



A Critical Review of Impacts of Greenhouse Gas Emissions on the U.S. Climate

Climate Working Group

United States Department of Energy

July 23, 2025

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A Generative Summary

This report critically reviews the impacts of greenhouse gas emissions on the U.S. climate, focusing on scientific uncertainties and policy implications.

Direct Human Influence on Ecosystems and Climate

- Carbon dioxide (CO₂) is identified as a pollutant that contributes to global greening, enhancing plant growth and agricultural productivity. However, it also lowers ocean pH, potentially harming coral reefs, though recent observations suggest resilience in some ecosystems.
- Human activities influence climate through radiative forcing, with historical data indicating a complex relationship between CO₂ emissions and atmospheric concentrations. Future emission scenarios may be overstated, affecting climate projections.
- Climate models show a wide range of sensitivity to CO₂, with discrepancies between model predictions and actual temperature observations, indicating models may overestimate warming.

Climate Response and Extreme Weather

- Most extreme weather events in the U.S. lack long-term trends, with claims of increased frequency or intensity of hurricanes, tornadoes, and droughts not supported by historical data.
- Sea level rise has been approximately 8 inches since 1900, with regional variations primarily due to land subsidence, and no acceleration beyond historical averages is observed.
- Attribution of climate change impacts to human emissions faces challenges from natural variability and model limitations, suggesting that solar activity may have been underestimated in its contribution to warming.

Economic Implications and Policy Considerations

- The economic impact of CO₂-induced warming may be less severe than commonly believed, and aggressive mitigation policies could be counterproductive.
- Estimates of the Social Cost of Carbon are sensitive to underlying assumptions, limiting their reliability for policymaking.
- U.S. climate policies are expected to have minimal direct effects on global climate, with any significant impacts emerging only after long delays.

This report emphasizes the need for a balanced, science-based discussion on climate change and energy policy, advocating for open debate and scrutiny of prevailing narratives.

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Report to U.S. Energy Secretary Christopher Wright
July 23, 2025

Climate Working Group:

John Christy, Ph.D.

Judith Curry, Ph.D.

Steven Koonin, Ph.D.

Ross McKittrick, Ph.D.

Roy Spencer, Ph.D.

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Table of Contents

SECRETARY'S FOREWORD	VIII
EXECUTIVE SUMMARY	IX
PREFACE	X
PART I: DIRECT HUMAN INFLUENCE ON ECOSYSTEMS AND THE CLIMATE	1
1 CARBON DIOXIDE AS A POLLUTANT	2
2 DIRECT IMPACTS OF CO₂ ON THE ENVIRONMENT	3
2.1 CO ₂ AS A CONTRIBUTOR TO GLOBAL GREENING	3
2.1.1 <i>Measurement of global greening</i>	3
2.1.2 <i>Photosynthesis and CO₂ levels</i>	4
2.1.3 <i>Rising CO₂ and crop water use efficiency</i>	6
2.1.4 <i>CO₂ fertilization benefits in IPCC Reports</i>	6
2.2 THE ALKALINE OCEANS	6
2.2.1 <i>Changing pH</i>	6
2.2.2 <i>Coral reef changes</i>	7
3 HUMAN INFLUENCES ON THE CLIMATE	11
3.1 COMPONENTS OF RADIATIVE FORCING AND THEIR HISTORY	11
3.1.1 <i>Historical radiative forcing</i>	11
3.1.2 <i>Change in atmospheric CO₂ since 1958</i>	13
3.2 FUTURE EMISSION SCENARIOS AND THE CARBON CYCLE	14
3.2.1 <i>Emission scenarios</i>	14
3.2.2 <i>The carbon cycle relating emissions and concentrations</i>	17
3.3 URBANIZATION INFLUENCE ON TEMPERATURE TRENDS	20
PART II: CLIMATE RESPONSE TO CO₂ EMISSIONS	24
4 CLIMATE SENSITIVITY TO CO₂ FORCING	25
4.1 INTRODUCTION	25
4.2 MODEL-BASED ESTIMATES OF CLIMATE SENSITIVITY	26
4.3 DATA-DRIVEN ESTIMATES OF CLIMATE SENSITIVITY	27
4.4 TRANSIENT CLIMATE RESPONSE	29
5 DISCREPANCIES BETWEEN MODELS AND INSTRUMENTAL OBSERVATIONS	31
5.1 INTRODUCTION	31
5.2 SURFACE WARMING	33
5.3 TROPOSPHERIC WARMING	34
5.4 VERTICAL TEMPERATURE PROFILE MISMATCH	36

5.5	STRATOSPHERIC COOLING	38
5.6	SNOW COVER MISMATCH.....	39
5.7	HEMISPHERIC SYMMETRY OF THE PLANETARY ALBEDO	41
5.8	U.S. CORN BELT	42
6	EXTREME WEATHER	46
6.1	INTRODUCTION	46
6.2	HURRICANES AND TROPICAL CYCLONES	48
6.3	TEMPERATURE EXTREMES	52
6.3.1	<i>Temperatures in the U.S. are becoming less extreme.....</i>	<i>53</i>
6.3.2	<i>Exceedances of a heat threshold.....</i>	<i>56</i>
6.3.3	<i>Heatwaves.....</i>	<i>57</i>
6.4	EXTREME PRECIPITATION	61
6.5	TORNADOES	66
6.6	FLOODING	67
6.7	DROUGHTS	68
6.8	WILDFIRES	69
7	CHANGES IN SEA LEVEL	75
7.1	GLOBAL SEA LEVEL RISE.....	75
7.2	U.S. SEA LEVEL RISE	75
7.3	PROJECTED SEA LEVEL RISE	79
8	UNCERTAINTIES IN CLIMATE CHANGE ATTRIBUTION	82
8.1	INTRODUCTION	82
8.2	ATTRIBUTION METHODS	83
8.3	ATTRIBUTION OF GLOBAL WARMING	84
8.3.1	<i>Natural climate variability.....</i>	<i>84</i>
8.3.2	<i>Optimal fingerprinting.....</i>	<i>88</i>
8.3.3	<i>Time series methods.....</i>	<i>89</i>
8.4	DECLINING PLANETARY ALBEDO AND RECENT RECORD WARMTH	90
8.5	ATTRIBUTION OF CLIMATE IMPACT DRIVERS	92
8.6	EXTREME EVENT ATTRIBUTION (EEA).....	95
8.6.1	<i>Case study – 2021 Western North America heat wave.....</i>	<i>96</i>
	PART III: IMPACTS ON ECOSYSTEMS AND SOCIETY	103
9	CLIMATE CHANGE AND U.S. AGRICULTURE	104
9.1	ECONOMETRIC ANALYSES.....	104
9.2	FIELD AND LABORATORY STUDIES OF CO ₂ ENRICHMENT	105

9.3	CROP MODELING META-ANALYSES	106
9.4	CO ₂ FERTILIZATION AND NUTRIENT LOSS	107
10	MANAGING RISKS OF EXTREME WEATHER	110
10.1	SOCIOECONOMIC CONTEXT	110
10.2	DATA CHALLENGES	111
10.3	MORTALITY FROM TEMPERATURE EXTREMES	111
10.3.1	<i>Heat and cold risks</i>	111
10.3.2	<i>Mortality risks and energy costs</i>	113
11	CLIMATE CHANGE, THE ECONOMY, AND THE SOCIAL COST OF CARBON	116
11.1	CLIMATE CHANGE AND ECONOMIC GROWTH	116
11.1.1	<i>Overview</i>	116
11.1.2	<i>Empirical analysis of climate change and economic growth</i>	119
11.2	MODELS OF THE SOCIAL COST OF CARBON	120
11.2.1	<i>Estimating the SCC</i>	121
11.2.2	<i>Variations in the SCC</i>	122
11.2.3	<i>Evidence for low SCC</i>	123
11.2.4	<i>Tipping points</i>	123
11.2.5	<i>Are there alternatives?</i>	125
12	GLOBAL CLIMATE IMPACTS OF U.S. EMISSIONS POLICIES	129
12.1	THE SCALE PROBLEM	129
12.2	CASE STUDY: U.S. MOTOR VEHICLE EMISSIONS	129
12.3	CONCLUDING THOUGHTS	130
	GLOSSARY	132
	METADATA FOR FIGURES AND TABLES	136
	ABOUT THE AUTHORS	140

SECRETARY'S FOREWORD

Energy, Integrity, and the Power of Human Potential

Over my lifetime, I've had the privilege of working as an energy entrepreneur across a range of fields—nuclear, geothermal, natural gas, and more—and I now serve as Secretary of Energy under President Donald Trump. But above all, I'm a physical scientist who sees modern energy as nothing short of miraculous. It powers every aspect of modern life, drives every industry, and has made America an energy powerhouse with the ability to fuel global progress.

The rise of human flourishing over the past two centuries is a story worth celebrating. Yet we are told—relentlessly—that the very energy systems that enabled this progress now pose an existential threat. Hydrocarbon-based fuels, the argument goes, must be rapidly abandoned or else we risk planetary ruin.

That view demands scrutiny. That's why I commissioned this report: to encourage a more thoughtful and science-based conversation about climate change and energy. With my technical background, I've reviewed reports from the Intergovernmental Panel on Climate Change, the U.S. government's assessments, and the academic literature. I've also engaged with many climate scientists, including the authors of this report.

What I've found is that media coverage often distorts the science. Many people walk away with a view of climate change that is exaggerated or incomplete. To provide clarity and balance, I asked a diverse team of independent experts to critically review the current state of climate science, with a focus on how it relates to the United States.

I didn't select these authors because we always agree—far from it. In fact, they may not always agree with each other. But I chose them for their rigor, honesty, and willingness to elevate the debate. I exerted no control over their conclusions. What you'll read are their words, drawn from the best available data and scientific assessments.

I've reviewed the report carefully, and I believe it faithfully represents the state of climate science today. Still, many readers may be surprised by its conclusions—which differ in important ways from the mainstream narrative. That's a sign of how far the public conversation has drifted from the science itself.

To correct course, we need open, respectful, and informed debate. That's why I'm inviting public comment on this report. Honest scrutiny and scientific transparency should be at the heart of our policymaking.

Climate change is real, and it deserves attention. But it is not the greatest threat facing humanity. That distinction belongs to global energy poverty. As someone who values data, I know that improving the human condition depends on expanding access to reliable, affordable energy. Climate change is a challenge—not a catastrophe. But misguided policies based on fear rather than facts could truly endanger human well-being.

We stand at the threshold of a new era of energy leadership. If we empower innovation rather than restrain it, America can lead the world in providing cleaner, more abundant energy—lifting billions out of poverty, strengthening our economy, and improving our environment along the way.

EXECUTIVE SUMMARY

This report reviews scientific certainties and uncertainties in how anthropogenic carbon dioxide (CO₂) and other greenhouse gas emissions have affected, or will affect, the Nation's climate, extreme weather events, and selected metrics of societal well-being. Those emissions are increasing the concentration of CO₂ in the atmosphere through a complex and variable carbon cycle, where some portion of the additional CO₂ persists in the atmosphere for centuries.

Elevated concentrations of CO₂ directly enhance plant growth, globally contributing to “greening” the planet and increasing agricultural productivity [Section 2.1, Chapter 9]. They also make the oceans less alkaline (lower the pH). That is possibly detrimental to coral reefs, although the recent rebound of the Great Barrier Reef suggests otherwise [Section 2.2].

Carbon dioxide also acts as a greenhouse gas, exerting a warming influence on climate and weather [Section 3.1]. Climate change projections require scenarios of future emissions. There is evidence that scenarios widely-used in the impacts literature have overstated observed and likely future emission trends [Section 3.1].

The world's several dozen global climate models offer little guidance on how much the climate responds to elevated CO₂, with the average surface warming under a doubling of the CO₂ concentration ranging from 1.8°C to 5.7°C [Section 4.2]. Data-driven methods yield a lower and narrower range [Section 4.3]. Global climate models generally run “hot” in their description of the climate of the past few decades – too much warming at the surface and too much amplification of warming in the lower- and mid-troposphere [Sections 5.2-5.4]. The combination of overly sensitive models and implausible extreme scenarios for future emissions yields exaggerated projections of future warming.

Most extreme weather events in the U.S. do not show long-term trends. Claims of increased frequency or intensity of hurricanes, tornadoes, floods, and droughts are not supported by U.S. historical data [Sections 6.1-6.7]. Additionally, forest management practices are often overlooked in assessing changes in wildfire activity [Section 6.8]. Global sea level has risen approximately 8 inches since 1900, but there are significant regional variations driven primarily by local land subsidence; U.S. tide gauge measurements in aggregate show no obvious acceleration in sea level rise beyond the historical average rate [Chapter 7].

Attribution of climate change or extreme weather events to human CO₂ emissions is challenged by natural climate variability, data limitations, and inherent model deficiencies [Chapter 8]. Moreover, solar activity's contribution to the late 20th century warming might be underestimated [Section 8.3.1].

Both models and experience suggest that CO₂-induced warming might be less damaging economically than commonly believed, and excessively aggressive mitigation policies could prove more detrimental than beneficial [Chapters 9, 10, Section 11.1]. Social Cost of Carbon estimates, which attempt to quantify the economic damage of CO₂ emissions, are highly sensitive to their underlying assumptions and so provide limited independent information [Section 11.2].

U.S. policy actions are expected to have undetectably small direct impacts on the global climate and any effects will emerge only with long delays [Chapter 12].

PREFACE

This document originated in late March 2025 when Secretary Wright assembled an independent group to write a report on issues in climate science relevant for energy policymaking, including evidence and perspectives that challenge the mainstream consensus. We agreed to undertake the work on the condition that there would be no editorial oversight by the Secretary, the Department of Energy, or any other government personnel. This condition has been honored throughout the process and the writing team has worked with full independence.

The group began working in early April with a May 28 deadline to deliver a draft for internal DOE review. The short timeline and the technical nature of the material meant that we could not comprehensively review all topics. Rather, we chose to focus on topics that are treated by a serious, established academic literature; that are relevant to our charge; that are downplayed in, or absent from, recent assessment reports; and that are within our competence.

While the report is intended to be accessible to non-experts, we have omitted some introductory or explanatory material that can easily be accessed elsewhere. Nor have we attempted to survey the entire literature related to the topics covered. We have focused as much as possible on literature published since 2020 and referenced previous IPCC and NCA assessment reports. We have also used data through 2024 where possible.

The writing team is grateful to Secretary Wright for the opportunity to prepare this report and for his support of independent scientific assessment and open scientific debate. We are also grateful to a team of anonymous DOE and national lab reviewers whose input helped improve the final report.

John Christy, Ph.D.

Judith Curry, Ph.D.

Steven Koonin, Ph.D.

Ross McKittrick, Ph.D.

Roy Spencer, Ph.D.