thousands will contract diseases like West Nile Virus; asthma and allergy attacks will hospitalize thousands more, especially children and the elderly; and millions of days of pregnancy will be lost, endangering the health of mothers and babies alike.

This new version gives a specific timeline, concentrating on near-term impacts that will affect the majority of Americans living today. It gives a sense of scale, emphasizing specific changes rather than trying to be comprehensive. And instead of talking about “health and well-being” generally, it highlights specific outcomes like death, hospitalization, and premature birth that are salient for readers.

Economy

Here is another example, this time with the NCA's summary on the economy:⁴⁰

Original Text

Without substantial and sustained global mitigation and regional adaptation efforts, climate change is expected to cause growing losses to American infrastructure and property and impede the rate of economic growth over this century.

Proposed Revision

Without rapid mitigation and adaptation, American builders, factory workers, and farmers will lose hundreds of millions of work hours and tens of billions of dollars in income because of extreme heat every year, all while paying billions more in taxes and bills to repair roads, bridges, and power grids damaged by extreme

Instead of focusing on “the rate of economic growth” – an important but abstract quantity – this sentence emphasizes the lost hours and lower incomes that will be felt by individual workers. Instead of discussing “losses to American infrastructure” in general terms, it focuses on how damage to specific kinds of infrastructure translates into higher bills and taxes.

Tourism and Recreation

For our third example, we look at the NCA's sentence summarizing impacts on Americans' enjoyment of the natural world:⁴¹

Original Text

Outdoor recreation, tourist economies, and quality of life are reliant on benefits provided by our natural environment that will be degraded by the impacts of climate change in many ways.

Proposed Revision

Traditional American pastimes will be cut short: contaminated water and dying fish will cancel more than a million swimming trips and tens of millions of fishing trips each year, while heat stroke risks make playing football unsafe and wildfires shut down our National Parks.

As before, we're drawing from the same sources that the NCA relies on. But instead of speaking vaguely about how recreation "will be degraded by the impacts of climate change in many ways," we can highlight specific activities that Americans cherish. "Degraded recreation" is a systemic problem: cancelled football games and fishing trips are personal and community problems.

New Realities

Since the publication of the Fourth NCA, climate science has become more certain than ever about the risks to our way of life. One of the most important findings is that every extra bit of warming doesn't just add to our risk – it multiplies risk. That's because of

“tipping points” in the climate, thresholds where irreparable change occurs and one problem compounds into further problems:

- **Massive earthquakes and tsunamis could be triggered by melting ice caps,** as they shift trillions of tons of weight across the Earth’s crust.⁴² North America and Europe face the risk of potentially catastrophic tsunamis triggered by the melting of Greenland’s ice sheet. Evidence of this type of geological risk due to climate change is already starting to appear. In July 2021, Alaska experienced its strongest earthquake in 50 years, raising a tsunami watch as far away as Hawaii.⁴³
- **Sea levels could rise abruptly to levels that will be irreversible for centuries,** threatening every continent's coastlines and devastating American cities. Potential tipping points include the disintegration of Greenland’s ice sheet, the cascading collapse of the West Antarctic ice sheet, and the thawing of the greenhouse gases currently locked in Arctic permafrost. The loss of Greenland’s ice sheet alone would release enough water to raise average sea levels more than 23 feet globally.⁴⁴
- **The way in which key ecosystems function could be radically altered** by temperature change. Rainforests could die back and leave only savannah behind. Coral reefs could suddenly die off, destroying fisheries. Whole forests could move northwards, rapidly changing environments. Some of these balls are already rolling: deforestation and warming have already transformed parts of the Amazon rainforest so they produce more carbon dioxide than they absorb.⁴⁵

- **The ocean and air circulation patterns that define the earth's climate could shift suddenly**, wreaking havoc across the globe. Water from melting ice could shut down currents in the Atlantic that are crucial to climate stability. Monsoon cycles in West Africa and India could be dramatically disrupted, affecting huge regions of the world.⁴⁶

Like cancer or car crashes, high-impact events matter even if they're not certain to occur. The current NCA doesn't pay enough attention to these high-risk scenarios, leaving readers without a robust sense of the real stakes of climate inaction, and limiting our ability to plan accordingly.⁴⁷

We now know that the rise in “natural” disasters has been directly driven by human emissions.⁴⁸ The recent heatwaves that sparked huge fires in the Pacific Northwest would have been “virtually impossible” without human-caused climate change.⁴⁹ Warmer air is pulling up more water from the Earth's surface, likely contributing to the droughts in the American Southwest.⁵⁰ That same water is creating dangerous flooding elsewhere.⁵¹ And it's likely that the intensification of hurricanes and cyclones is down to our emissions as well.⁵²

Conclusion

Scientists have sounded “code red for humanity.”⁵³ The Earth is already more than 1.8°F (1°C) warmer than in the pre-industrial era: the last decade was the warmest in 125,000 years.⁵⁴ CO₂ concentrations are higher than they've been for 2 million years. Sea levels are rising and glaciers are retreating at the fastest pace in more than 2,000 years.⁵⁵ Oceans are warming faster than at any time since the last ice age.

Even if we aggressively cut emissions, we are already likely to exceed our target of 2.7°F (1.5°C) within the next twenty years.⁵⁶

That said, keeping global warming from going further by the end of the century is still possible—if we commit to ambitious decarbonization now.⁵⁷ We don't have to wait for new research breakthroughs to begin—much of the technology needed to head to net zero is already here. Making bold investments in that transformation will produce massive benefits, not only for the Earth's climate, but for the lives of everyone in the United States of America.

While the NCA's charge is not to recommend policies or investment strategies, it does need to clearly explain the threat of climate change and the opportunity for action. The U.S. Congress, national security strategists, the Council of Economic Advisors, the intelligence community, and public at large could all benefit from greater clarity, not only about the physical effects of climate change but also about its human consequences. It's up to the NCA to provide that information in the clearest possible terms.

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Notes

¹ Rather than relying on one set of models, we use ranges that are consistent with multiple models, including the RCP4.5 projections (Representative Concentration Pathways) which represent a much more moderate climate change trajectory than the more extreme RCP8.5 projections. This means our numerical projections represent lower-bound estimates. Models based on the newer SSP3-7.0 and SSP4-6.0 projections (Shared Socioeconomic Pathways) would be preferable, but the U.S. climate impact literature is only beginning to incorporate them. See Hausfather (2019), <https://www.carbonbrief.org/explainer-the-high-emissions-rcp8-5-global-warming-scenario>.

² Crimmins (2020), p. 12.

³ Ibid.

⁴ Martinich and Crimmins (2019), Supplementary Information, Table 4. Under RCP 4.5, we can expect increased deaths from extreme heat (2,600) and smog (550), emergency department visits due to aeroallergens (900), and cases of West Nile Virus (1,000) every year by 2050.

⁵ EPA (2021a), p. 6: “Black and African American individuals are 40% more likely than non-Black and non-African American individuals to currently live in areas with the highest projected increases in mortality rates due to climate-driven changes in extreme temperatures. In addition, Black and African American individuals are 34% more likely to live in areas with the highest projected increases in childhood asthma diagnoses due to climate-driven changes in particulate air pollution”.

⁶ Harford (2021).

⁷ Barrecca and Schaller (2020), Supplementary Information, Fig. 3, and Gamble and Balbus (2016), p. 256

⁸ Petersen et al. (2019) and Kim et al. (2021).

⁹ Kim et al. (2021).

¹⁰ Martinich and Crimmins (2019), Supplementary Information, Tables 4 and 5. Under RCP 4.5, we can expect annual losses of 700 million hours and \$35 billion in income by 2050. High-risk sectors include agriculture, construction, manufacturing, mining, and transportation (Graff et al. 2014), which accounted for 26 million employees in 2020 (BLS 2021).

¹¹ EPA (2021a), p. 6: “Hispanic and Latino individuals are 43% more likely than non-Hispanic and non-Latino individuals to currently live in areas with the highest projected labor hour losses in weather-exposed industries due to climate-driven increases in high-temperature days [...] American Indian and Alaska Native individuals are also 37% more likely to live in areas with the highest projected labor hour losses in weather-exposed industries due to climate-driven increases in high-temperature days.”

¹² Healy (2021), <https://www.nytimes.com/2021/06/20/us/100-degree-weather.html>.

¹³ Maricopa County Public Health (2021), <https://www.maricopa.gov/ArchiveCenter/ViewFile/Item/5299>.

¹⁴ Brown et al. (2015).

¹⁵ Gowda et al. (2018) and Martinich and Crimmins (2019), Supplementary Information, Table 5. Under RCP4.5, we can expect crop yield decreases to cost \$7.7 billion and shellfish supply decreases to cost \$6.1 billion annually by 2050.

¹⁶ Shaw et al. (2020), <https://projects.propublica.org/climate-migration/>

¹⁷ Kay (2021), <https://www.businessinsider.com/california-water-shortage-drought-could-cause-farm-food-prices-rise-2021-6>

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- ¹⁸ Union of Concerned Scientists (2018): 300,000 homes, with 550,000 people, will be threatened with chronic inundation by 2045.
- ¹⁹ Climate Insurance Working Group (2021).
- ²⁰ Kousky et al. (2018).
- ²¹ Sullivan (2021), <https://www.nytimes.com/2021/09/10/your-money/extreme-weather-homeowner-insurance.html>.
- ²² Martinich and Crimmins (2019), Supplementary Information, Table 5. Under RCP 4.5, by 2050 we can expect increased annual repair costs for roads (\$6.5 billion), bridges (\$1.5 billion), rail lines (\$1.5 billion), and drainage systems (\$4.3 billion).
- ²³ Marshall (2021), <https://www.wired.com/story/oregons-buckled-roads-melted-cables-warning-signs/>.
- ²⁴ USGCRP (2018), p. 179: "Repairs to electricity generation, transmission, and distribution systems from recent hurricane events are costing billions of dollars. Con Edison and Public Service Electric and Gas invested over \$2 billion (in 2014 dollars) in response to Superstorm Sandy. An estimate to build back Puerto Rico's electricity systems in response to Hurricanes Irma and Maria is approximately \$17 billion (in 2017 dollars)."
- ²⁵ Fant et al. (2020), <https://doi.org/10.1016/j.energy.2020.116899>.
- ²⁶ Jessel et al. (2021), <https://www.frontiersin.org/articles/10.3389/fpubh.2019.00357/full>.
- ²⁷ Kenwood and Raja (2014), <https://assets.climatecentral.org/pdfs/PowerOutages.pdf>.
- ²⁸ Busby et al. (2021), <https://www.sciencedirect.com/science/article/pii/S2214629621001997>
- ²⁹ Gamble and Balbus (2016), p. 259.
- ³⁰ DOD (2014), p. vi: "The impacts of climate change may increase the frequency, scale, and complexity of future missions, including defense support to civil authorities, while at the same time undermining the capacity of our domestic installations to support training activities"
- ³¹ American Security Project (n.d.), <https://www.americansecurityproject.org/climate-energy-and-security/climate-change/climate-change-and-u-s-military-basing/>
- ³² Altman (2019), <https://www.tampabay.com/florida/2019/01/18/tyndall-air-force-base-finds-new-mission-with-the-billions-to-be-spent-repairing-hurricane-damage/>.
- ³³ Price (2019), <https://www.wunc.org/military/2019-01-16/hurricane-florence-repairs-at-camp-lejeune-will-cost-billions-and-more-big-storms-are-likely>.
- ³⁴ Chapra et al. (2017), Supplementary Information, Table 7. Under RCP 4.5, the average model prediction is between 1.2 and 1.5 million visitor-days lost because of harmful algal cell concentrations above 100k/mL.
- ³⁵ Martinich and Crimmins (2019), Supplementary Information, Table 4. Under RCP 4.5, we can expect 54-80 million lost coldwater fishing days.
- ³⁶ Dahl et al. (2019) and Climate Central (2019), <https://www.climatecentral.org/news/extreme-heat-when-outdoor-sports-become-risky-2019>.
- ³⁷ Chappell (2021), <https://www.npr.org/2021/08/31/1032822337/every-national-forest-in-california-is-closing-because-of-wildfire-risk>
- ³⁸ Gamble and Balbus (2016), p. 255.
- ³⁹ USGCRP (2018), p. 27.
- ⁴⁰ USGCRP (2018), p. 25.
- ⁴¹ USGCRP (2018), p. 31.
- ⁴² Masih (2019), <https://iopscience.iop.org/article/10.1088/1755-1315/167/1/012018> and Cookson (2021), <https://www.frontiersin.org/articles/10.3389/fpubh.2021.622041/full>

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- ⁴³ Taylor and Hauser (2021), <https://www.nytimes.com/2021/07/29/us/alaska-earthquake-tsunami-warning.html>.
- ⁴⁴ McSweeney (2020), <https://www.carbonbrief.org/explainer-nine-tipping-points-that-could-be-triggered-by-climate-change>.
- ⁴⁵ Denning (2021), <https://www.nature.com/articles/d41586-021-01871-6> and Gatti et al. (2021), <https://www.nature.com/articles/s41586-021-03629-6>.
- ⁴⁶ McSweeney (2020).
- ⁴⁷ Crimmins (2020), p. 9 (“assessments are neglecting to provide readers with an informed understanding of impacts at the distributional extremes”). See also Sutton (2018).
- ⁴⁸ The IPCC is generally quite cautious about assigning probabilities to all its statements, but now states as that it is an “established fact” that anthropogenic emissions “have led to an increased frequency and/or intensity of some weather and climate extremes” (McSweeney 2021), <https://www.carbonbrief.org/explainer-what-the-new-ipcc-report-says-about-extreme-weather-and-climate-change>.
- ⁴⁹ Philip et al. (2021), <https://www.worldweatherattribution.org/wp-content/uploads/NW-US-extreme-heat-2021-scientific-report-WWA.pdf>.
- ⁵⁰ EPA (2021b), <https://www.epa.gov/climate-indicators/southwest>
- ⁵¹ Bhatia and Popovich (2021), <https://www.nytimes.com/2021/08/25/climate/nyt-climate-newsletter-drought-floods.html>.
- ⁵² Bhatia et al. (2020), <https://www.nature.com/articles/s41467-019-08471-z.pdf>.
- ⁵³ Guterres (2021), <https://www.un.org/press/en/2021/sgsm20847.doc.htm>.
- ⁵⁴ IPCC (2021), p. SPM-9 (“Temperatures during the most recent decade (2011–2020) exceed those of the most recent multi-century warm period, around 6500 years ago [...] Prior to that, the next most recent warm period was about 125,000 years ago when the multi-century temperature [0.5°C to 1.5°C relative to 1850–1900] overlaps the observations of the most recent decade (medium confidence).”) and p. SPM-38, Table SPM.2.
- ⁵⁵ IPCC (2021), p. SPM-9 (“The global nature of glacier retreat, with almost all of the world’s glaciers retreating synchronously, since the 1950s is unprecedented in at least the last 2000 years (medium confidence”).
- ⁵⁶ IPCC (2021), p. SPM-18 (“Under the five illustrative scenarios, in the near term (2021-2040), the 1.5°C global warming level is very likely to be exceeded under the very high GHG emissions scenario (SSP5-8.5), likely to be exceeded under the intermediate and high GHG emissions scenarios (SSP2-4.5 and SSP3-7.0), more likely than not to be exceeded under the low GHG emissions scenario (SSP1-2.6) and more likely than not to be reached under the very low GHG emissions scenario (SSP1-1.9)”).
- ⁵⁷ Carbon Brief Staff (2021), <https://www.carbonbrief.org/in-depth-qa-the-ipccs-sixth-assessment-report-on-climate-science>.