CENTER FOR ENVIRONMENTAL ACCOUNTABILITY

COMMENTS OF THE
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Comments on the National Oceanic and Atmospheric Administration (NOAA) Availability for Public Comment on NCA6 Draft Prospectus.

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I. Introduction

The Global Change Research Act of 1990 ("GCRA") was nothing if not ambitious.[1] It established the U.S. Global Change Research Program ("USGCRP") and directed it to help policy makers intelligently respond to "global change," which the statute defines as "changes in the global environment (including alterations in climate, land productivity, oceans or other water resources, atmospheric chemistry, and ecological systems) that may alter the capacity of the Earth to sustain life."[2] The USGCRP receives billions of dollars annually and is required to submit, at least every four years, a report on "global change" to Congress and the President that "(1) integrates, evaluates, and interprets the findings of the Program and discusses the scientific uncertainties associated with such findings; (2) analyzes the effects of global change on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity; and (3) analyzes current trends in global change, both human-induced and natural, and projects major trends for the subsequent 25 to 100 years."[3]

That report was intended to be a sophisticated synthesis of best scientific evidence about how both human-induced and natural changes had impacted the world across a broad swath of categories, and how those changes were expected to continue over the next century. The report would "combine and interpret" that data in such a manner that it would be "readily usable by policymakers attempting to formulate effective strategies for preventing, mitigating, and adapting to the effects of" those changes.[4]

But past reports have fallen far short of the mark. The latest USGCRP report, the Fifth National Climate Assessment ("NCA5"), is a political document intended to support the Biden Administration's pre-ordained climate policy agenda rather than an objective analysis that helps inform rational policymaking. As the name indicates, rather than addressing "global change" as defined in the GCRA, NCA5 only looks at climate change. And while it dresses itself in the language of science and probability, it is not a scientific assessment of how the world, or even just the climate, is changing. For example, NCA5 myopically focuses on the least likely global warming scenario, fails to adequately frame the uncertainty of its prognostications, and

[1] Pub. L. No. 101-606, 104 Stat. 3096 (1990) (codified at 15 U.S.C. § 2921 *et seq.*).

[2] 15 U.S.C. § 2921(3).

[3] *Id.* § 2936.

[4] *Id.* § 2943(d).

uncritically relies on studies that fail the information quality standards to which the USGCRP is bound by law.

The Sixth National Climate Assessment ("NCA6") is an opportunity for the USGCRP to correct these past faults and provide lawmakers with the information necessary to make the tradeoffs inherent in the type of policy options that the GCRA had in mind. There are at least four things the USGCRP must do to fulfill their statutory mandate in this next report.

First, the report must address "global change" as it is defined in the statute. Past reports including NCA5 have interpreted the term to mean something like "climate change and its related global effects." But while "global change" includes climate change, it is not limited to it. By narrowing NCA5 and its predecessors' focus to only climate change, USGRP has deprived policymakers and the public of the context necessary to understand climate impacts and are misled about current trends in global change. Providing that context would remedy this defect.

Second, the report must reflect the most likely global change scenarios. Past reports have placed an outsized emphasis on the most extreme and unlikely climate change scenarios while simultaneously ignoring the ways in which predictable adaptation will limit the costs associated with those changes. As a consequence, these reports systematically overstate the harm that climate change has caused to date and that climate change could reasonably be expected to cause in the future. These errors prevent the reports from fulfilling their statutory mission to provide "usable information" for policy decisions.

Third, the report must adequately address scientific uncertainty. If there are lessons to be learned from the COVID-19 epidemic, chief among them is that experts have imperfect knowledge and must clearly communicate to both policymakers and the public the extent to which their pronouncements are grounded in supposition. While past USGCRP reports employ a complicated system for labeling the likelihood and confidence of certain predictions, these labels are deeply misleading. NCA5, for example, describes its likelihood labels as "based on statistical analysis of observed or projected results." But these are only likelihoods *if* a certain emissions or warming scenario comes to pass. The scenarios themselves—by far the most important part of the projection—"do not have relative likelihoods assigned." As a result, something that is only likely in the event of a very unlikely future is still labeled by NCA5 as "very likely, high confidence." This is deeply misleading.

Fourth, the report must ensure information quality and scientific integrity. The report is required by the Information Quality Act ("IQA") to present information in an "accurate, reliable, and unbiased" manner. But by neglecting to provide appropriate context for findings, by relying on

substantively flawed studies, and by failing to address broad conflicts of interest issues, NCA5 fell far short of the IQA's standard. Unless these errors are remedied by NCA6, its findings will be similarly undermined.

II. The Report Must Address "Global Change," Not Just Climate Change.

"Global change" is defined by the GCRA as "changes in the global environment (including alterations in climate, land productivity, oceans or other water resources, atmospheric chemistry, and ecological systems) that may alter the capacity of the Earth to sustain life."[5] In previous iterations of its reports, the USGCRP has read this definition to mean something like "climate change and its related global effects."[6] This focus is evident in the structure of the reports—which almost exclusively explore the impacts of climate change on various global systems while neglecting other trends—and even in the titles of the "National Climate Assessments" themselves.

But a plain language interpretation of the definition suggests a much broader meaning and remit. While "global change" includes "alterations in climate" (i.e., climate change), the enumeration of other "alterations" in addition to climate means that "global change" must necessarily include other "changes" "that may alter the capacity of the Earth to sustain life" as well.[7] A version of the report that was faithful to this statutory mandate would explore not just climate change trends, but the trends in the many other global metrics that are important to human life. This would include trends in things like energy production/use (up), disaster resilience (up), deaths from natural disasters (down), human health (up), agricultural production (up), coastal population (up), criteria pollutant emissions (down), and so on and so forth. As the above listing suggests, global economic well-being has significantly increased over the last century, and the next 100 years promise to bring about similar shifts which will have a large impact on "the capacity of the Earth to sustain life" than climate change.

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[5] 15 U.S.C. § 2921(3).

[6] *See* Nat'l Rsch. Council, *A Review of the U.S. Global Change Research Program's Draft Strategic Plan* 8–9 (2012), https://perma.cc/RUL8-E7AR.

[7] *See Gustafson v. Alloyd Co.*, 513 U.S. 561, 575 (1995) ("[A] word is known by the company it keeps (the doctrine of *noscitur a sociis*). This rule we rely upon to avoid ascribing to one word a meaning so broad that it is inconsistent with its accompanying words, thus giving 'unintended breadth to the Acts of Congress.'").

Energy consumption and economic output are up. Global primary energy use increased dramatically during the twentieth century.[8] In 1900, the world consumed roughly 44 exajoules per year, about half of which came from fossil fuels.[9] By 2000, energy consumption had grown more than ten-fold, raising per capita energy availability more than four-fold, and energy consumption continues its upward climb today.[10] This energy growth has facilitated tremendous economic growth, and is a but-for cause of many of the other advances documented below, including many important improvements in environmental quality. But despite this triumph, nearly a billion people continue to live in energy poverty and have been unable to fully enjoy the benefits experienced in the rest of the world. As energy growth continues, economic development in thus far underdeveloped regions can be expected to grow as well.[11]

Disaster resilience is up. Disaster resilience is the ability of a community to recover quickly or rebound from a natural disaster. Largely because of growing economic prosperity, humans are now more resilient to disasters and changes in weather and climate than at any point in human history. This growing resilience is reflected in the declining impact that natural disasters have on modern economies. Flood damage as a percentage of GDP has plummeted since 1940.[12] While property damage from hurricanes has increased, this is due largely to increased growth and exposure resulting from more and more expensive property being built along the coastline.[13]That

[8] *Global Direct Primary Energy Consumption*, Our World In Data, https://ourworldindata.org/grapher/global-primary-energy [https://perma.cc/BD6F-893E] (visited June 7, 2024).

[9] *Id.*

[10] *Id.*

[11] Sarah McFarlane & Kate Abnett, *African Nations Tell COP27 Fossil Fuels Will Tackle Poverty*, Reuters (Nov. 10, 2022), https://tinyurl.com/ynwn3xm8 ("African nations must be allowed to develop fossil fuel resources to help lift their people out of poverty, governments said at the COP27 climate talks in Egypt, which welcomed leaders of oil and gas companies sidelined at previous talks.").

[12] *See* Frances V. Davenport et al., *Contribution of Historical Precipitation Changes to US Flood Damage*, 118 PNAS, art. no. e2017524118 (Jan. 11, 2021), https://doi.org/10.1073/pnas.2017524118; Sean A. Parks et al., *High-severity Fire: Evaluating its Key Drivers and Mapping Its Probability Across Western US Forests*, 13 Env't Res. Letters, art. no. 044037 (Apr. 18, 2018), https://doi.org/10.1088/1748-9326/aab791.

[13] Philip J. Klotzbach et al., *Trends in Global Tropical Cyclone Activity: 1990–2021*, 49 Geophysical Rsch. Letters, art. no e2021GL095774 (Mar. 14, 2022), https://doi.org/10.1029/2021GL095774; *see also* Adam B. Smith & Richard W. Katz, *US Billion-Dollar Weather and Climate Disasters: Data Sources, Trends, Accuracy and Biases*, 67 Nat. Hazards 387, 408 (2013), https://doi.org/10.1007/s11069-013-0566-5 ("[I]t is difficult to attribute any part of the trends in losses to climate variations or change, especially in the case of billion-dollar disasters."); Roger Pielke Jr., *"Billion Dollar Disasters" Are a National Embarrassment*, The Honest Broker (Jan. 8, 2023), https://perma.cc/SJ6N-4ZMA.

coastal development has increased is, of course, a testament to owners' confidence that they can repair or replace what gets damaged or destroyed in a storm.

Deaths from natural disasters are down. Over the last century, there has been an over 90% decline in annual global deaths from extreme weather events, even while the world population has more than tripled over the same time period.[14] The principal reason why natural disasters cause far fewer deaths than they did a century ago is because the worst killers—droughts and floods—have been mitigated by technological improvements, with the result being that most natural disaster deaths in the 21st century now stem from earthquakes, which are not associated with climate change.[15] Similarly, since 1960 there has been an 85% decline in the mortality impact of high-temperature days, attributable primarily to increased access to electricity and the growth of residential air conditioning.[16]

This trend is likely to continue, even if the climate warms. In the U.S. specifically, global average warming below 3 degrees Celsius above preindustrial levels will reduce temperature-related mortality because the reduction in cold-related mortality exceeds any increase in heat-related deaths.[17] Thus, while a recent time-series analysis identified a slight increase in heat-related deaths, this was more than offset by reductions in cold-related deaths, with climate-related mortality decreasing by about 166,000 deaths per year.[18] Above 3 degrees, the outcome depends on the level of adaptation, with certain strong-adaptation models resulting in total heat-related mortality decreasing at all levels of warming.[19]

Other extreme weather may chart a similar course. A recent analysis of natural disaster data from the Emergency Events Database of the Center for Research on the Epidemiology of Disasters concluded that since 2002, data demonstrates a "significant decline in number of events" relative

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[14] Hannah Ritchie & Pablo Rosado, *Natural Disasters*, Our World in Data (rev. Jan. 2024), https://our-worldindata.org/natural-disasters [https://perma.cc/W9CH-QRWU].

[15] *Id.*

[16] Alan Barreca et al., *Adapting to Climate Change: The Remarkable Decline in the US Temperature-Mortality Relationship over the Twentieth Century*, 124 J. of Pol. Econ. 105, 130 (2016).

[17] Jangho Lee & Andrew E. Dessler, *Future Temperature-Related Deaths in the US: The Impact of Climate Change, Demographics, and Adaptation*, 7 GeoHealth, art. no. e2023GH000799 (2023), https://doi.org/10.1029/2023GH000799.

[18] Qi Zhao et al., *Global, Regional, and National Burden of Mortality Associated with Non-Optimal Ambient Temperatures from 2000 to 2019: A Three-Stage Modelling Study*, 5 Lancet Planetary Health e415, e420–22 (2021), https://doi.org/10.1016/S2542-5196(21)00081-4.

[19] *Id.*

to the 1922–1975 and 1975–2002 periods.[20] While deaths from extreme weather events have dramatically declined, the large majority of those remaining are concentrated in poorer nations with less access to affordable energy, air conditioning, and infrastructure that mitigates drought and flood events.[21] The upshot is that societies with enhanced economic and technological prosperity are and will continue to be far safer places to live than they were a century ago, even if extreme weather increases.

Human health is up. From 1900 to 2021, the average life expectancy across the world has more than doubled, from 32 years to 71 years.[22] This rise can be attributed to dramatic advances in health (including nutrition, clean water, sanitation, neonatal healthcare, etc.) as well as improvements in living standards and economic growth, which were driven in part by greater access to energy resources.[23] Models suggest that these trends are likely to continue. There is a significant positive relationship between economic growth and life expectancy. Continuing economic growth could thus continue this trend, particularly as poorer countries continue to gain access to energy.[24]

Agricultural production is up. Global crop yields have grown exponentially over the last hundred years. This growth in agricultural output is the result of many improvements to productivity such as improved crop varieties, irrigation, and mechanization. But almost half of the growth can be tied to the development of the Haber-Bosch process by which almost all synthetic fertilizer is made today.[25] That process uses natural gas as a feedstock to convert atmospheric nitrogen into ammonia, which is often the rate limiting nutrient for crops. A study by Erisman et al. estimates that synthetic fertilizer made through this process has supported 42

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[20] Gianluca Alimonti & Luigi Mariani, *Is the Number of Global Natural Disasters Increasing?*, 23 Env't Hazards 1, 13 (2023), https://doi.org/10.1080/17477891.2023.2239807.

[21] María Eugenia Ibarrarán et al., *Climate Change and Natural Disasters: Macroeconomic Performance and Distributional Impacts*, 11 Env't Dev. Sustain. 549, 555–56 (2009), https://doi.org/10.1007/s10668-007-9129-9.

[22] Saloni Dattani et al., *Life Expectancy*, Our World in Data (2023), https://ourworldindata.org/life-expectancy?insight=life-expectancy-has-increased-across-the-world#key-insights.

[23] *Id.*

[24] Lei He & Na Li, *The Linkages Between Life Expectancy and Economic Growth: Some New Evidence*, 58 Empirical Econ. 2381, 2400 (2018), https://doi.org/10.1007/s00181-018-1612-7.

[25] Hannah Ritchie, *How Many People Does Synthetic Fertilizer Feed?*, Our World In Data (Nov. 7, 2017), https://ourworldindata.org/how-many-people-does-synthetic-fertilizer-feed [https://perma.cc/K6KV-7FBF].

percent of global births over the past century, and feeds approximately 48 percent of the global population or nearly 3.9 billion people today.[26]

Coastal population is up. The recent growth of so-called "billion-dollar disasters" as a result of tropical storms and flooding has often been attributed to climate change. But there is no obvious increasing trend in hurricane activity.[27] Instead, this growth is more likely related to population growth in areas that have *always* been vulnerable to extreme weather events: coastal regions.[28] Since 1970, coastal shoreline county population has increased 40%, placing approximately 35 million more people and their homes in the direct path of storm surges.[29] As of 2010, the coastal shoreline county population density was approximately four times greater than that of the average United States county population density.[30] As population increases in areas that have always been vulnerable to extreme weather, the potential cost of extreme weather events increases. More storms aren't hitting the developed areas because there are more storms, but because the size and density of developed areas is getting bigger.

Criteria pollutant emissions are down. Since the passage of the Clean Air Act in 1970, air quality in the United States has dramatically improved. Since 1970, "the combined emissions of criteria and precursor pollutants have dropped by 78%."[31] The United States has both grown in wealth and increased the quality of its air. Deaths from indoor air pollution globally are also down. These reductions are the result of the substitution of solid fuels such as dung, wood, and charcoal for clean burning fuels such as propane (liquified petroleum gas) and natural gas.[32] This trend can be expected to continue as further economic development continues to distribute these fuels to new communities.

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[26] Jan Willem Erisman et al., *How a Century of Ammonia Synthesis Changed the World*, 1 Nature Geosci. 636 (2008), https://doi.org/10.1038/ngeo325.

[27] *See* Philip J. Klotzbach et al., *Continental U.S. Hurricane Landfall Frequency and Associated Damage: Observations and Future Risks*, 99 Bull. Am. Meteorological Soc'y 1359 (2018), https://doi.org/10.1175/BAMS-D-17-0184.1.

[28] Stephen Strader & Walker Ashley, *The Expanding Bull's-eye Effect*, 68 Weatherwise, no. 5, at 23, 25 (2015), https://doi.org/10.1080/00431672.2015.1067108.

[29] *Id.* at 27.

[30] *Id.*

[31] EPA, *Our Nation's Air: Trends Through 2021* (2022), https://gispub.epa.gov/air/trendsreport/2022/#introduction.

[32] Hannah Ritchie & Max Rosner, *Indoor Air Pollution*, Our World In Data (rev. Mar. 2024), https://our-worldindata.org/indoor-air-pollution; *see also* Zablon Weku Shilenje et al., *A Review on Household Air Pollution and Biomass Use over Kenya*, 10 Frontiers Env't Sci., Oct. 19, 2022, https://doi.org/10.3389/fenvs.2022.996038.

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As all of these trends suggest, narrowing an examination of the "effects of global change" to an examination of only climate change presents a myopic and misleading vision of the world. Increasing energy consumption presents climate change risks, but also many corresponding benefits. The job Congress gave NOAA here is to help policymakers better understand these realities and the corresponding tradeoffs. A more enlightening comparison is how life 25 or 100 years from now—with all aspects of global change considered—might compare to life today.

Illustrative of these different perspectives are two different framings of the prediction's generated by William Nordhaus's DICE-2016 model. That model estimates that 3 degrees Celsius of warming by 2100 will result in costs equivalent to 3.9% of global GDP in that year.[33] When framed so that only these climate damages are visible, the model appears to predict a staggering $19.5 trillion loss.[34] But such a framing neglects how that "reduced" GDP compares to GDP today. The DICE model estimates that by 2100, with or without climate change, the world will have a global GDP of $500 trillion, more than six times the 2015 global GDP of $75 trillion.[35] The economic effect of climate change is thus not to reduce world wealth, but only to lower its growth from a multiple of 6.7 to a multiple of 6.5 by the end of the century.[36] Perhaps no number better demonstrates that fixation on climate harms in insolation from broader positive change is a "first world problem."

In other words, the DICE Model suggests that, while climate change has negative impacts, the trends of "global change" are overwhelmingly positive. It is the latter which the USGCRP is required to report on.

III. The Report Must Reflect the Most Likely Global Change Scenarios.

To fulfill the Congressional mandate of the GCRA "to provide usable information on which to base policy decisions relating to global change," the report must use scenarios of change that reflect the most up to date science and data. There were three major flaws with the projections of global change in NCA5: a disproportionate focus on an implausibly extreme warming scenario,

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[33] Oren Cass, *How to Worry about Climate Change*, Nat'l Affs., Winter 2017, https://www.nationalaffairs.com/publications/detail/how-to-worry-about-climate-change/.

[34] *Id.*

[35] *Id.*

[36] *Id.*

an irrational devaluation of the value of adaptation, and a resulting misrepresentation of the projected damages from climate change.

RCP8.5 is not a plausible warming scenario. In NCA5, the "overwhelmingly dominant scenario" used to make predictions of the future was RCP8.5.[37] While NCA pays lip-service to the fact that this is a "a very high [warming] scenario," RCP8.5 and its sister scenario SSP5-8.5 make up about half of all scenario mentions in the report.

RCP8.5 is one of four "radiative forcing pathways" that were developed by the IPCC as a stopgap research tool to be used by researchers while scenario developers worked in parallel to develop socioeconomically plausible emissions scenarios. These pathways, called Representative Concentration Pathways, or RCPs, were constructed to represent hypothetical low, medium, high, and very high radiative forcing pathways. Thus, the scenarios were called RCP2.6, RCP4.5, RCP6.0, and RCP8.5, respectively, indicating the radiative forcing expected by 2100 (e.g., RCP8.5 assumed a pathway that reached a radiative forcing of 8.5 watts per square meter in 2100).

Critically, these scenarios were not intended to be *predictions*. Instead, the IPCC stressed that "[i]t is an open research question as to how wide a range of socioeconomic conditions could be consistent with a given [RCP] pathway of forcing, including its ultimate level, its pathway over time, and its spatial pattern."[38] The IPCC warned researchers and policymakers against reading too much into the different scenarios: "The differences between the RCPs can therefore not directly be interpreted as a result of climate policy or particular socioeconomic developments."[39]

Despite this, RCP8.5 is now firmly lodged in the scientific literature as the expected trajectory of radiative forcing. Thousands of scientific papers refer to RCP8.5 as the "business-as-usual" scenario.[40] The reliance on RCP8.5 is to the research's detriment, because RCP8.5 is now widely

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[37] Roger Pielke, *Climate Misinformation from the Biden Administration*, The Honest Broker (Nov. 8, 2022), https://perma.cc/E86P-KNXC.

[38] IPCC, *IPCC Expert Meeting Report: Towards New Scenarios for Analysis of Emissions, Climate Change, Impacts, and Response Strategies*, at ix, 43 (Sept. 2007), https://perma.cc/NKC2-GULA.

[39] RCP Database (version 2.0, 2009), https://perma.cc/UJR3-MTYT.

[40] *See Google Scholar Search*, https://scholar.google.com/scholar?hl=en&as_sdt=0%2C6&q=rcp8.5+%22business+as+usual%22&btnG= (searching "rcp8.5 'business as usual'") (visited June 7, 2024). Admittedly, some of these papers are critiquing the use of the term "business-as-usual" to describe RCP8.5, but many if not most take the scenario at face value.

regarded by the climate science community as implausibly extreme.[41] While the latest projections of the International Energy Agency expect a median warming of around 2.4°C by 2100, RCP8.5 projects a temperature rise of around 5°C.[42]

There is strong evidence that both near-term and long-term greenhouse gas emissions are already well below those needed to create emissions scenarios associated with RCP8.5. As Zeke Hausfather and Glen Peters explain, the "[e]mission pathways to get to RCP8.5 generally require an unprecedented fivefold increase in coal use by the end of the century, an amount larger than some estimates of recoverable coal reserves."[43] But, at this point, such an increase in coal use is implausible. "[A]lthough increases are still possible, many energy forecasts expect it to flatline over the next few decades."[44] With coal-derived energy gradually being replaced with natural gas or other low carbon sources, emissions per unit of energy will tend to decline, and absent a proportional rise in energy use, total emissions will fall.

Additionally, the high emissions scenarios associated with RCP8.5 generally rely on a continued growth in global population, which would raise total emissions even if emissions per capita declined. But this isn't likely to happen either. There were 129 million births globally in 2021.[45] This is an increase from around 93 million in 1950, but a decline from the peak of 142 million in 2016.[46] Overall, fertility has declined steadily at a global level and across almost all countries and territories since 1950 and is likely to continue to do so until 2100, from a global total fertility rate of more than 4.8 births per woman in 1950 to approximately 2.2 in 2021.[47] For nearly all countries sustained low fertility will produce a contracting population before the end of the 21st

[41] Malte Meinshausen et al., *A Perspective on the Next Generation of Earth System Model Scenarios: Towards Representative Emission Pathways (REPs)*, Geosci. Model Dev. (preprint) (Sep. 6, 2023), https://doi.org/10.5194/gmd-2023-176.

[42] Int'l Energy Agency, *World Energy Outlook 2023*, at 22 (2023), https://perma.cc/8S7J-8R88; Zeke Hausfather & Glen P. Peters, Comment, *Emissions—The "Business As Usual" Story Is Misleading*, 577 Nature 618, 618 (2020), https://doi.org/10.1038/d41586-020-00177-3; Zeke Hausfather, *Explainer: The High-Emissions 'RCP8.5' Global Warming Scenario*, CarbonBrief (Aug. 21, 2019), https://perma.cc/9LD9-EGDU.

[43] Hausfather & Peters, *supra* note 42, at 619.

[44] *Id.*

[45] GBD 2021 Fertility & Forecasting Collaborators, *Global Fertility in 204 Countries and Territories, 1950–2021, with Forecasts to 2100*, Lancet (Mar. 20, 2024), https://doi.org/10.1016/S0140-6736(24)00550-6.

[46] *Id.*

[47] *Id.*

century.[48] With a declining population—particularly in wealthier countries which are responsible for higher per capita greenhouse gas emissions—emissions will also tend to decline.

These reasons, among others, have led EPA in its modeling of climate change to acknowledge that RCP8.5 is not a plausible emissions pathway. When it began to update its Social Cost of Greenhouse Gases methodology in 2022, EPA noted the weakness of models that depended on RCP8.5, and excised it from its own emissions projections, "based on a review of available sources of long-run projections for socioeconomic variables and GHG emissions necessary for damage calculations."[49] Instead, EPA decided to use "the socioeconomic and emissions projections recently developed under the Resources for the Future Social Cost of Carbon Initiative."[50]

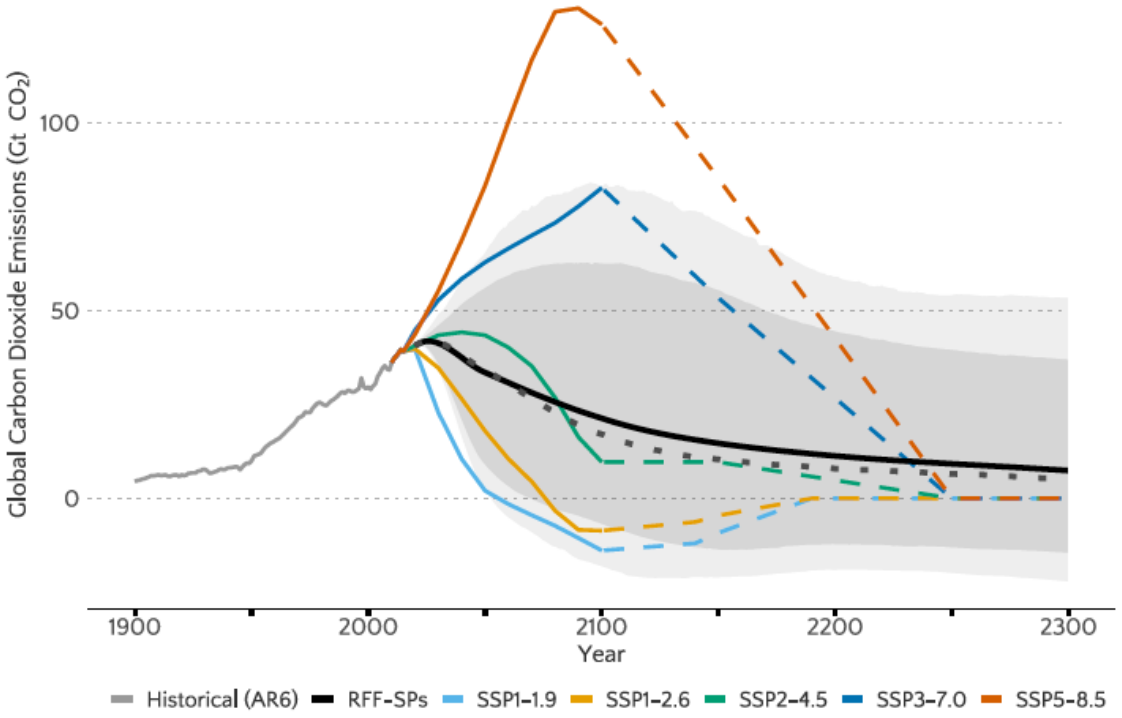
As shown in the figure below, the Resources for the Future emissions projections that EPA used (the black line) represent warming scenarios that are far, far less than those of RCP8.5, most closely approximated by the orange line, representing its sister emissions scenario SSP5-8.5. That emissions scenario is so unlike all other projections of emissions that EPA felt the need to explain that SSP5-8.5 is the "only SSP-RCP pairing with CO_2 emissions projections outside the 1st to 99th percentile range of RFF-SPs."[51]

[48] *Id.*

[49] EPA, *External Review Draft of Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances* 19 (Sept. 2022), https://perma.cc/QB6W-LBH7.

[50] *Id.*

[51] *Id.* at 24.



Net Annual Global Emissions of Carbon Dioxide (CO_2) under RFF-SPs and SSPs, 1900–2300.[52]

Adaptation and mitigation will dramatically reduce the expected damages from climate change. Humanity has an impressive track record of reducing vulnerability to extreme weather. As noted above, there has been an over 90 percent decline in annual global deaths from extreme weather over the last century even while the world population has more than tripled.[53] One recent study documented a "a clear decreasing trend in both human and economic vulnerability, with global average mortality and economic loss rates that have dropped by 6.5 and nearly 5 times."[54]

This is because wealthier societies with abundant access to energy and technology are far better at adapting to extreme weather than our predecessors. When hot weather threatens heat stroke, we install air conditioners. When areas become prone to flooding, we build on higher ground. Indeed, the World Health Organization has explained in its own *Quantitative Risk Assessment of*

[52] *Id.* at 25 (Figure 2.1.3).

[53] Ritchie & Rosado, *supra* note 14.

[54] Giuseppe Formetta & Luc Feyen, *Empirical Evidence of Declining Global Vulnerability to Climate-related Hazards*, 57 Glob. Env't Change, art. no. 101920, at *1 (2019), https://doi.org/10.1016/j.gloenvcha.2019.05.004.

the Effects of Climate Change, that "the attributable mortality is zero when 100% adaptation is assumed."[55]

But NCA5 inexplicably downplays this history. Instead, the report relegates discussions of adaptation and mitigation to chapters 31 and 32. And when the report finally reaches the topic, the discussion primarily consists of an array of platitudes like the need "to empower all voices" or to "go beyond the traditional offerings of science, data, and information to be more accessible and to meet the needs of overburdened and frontline communities."[56] Practical steps towards adaptation, like "using air-conditioning during heatwaves, increasing irrigation or temporarily reducing water consumption to address frequent droughts, using sandbags to resist coastal erosion, redefining fisheries boundaries in response to shifting habitats, or elevating homes above flood waters" are pooh-poohed because they are not sufficiently "transformative actions." Instead, the report suggests that policymakers should focus on "redesigning cities," "reimagining how and where crops are produced," and making "fundamental changes in economic and governance paradigms to redress historical injustices and center equity and justice."[57] This emphasis on transformation—one might even say revolution—when coupled with the report's focus on decreasing global energy consumption sounds rather like "degrowth ecological communism."[58] It bears mentioning moreover that the environmental record of those nations who have embraced "fundamental changes in economic and governance paradigms to redress historical injustices and center equity and justice" is very poor indeed.[59]

The root of NCA5's rejection of practical solutions seems to be the authors' conclusion that the economic growth that would facilitate such adaptation is actually part of the problem. The report's chapter, "Social Systems and Justice" includes the beautifully abstruse claim that "[s]ocial systems produce and distribute climate change and its impacts through mechanisms such as economic growth ..."[60] How precisely a global atmospheric phenomenon like climate

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[55] World Health Org., *Qualitative Risk Assessment of the Effects of Climate Change on Selected Causes of Death, 2030s and* 2050s, at 23 (2014), https://tinyurl.com/24wc8ddv.

[56] NCA5, ch.31, *Adaptation* (2023), https://doi.org/10.7930/NCA5.2023.CH31.

[57] *Id.*

[58] *See generally* Kohei Saito, *Marx in the Anthropocene: Towards the Idea of Degrowth Communism* (2022).

[59] *See, e.g.*, Maria Shahgedanova & Timothy P Burt, *New Data on Air pollution in the Former Soviet Union*, 4 Global Environmental Change 201-227 (USSR generated 1.5 times the pollution per unit of gross national product as the U.S. and was the world's second largest producer of harmful emissions).

[60] NCA5, ch.20.

change is "distribute[d]" by "social systems" is not explained, but the authors make clear that "economic growth" must be stopped.[61] But even that cure is worrying to the chapter's authors as "[c]urbing economic growth is not expected to proceed evenly at a global scale…."[62]

This catch-22 is ultimately a result of the way the report focuses on climate change while ignoring global change more broadly. In climate literature, adaptation is often narrowly framed as only those actions explicitly taken to reduce the impact of climate change.[63] NCA5 is no exception, defining adaptation as "actions taken to reduce risks from today's changed climate conditions and to prepare for further impacts in the future."[64] Thus, if some technological or socioeconomic trend would have occurred in the absence of climate change, the report cannot count it as adaptation. "For example, the adoption of tractors instead of manual labor can cause a large increase in [crop] yields, but this would not be an explicit adaptation to climate change, and thus it would not be considered in a projection of future [crop] yields that 'accounts for adaptation.'"[65]

As Patrick Brown explains

> Herein lies the obscurantism. Although most readers will understand the word "decrease" to mean a *decrease relative to today*, the IPCC uses the word to mean a decrease *relative to a hypothetical world without climate change*. So crop yields can be projected to continue to increase overall, but still be said to decrease compared to a hypothetical world with no climate change but in which everything else is the same.[66]

While precise quantification of how future vulnerability will be reduced is difficult, there is no doubt that at least some adaptation will occur. Even with no technological changes—a highly improbable future—there are already meaningful ways that populations can reduce their exposure to the most damaging aspects of climate change that NCA5 rejects out of hand.

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[61] *Id.*

[62] *Id.*

[63] *See* Patrick Brown, *The IPCC Report on the Impacts of Climate Change is Depressing*, Breakthrough Inst. (Mar. 30, 2023), https://perma.cc/NKF4-WC9H.

[64] NCA5, ch.31, *supra* note 56.

[65] *See* Brown, *supra* note 63.

[66] *Id.* (emphases in original).

Past reports misrepresent the damages from climate change. The consequences of a narrow focus on extreme scenarios and complete exclusion of context led NCA5 to make a number of erroneous claims about the consequences of climate change that simply aren't borne out by the data. For instance, that report states that "risks from extreme events are increasing" and lists as examples "heat-related illnesses and death, costlier storm damages, longer droughts that reduce agricultural productivity and strain water systems, and larger, more severe wildfires that threaten homes and degrade air quality." But this simply isn't true.

According to the IPCC, the only extreme weather that is thus far attributable to climate change with medium- or high-confidence are limited increases in hot spells (primarily in the tropics) and decreases in cold spells (primarily in Africa, Australia, and Northern South America).[67] Taken together, this warming has been a net-benefit for human life. As noted above, while both extreme hot and extreme cold can be fatal, extreme cold is far more deadly. A 2015 meta-study found that 17 times more deaths are attributable to low temperatures than to high.[68] And a 2021 study found that, while heat-related deaths have increased somewhat over the last two decades, they were more than offset by reductions in cold-related deaths, with the net effect that climate-related mortality has decreased by about 166,000 deaths per year.[69]

The IPCC further reports that the frequency and intensity of droughts, floods, and storms (including tropical storms and hurricanes) do not appear to have meaningfully increased over the last century.[70] While there is large annual variability in hurricane activity, the data shows no obvious increasing trend.[71] Tornadoes of a greater than F3 magnitude have shown a *downward* trend over the last 70 years.[72] Similarly, flood damage as a percentage of GDP has plummeted since 1940. [73] Wildfire damage is on a slight upward trend over the last two decades, but a

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[67] IPCC, *Climate Change 2021: The Physical Science Basis* 1856 (2021) (Table 12.12: Emergence of CIDs in Different Time Periods, As Assessed in This Section), https://report.ipcc.ch/ar6/wg1/IPCC_AR6_WGI_FullReport.pdf.

[68] *See* Antonio Gasparrini et al., *Mortality Risk Attributable to High and Low Ambient Temperature: A Multicountry Observational Study*, 386 Lancet 369 (2015), https://doi.org/10.1016/S0140-6736(14)62114-0.

[69] *See* Qi Zhao et al., *supra* note 18.

[70] IPCC, *Climate Change 2021: The Physical Science Basis*, *supra* note 67, at 1856 (Table 12.12: Emergence of CIDs in Different Time Periods, As Assessed in This Section).

[71] *See* Philip J. Klotzbach et al., *Continental U.S. Hurricane Landfall Frequency and Associated Damage*, *supra* note 27.

[72] *See National Weather Service, Storm Prediction Center*, NOAA, https://www.spc.noaa.gov/wcm (last updated Jan. 14, 2024).

[73] *See* Frances V. Davenport et al., *supra* note 12.

downward trend when compared to 40 million acres burned nearly each year in the 1930s and 1940s.[74]

As noted above, while property damage from hurricanes and the resulting flooding has increased in recent years, this is due largely to increased growth and exposure resulting from more valuable property being built along the coastline.[75] As even NCA5 is forced to concede, "Although climate change has played a significant role in [loss] trends, consensus is lacking on the extent to which increased losses are attributable to climate change versus other factors."[76]

NCA6 must follow its statutory mandate and present the most accurate picture of the future that it can, and with the appropriate caveats about the limits of our knowledge, as discussed next. To do so, it must focus its predictions on the most likely climate scenarios and account for the likely adaptations that will be made in response to those changes. Without taking human ingenuity and adaptability into account, the project will not have any credibility as an assessment of global change.

IV. The Report Must Adequately Address Scientific Uncertainty.

The GCRA requires that the report "discusses the scientific uncertainties associated with [its] findings." But discussions of these uncertainties in past reports have been deeply misleading.

As in previous reports, NCA5 uses labels throughout the report to signal to readers the level of scientific confidence and certainty associated with its findings. There are two types of labels used. "Confidence" labels reflect whether "a finding is based on the type, amount, quality, strength, and consistency of evidence; the skill, range, and consistency of methods to detect, evaluate, attribute, and interpret climate trends; and the degree of agreement across scientific information sources."[77] "Likelihood" labels reflect whether "a finding is based on measures of certainty expressed probabilistically; in other words, based on statistical analysis of observed or

[74] Sean A. Parks et al., *supra* note 12.

[75] Klotzbach et al., *Trends in Global Tropical Cyclone Activity*, *supra* note 13; *see also* Smith & Katz, *supra* note 13, at 408 ("[I]t is difficult to attribute any part of the trends in losses to climate variations or change, especially in the case of billion-dollar disasters."); Roger Pielke Jr., *"Billion Dollar Disasters" Are a National Embarrassment*, *supra* note 13.

[76] NCA5, ch.17, *Climate Effects on US National Interests* (2023), https://doi.org/10.7930/NCA5.2023.CH17.

[77] NCA5, *Front Matter* (2023), https://nca2023.globalchange.gov/chapter/front-matter/#section-2.

projected results or on the authors' expert judgment based on their assessment across scientific information sources."[78]

These labels are sprinkled throughout the document and give the appearance of a sophisticated and careful vetting of the data. For example, the report explains that it "is an established fact that climate change is harming physical, mental, spiritual, and community health and well-being through the increasing frequency and intensity of extreme events, increasing cases of infectious and vector-borne diseases, and declines in food and water quality and security. Climate-related hazards will continue to grow, increasing morbidity and mortality across all regions of the US (*very likely, very high confidence*)."[79]

But these labels of probability only reflect the probability of the prediction occurring *if* a certain emissions or warming scenario comes to pass. The scenarios themselves, which must occur for the prediction to come true, "do not have relative likelihoods assigned."[80] This is a simple mathematical error. An event likely to occur only in an unlikely future scenario requires an assessment of conditional probability, meaning it relies on the unlikely future scenario actually happening as an assumed condition precedent. Since the unlikely future scenario is already improbable, the contingent event is even less probable. This is basic combinatorics: if X cannot happen unless Y happens first, the probability is calculated by multiplying likelihood of Y by the likelihood of X—e.g., one has only a 25% chance of getting heads twice in a row in a coin toss.

While NCA5 says that the various RCP scenarios "are all plausible futures" this is simply not true. The USGCRP has previously explained the "uncertainty in [these] future projections is relatively high, incorporating both the uncertainty due to multiple scenarios as well as uncertainty regarding the response of the climate system to human emissions. These uncertainties increase the further out in time the projections go." [81] And as discussed above, RCP8.5 is tremendously unlikely and is the "only SSP-RCP pairing with CO_2 emissions projections outside the 1st to 99th percentile range of RFF-SPs."[82] As a result, any event that

[78] *Id.*

[79] NCA5, ch.15, *Human Health* (2023), https://doi.org/10.7930/NCA5.2023.CH15.

[80] NCA5, *Front Matter*, *supra* note 77.

[81] Climate Science Special Report, NCA4, ch.4, *Climate Models, Scenarios, and Projections* (2017), http://doi.org/10.7930/J0WH2N54.

[82] EPA, *External Review Draft of Report on the Social Cost of Greenhouse Gases*, *supra* note 49, at 24.

would occur only in that scenario must necessarily be very unlikely. But NCA5 labels those events as "very likely, very high confidence." That is "very" misleading.

To these uncertainties is added the compounding uncertainties related even making predictions a century hence in the first place. Estimating damage far in the future is difficult because, as John Pezzey of the Australian National University has explained, the "statistical analyses" that undergird damage functions necessarily "rest[ ] on untestable, far-out-of-sample extrapolation."[83]

> Estimating the damage to welfare from more heatwaves or hurricanes in 2050 or 2100 caused by an extra tonne of CO_2 emitted now is so unfathomable because normal scientific methods … cannot apply. First, there are no adequate comparators for testing damage functions at the necessary scale; second, there are no agreed, quantitatively stable laws underlying damage modeling; and third, slow Earth-system response times greatly limit climate damage learning (how much any damage observed decades from now can improve a damage function for likely warming in the century after that).[84]

Testing extended climate projections is generally harder than testing predictions in other earth sciences, given both the climate's immense complexity, and the unprecedented degree of temperature rise predicted by many climate scientists.[85] While stable underlying laws make climate modeling based on past observations meaningful, those observations do not contain data with modes and rates of change equivalent to those predicted.[86]

This problem becomes more complicated when predictions move from climate science to social science. Pezzey explains that:

> The Earth system including people, each with complex brains, is vastly harder to model than the system without humanity that pure climate science models. Though important progress has been made in analyzing complex system dynamics … such analysis falls far short of any consensus about the nature, or even existence, of quantitatively stable laws for humanity's responses to unprecedented, centennial climate change.

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[83] John C. V. Pezzey, *Why the Social Cost of Carbon Will Always Be Disputed*, 10 WIREs Climate Change, art. no. e558 (Nov. 12, 2018), https://doi.org/10.1002/wcc.558.

[84] *Id.*

[85] *Id.*

[86] *Id.*

Isaac Asimov's classic sci-fi novel, *Foundation* (1951), imagines a future where future human activity can be mathematically predicted through a statical modeling technique called "psychohistory." Needless to say, no such technique exists. One hundred years ago, nuclear power plants, photovoltaic cells, and home air conditioning didn't exist. How can the USGCRP predict what technological revolution will change the climate or our response to it in the coming 100 years? The biggest impact on global carbon emissions in the last two decades came as a result of the COVID-19 pandemic and the 2008 financial crisis, neither of which could have been predicted by an USGCRP model.

To fulfill its statutory mandate, USGCRP must accurately report on uncertainty in NCA6. Labels of likelihood must reflect the likelihood that the event will come to pass, not the likelihood that such an event will occur given a certain scenario. Further, the report should be organized to present a representative view of the data to readers. Discussions of the fundamental limitations of predictive models should be put at the very front of the report. And any predictions in which the likelihood of or confidence in that outcome is "medium" or "low," should be relegated to an appendix section explicitly labeled as containing unlikely events, so they do not mislead the readers. This would necessarily include any prediction, at any level of confidence, that is based on RCP6.0 or RCP8.5.

V. The Report Must Ensure Information Quality and Scientific Integrity.

The USGCRP and its reports are required by law to comply with the IQA and to meet the highest information quality standards set by the federal government. The IQA places strict requirements on federal agencies to ensure the accuracy of information they disseminate to the public.[87] To that end, the IQA mandates that agencies implement measures to guarantee the quality, objectivity, utility, and integrity of released information. Both the Office of Management and Budget ("OMB") and individual agencies have developed guidelines to uphold these standards.[88] Because National Oceanic and Atmospheric Administration ("NOAA") is the administrative agency overseeing the USGCRP reports, its agency guidelines cover the report.[89] Two these requirements are of particular relevance to the USGCRP reports: "objectivity" and "utility."

[87] Pub. L. No. 106-554, app. C, § 515, 114 Stat. 2763A-153 (2000) (H.R. 5658).

[88] *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencie*s, 67 Fed. Reg. 8452 (Feb. 22, 2002).

[89] NOAA, *Information Quality Guidance for the National Climate Assessment* (Feb. 2023), Perma | nca2023.globalchange.gov.

NCA5 does not meet IQA standards for "objectivity." According to OMB guidelines, "[o]bjectivity" "involves two distinct elements, presentation and substance."[90] Presentation requires that information "is presented within a proper context" and notes that "[s]ometimes, in disseminating certain types of information to the public, other information must also be disseminated in order to ensure an accurate, clear, complete, and unbiased presentation."[91] Substance requires that the information itself is "accurate, reliable, and unbiased" and that "[i]n a scientific … or statistical context, the original and supporting data shall be generated, and the analytic results shall be developed, using sound statistical and research methods."[92]

The information in past reports has not been presented with "proper context" to "ensure to an accurate, clear, complete, and unbiased presentation." As described above, NCA5's narrow focus on climate change to the exclusion of "global change" deprives policymakers and the public of the context necessary to understand climate impacts and are misled about current trends in global change.[93] Additionally, the outsized emphasis that NCA5 put on the most extreme and unlikely climate change scenarios while simultaneously downplaying the ways in which predictable adaptation will limit the costs associated with those changes, misrepresents the seriousness of current trajectories.[94] Finally, NCA5's misrepresentation of the likelihood of and its confidence in certain predictions, by eliding the uncertainty of the emissions scenarios themselves are deeply misleading.[95] This "hard sell" approach may be something we tolerate for extended warranty pitches, but it is very out of place in scientific analysis.

Nor is the "substance" of the information presented in past reports "accurate, reliable, and unbiased." NCA5 explains that it uses a "Damages by Degree" method which it explains as an "[i]mproved understanding of the risks human and environmental systems face under each additional increment of global warming," which "has helped scientists quantify potential damages to health, ecosystems, livelihoods, and the economy… ."[96] A similar analysis was used by EPA in recently proposed update to its Framework for Evaluating Damages and Impacts

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[90] 67 Fed. Reg. at 8459.

[91] *Id.*

[92] *Id.*

[93] *See supra* Part II.

[94] *See supra* Part III.

[95] *See supra* Part IV.

[96] NCA5, *Front Matter*, *supra* note 77.

(FrEDI), a tool that the USGCRP touts as one of its "recent accomplishments" in a report to Congress.[97] FrEDI provides damage as a function of temperature, and its users are free to supply their own temperature as a function of time.[98]

But "damages by degree" models are only effective if the damage functions which underly them are effective. But many of the studies that used to construct these damages models rely on RCP8.5.[99] Those studies generally relate damages to increasing temperatures via the development a mathematical function—typically a simple linear regression of damages on

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[97] USGRP, *Our Changing Planet: The U.S. Global Change Research Program for Fiscal Year 2021*, at 1 (2024), https://doi.org/10.7930/ocpfy2024.

[98] EPA, 430-R-24-001, *Draft Technical Documentation for the Framework for Evaluating Damages and Impacts (FrEDI)* 1 (Feb. 2024), https://perma.cc/93L5-NWMA.

[99] *See, e.g.*, W. Schlenker & M.J. Roberts, *Nonlinear Temperature Effects Indicate Severe Damages to U.S. Crop Yields Under Climate Change*, 106 PNAS 15594 (2009), https://doi.org/10.1073/pnas.0906865106 (predicting a 63–82% decrease in agricultural yields from 2070–2099 using RCP8.5); S. Hsiang et al., *Estimating Economic Damage from Climate Change in the United States*, 356 Sci. 1362 (2017), https://doi.org/10.1126/science.aal4369 (describing RCP8.5 as "business-as-usual" and predicting GDP loss of 1.5–5.6% under that scenario); J. Lee et al., *The Impact Of Climate Change On The Recoverability Of Airline Networks*, 95 Transp. Rsch. Part D: Transp. & Env't, art. no. 102801 (2021), https://doi.org/10.1016/j.trd.2021.102801 (forecasting a 16–50% increase in recovery costs by 2035 due to airline network disruption using RCP8.5); M. Burke et al., *Global Non-linear Effect Of Temperature On Economic Production*, 527 Nature 235 (2015), https://doi.org/10.1038/nature15725 (using RCP8.5 to predict GDP growth to decline by 0.13% per year per 1 degree Fahrenheit warming and global GDP per capita to decline by 19.6%); L. Barrage, *Fiscal Costs of Climate Change in the United States*, Econ. Working Paper Series 23/380, ETH Zurich, Ctr. of Econ. Rsch. (2023), https://doi.org/10.3929/ethz-b-000605514 (using RCP8.5 to predict a 1.45% increase in public services costs by 2050); D.B. Diaz, *Estimating Global Damages From Sea Level Rise With The Coastal Impact And Adaptation Model (CIAM)*, 137 Climatic Change 143 (2016), https://doi.org/10.1007/s10584-016-1675-4 (predicting that sea level rise will lead coastal damages to increase by $550 billion in an optimal adaptation scenario and $2.6 trillion in a no adaptation scenario, both using RCP8.5); P.H. Larsen et al., *Projecting Future Costs To U.S. Electric Utility Customers From Power Interruptions*, 147 Energy 1256 (2018), https://doi.org/10.1016/j.energy.2017.12.081 (using RCP8.5 to forecast the consumer cost of electricity outages to balloon by $2.3–6.8 trillion); P. Chinowsky et al., *Impacts Of Climate Change On Operation Of The US Rail Network*, 75 Transp. Pol'y 183 (2019), https://doi.org/10.1016/j.tranpol.2017.05.007 (describing RCP8.5 as a continuation of the present emissions patterns and predicting a $43–$73 billion increase in costs from railroad network delays); J.E. Neumann et al., *Climate Change Risks To US Infrastructure: Impacts On Roads, Bridges, Coastal Development, And Urban Drainage*, 131 Climatic Change 97 (2015), https://doi.org/10.1007/s10584-013-1037-4 (using RCP8.5 to predict increases in the costs of road and urban drainage degradation of $116 billion and $29 billion respectively); S. Feng et al., *Linkages Among Climate Change, Crop Yields And Mexico–US Cross-border Migration*, 107 PNAS 14257 (2010), https://doi.org/10.1073/pnas.1002632107 (using RCP8.5 to forecast an increase of 3.2 million migrants from Mexico); *see also* M. Auffhammer & J.R. Vincent, *Unobserved Time Effects Confound The Identification Of Climate Change Impacts*, 109 PNAS 11973 (2012), https://doi.org/10.1073/pnas.1202049109; S. Feng & M. Oppenheimer, *Applying Statistical Models To The Climate-migration Relationship*, 109 PNAS E2915 (2012), https://doi.org/10.1073/pnas.1212226109; M. Burke et al., *Higher Temperatures Increase Suicide Rates In The United States And Mexico*, 8 Nature Climate Change 723 (2018), https://doi.org/10.1038/s41558-018-0222-x (predicting an increase in deaths by suicide of 5,600 to 26,000 by 2050 using RCP8.5); D.L. Swain et al., *Increased Flood Exposure Due To Climate Change And Population Growth In The United States*, 8 Earth's Future, art. no. e2020EF001778 (2020), https://doi.org/10.1029/2020ef001778 (describing a climate regime using RCP8.5 as a "medium warming" scenario and predicting a mean increase in the 100-year precipitation event of ~20% (magnitude) and >200% (frequency), yielding a ~30–127% increase in population exposure).

changes in temperature—for different impact categories. But because damages from rising temperature tend to be nonlinear, the inclusion of these more extreme values in the damage function biases the mathematical relationship to project higher damage at *all* temperatures. The use of the extreme RCP8.5 scenario then results in much larger damages at lower temperatures than would result if extreme scenarios were not included, simply due to the linear fitting used to create the impact function.[100]

A model that produces inflated damage estimates through the use of the flawed RCP8.5 scenario is not using "accurate" or "reliable" data, as that scenario is widely recognized as out-of-date and as having been empirically falsified. Sound scientific practice requires collecting data on future damage projections from studies that consider reasonably likely future outcomes and not results tainted by a scenario that EPA itself has conceded is incredibly improbable. NCA5's systematic reliance on information that uses RCP8.5 indicates a failure by USGCRP to consider all relevant factors or reflects an inaccurate understanding of the causal relationships within the system being modeled. The biased data implies the model was built on information that is deliberately unrepresentative, leading to deliberately unreliable and misleading predictions.

Other studies relied on by NCA5 are even more deeply flawed. In its economics chapter, coauthored by Solomon Hsiang, NCA5 relies on a 2015 study[101] by Marshall Burke, Solomon Hsiang, and Edward Miguel for the proposition that "[o]ver the coming century" climate change will result in "large negative impacts on economic production."[102] That study purports to show that unrestrained global warming will reduce world GDP per capita by 23 percent in the year 2100, nearly an order of magnitude more than the Nordhaus DICE model.[103] But as other economists have demonstrated, that study is "is shallow and misleading."[104]

> The authors use data with characteristics that are known to create spurious regression results without making proper adjustments or even acknowledging these characteristics. They estimate parameters of a quadratic curve relating temperature to growth, and then cherry-pick countries to include in a

[100] For a more detailed explanation of FrEDI's structural flaws, see Ctr. for Env't Accountability, Comment ID No. EPA–HQ–OAR–2023–0614–0005, *Comments on Technical Documentation for the Framework for Evaluating Damages and Impacts (FrEDI)* (Apr. 24, 2024).

[101] M. Burke et al., *Global Non-linear Effect Of Temperature On Economic Production*, *supra* note 99.

[102] NCA5, ch.19, *Economics* (2023), https://doi.org/10.7930/NCA5.2023.CH19

[103] M. Burke et al., *Global Non-linear Effect Of Temperature On Economic Production*, *supra* note 99.

[104] *See* David Barker, Comment, *Global Non-Linear Effect of Temperature on Economic Production: Comment on Burke, Hsiang, and Miguel*, 21 Econ. J. Watch 35 (2024), https://perma.cc/X779-8SQB.

> chart that appears to confirm the shape of this curve. The curve is then used to project growth rates into the distant future using temperature scenarios that a more recent comment in *Nature* described as either "extremely unlikely" or "unlikely." … The headline result, that warming will reduce global GDP per capita by 23 percent, is more than double the mean estimate of [the authors'] bootstrap estimation, which they do not report. [The authors] claim that their result is "globally representative", but it does not hold without Greenland and the regions of the Sahara and Central Africa, and it does not hold in large regions of the world.[105]

That the Burke, Hsiang, and Miguel chapter was cited in a chapter coauthored by one of its own authors raises separate questions of bias, conflicts of interest, and ethics. Studies in which Hsiang is a coauthor or Burke a coauthor are together cited more than two dozen times. These repeated citations raise questions about whether these authors' work was selected due to their expertise or because of their relationships in charge or report. Similar questions can be asked about the participation of all the authors that receive government grants to publish papers on the severity of climate change. There are more than 700 authors involved in the publication of NCA5, all of whom, by participating in the construction of a document and serving on panels that create assessments that call for future research on the severity of climate change, are potentially implicated in conflicts of interest or ethical issues.

NCA5 does not meet IQA standards for "utility." According to OMB, utility refers to "the usefulness of the information to its intended users, including the public," with an emphasis on "transparency."[106] Similarly, NOAA's Scientific Integrity Policy provides that "to achieve" its mission "[t]ransparency, traceability, and integrity at all levels are required."[107] Transparency is characterized by "visibility" and "accessib[ility]" of information and traceability refers to "[t]he ability to verify sources, data, information, methodology, results, assessments, research, analysis, conclusions or other evidence to establish the integrity of findings."[108]

Many of the studies relied upon by NCA5 are either trapped behind paywalls, fail to publish their underlying data, or both. When a study is inaccessible due to paywalls, it becomes impossible for an independent third party to replicate the analysis or verify the findings. This renders the report's conclusions opaque and unsubstantiated, raising legitimate concerns about the reliability

[105] *Id.* at 35–36.

[106] 67 Fed. Reg. at 8459.

[107] NOAA, Order No. 202-735D.3, *Scientific Integrity* § 5, at 9 (Mar. 1, 2024), https://perma.cc/VT3Z-UHYN.

[108] *Id.* § 3.23–24, at 8.

and accuracy of the information presented, issues that are exacerbated by the size and complexity of the topic. Such a report falls short of the standards required by the IQA and undermines the public and policymakers' right to access and scrutinize the evidence upon which policy decisions are made.

Similarly, when a report fails to provide access to the raw data underpinning its conclusions, it erects an insurmountable barrier for the scrutiny of that data or the assessment of the validity of the findings. This lack of access casts a shadow on the report's conclusions, undermining public trust in the government's decision-making process.

To remedy these information quality issues and ensure it is compliant with the IQA, the USGCRP must set out clear standards for how it will characterize its findings and how it will select authors and studies to rely on before the report begins to be drafted. These standards must provide clear answers to questions including:

- What criteria will the USGCRP use for ensuring its work is presented with appropriate context to ensure the presentation is "accurate, reliable, and unbiased"?

- What criteria will the USGCRP use for ensuring the underlying methodology it uses is "accurate, reliable, and unbiased"?

- What criteria will the USGCRP use for ensuring that the studies it cites are "accurate, reliable, and unbiased"?

- How will the USGCRP address conflicts of interest and ethics issues among its hundreds of authors and reviewers, including conflicts of interest related to sources of grant funding?

- How will the USGCRP ensure that the authors and reviewers of the report are not those who have previously published low-quality work and how will it ensure that the reviewers it identifies to make such a determination do not themselves have conflicts of interest related to serving as the evaluators of their own work, work of their collaborators, or work funded by the entities that fund them?

VI. Conclusion

The Center for Environmental Accountability urges the USGCRP to develop the NCA6 with these requirements in mind.

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