Five Considerations for Twenty-First Century Climate Policy

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FIVE CONSIDERATIONS FOR TWENTY-FIRST CENTURY CLIMATE POLICY

Matthew G. Burgess*

ABSTRACT

As the twenty-first century advances, society is entering a new phase regarding climate change. Impacts of climate change are becoming more salient in the present, rather than being only far-off in the future. Progress on flattening—and in many affluent countries, reducing—greenhouse gas emissions is also becoming salient, though the progress underperforms international targets. Slowing economic growth and major technological and geopolitical disruptions are creating new challenges and uncertainties. One of these challenges is a political climate of deep divisions and rising distrust in fact-finding institutions—a climate that is ripe for demagoguery. In the United States and some other countries, the issue of climate change has become divisive and has been wielded rhetorically by demagogic political figures and movements on both extremes of the political spectrum.

This Article outlines five important considerations for climate policy in this new phase of the twenty-first century, focusing on both the global and the U.S. contexts. (1) Mid-range emissions and warming scenarios are most plausible. In contrast, the science and public discourse of climate change has often focused on extremes. Focusing instead on plausible scenarios offers opportunities to consider important nuances and tradeoffs, and to de-polarize the discourse. (2) Economic growth and income convergence will continue but will probably be slower than previously expected. Continuing economic growth and income convergence would portend continuing improvements throughout the century, in many—if not most—measures of human well-being broadly across the world. However, growth and convergence underperforming expectations could create challenges for climate finance, climate politics, and adaptation to climate change impacts. (3) Major investments are needed in mitigation, adaptation, and carbon removal. The public discourse of climate change has often been hyper-focused on reducing greenhouse-gas emissions (i.e., mitigation). Mitigation is important and

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requires major investments, but realistic paths to carbon neutrality and minimizing climate risks to society also require major investments in adaptation and carbon removal. (4) The United States needs a bipartisan approach. Becoming carbon neutral will require changes to every aspect of society, implemented and sustained over decades, and supported by all levels of government. There is simply no realistic path to achieving such changes without cooperation of both parties. Recent research suggests there are opportunities for bipartisanship and common ground. (5) Catastrophism and utopianism carry underappreciated risks. The risks of complacency and inaction on climate change are becoming better understood, but policymakers and the public should also understand the risks to utopianism and catastrophism, which are responsible for some of history’s worst atrocities. As climate consciousness increases and political divisions harden, the risks of climate catastrophism and utopianism could increase.

I. MID-RANGE EMISSIONS AND WARMING SCENARIOS ARE MOST PLAUSIBLE

II. ECONOMIC GROWTH AND INCOME CONVERGENCE WILL PROBABLY CONTINUE, BUT SLOWER THAN EXPECTED

III. MAJOR INVESTMENTS ARE NEEDED IN MITIGATION, ADAPTATION, AND CARBON REMOVAL

IV. THE UNITED STATES NEEDS A BIPARTISAN APPROACH

V. CATASTROPHISM AND UTOPIANISM POSE UNDERAPPRECIATED RISKS

VI. CONCLUSION

I. MID-RANGE EMISSIONS AND WARMING SCENARIOS ARE MOST PLAUSIBLE

Research into potential future impacts of climate change relies heavily on scenarios. Scenarios project pathways of radiative forcing—how much energy cumulative greenhouse gas emissions have added to the atmosphere via the greenhouse effect—which are derived from assumed pathways of emissions. Forcing is usually expressed as Watts (a unit of energy) per meter squared (a unit of area) (W/m²).¹ Climate models translate forcing from scenarios into warming and physical climate system changes. Climate impact

¹ The canonical references for the IPCC’s climate change scenarios are Keywan Riahi et al., The Shared Socioeconomic Pathways and Their Energy, Land Use, and Greenhouse Gas Emissions Implications: An Overview, 42 GLOB. ENV’T CHANGE 153, 153–54 (2017); and Richard H. Moss et al., The Next Generation of Scenarios for Climate Change Research and Assessment, 463 NATURE 747, 749 (2010).
Five Considerations

studies project the consequences of these climate system changes for economies, ecosystems, natural disasters, and other outcomes of interest.\(^2\)

The Intergovernmental Panel on Climate Change (IPCC)’s Working Group II (WGII) synthesizes climate impact studies for each IPCC assessment cycle.\(^3\)

The most widely-used scenarios in climate impacts research are the Representative Concentration Pathway (RCP) and the Shared Socioeconomic Pathway (SSP) marker scenarios.\(^4\)

These scenarios were central to the IPCC’s Fifth and Sixth Assessment Reports, respectively.\(^5\)

There are four RCP scenarios, which span a range of roughly 2°C warming (above pre-industrial temperatures) by 2100 (RCP2.6) to roughly 4.5°C warming by 2100 (RCP8.5). There are seven SSP marker scenarios, spanning a range of roughly 1.5°C warming by 2100 (SSP1-1.9) to roughly 4.5°C warming by 2100 (SSP5-8.5). The number at the end of each scenario name represents the forcing in 2100 (e.g., RCP8.5 and SSP5-8.5 each produce roughly 8.5W/m\(^2\) forcing in 2100). The SSPX number (X) in SSP scenarios denotes one of five socioeconomic sets of assumptions (“storylines”: SSP1, SSP2, . . . , SSP5),\(^6\) which vary in their assumed economic growth, population growth, trade and technological advancement, and other factors. The sets of RCP and SSP marker scenarios are chosen from a broader family of thousands of scenarios produced by the integrated assessment modeling community.\(^7\)

The sets of marker scenarios were not designed to be accurate predictions of the future, but rather to span a range of possible outcomes. This range includes both scenarios consistent with the target of limiting warming to 1.5°C (SSP1-1.9) and scenarios at the extreme high-emissions end (RCP8.5 and SSP5-8.5), representing coal-dominated futures with no climate policy in place throughout the century.\(^8\)

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\(^2\) For a recent review of the relationship between scenarios and impact studies, aimed at a non-specialist audience, see Matthew G. Burgess et al., *Climate Change Scenarios in Fisheries and Aquatic Conservation Research*, 80 ICES J. MARINE SCI. 1163 (2023).


\(^4\) See Moss et al., *supra* note 1, at 752; Riahi et al., *supra* note 1, at 154.


\(^6\) Riahi et al., *supra* note 1, at 155–56.


\(^8\) See Moss et al., *supra* note 1, at 754; Riahi et al., *supra* note 1, at 157, 160.
Climate impact research has overwhelmingly focused on RCP8.5 and SSP5-8.5, and studies often incorrectly label these scenarios as “business as usual.” These scenarios account for more than half of scenario mentions in the most recent IPCC WGII report and U.S. National Climate Assessment. Studies using these high-emission scenarios are often cited in popular media, as they tend to produce the most dramatic headlines. Overuse of these scenarios and mislabeling them as business as usual has been widely criticized since 2020. RCP8.5 and SSP5-8.5 remain the most commonly used scenarios, but a recent review of one sub-discipline (fisheries and aquatic conservation) found that, since 2020, these scenarios have been less-often called business as usual, and have been more-often paired with another lower-emission scenario within studies.

The reason impact studies’ widespread reliance on RCP8.5 and SSP5-8.5 has become controversial is that multiple lines of evidence suggest that these scenarios are implausible. They project global coal demand per person as increasing by three times to six times, while the International Energy Agency (IEA) projects that coal demand per person will decrease under current policies or stated policies. SSP5-8.5 projects a world in 2100 that has gross domestic product (GDP) per capita of over 100,000 USD in today’s

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9 See Burgess et al., supra note 2, at 1163; Roger Pielke, Jr. & Justin Ritchie, Distorting the View of Our Climate Future: The Misuse and Abuse of Climate Pathways and Scenarios, 72 ENERGY RSCH. & SOC. SCI., no. 101890, 2021, at 1, 5–6; Matthew G. Burgess et al., Catastrophic Climate Risks Should Be Neither Understated nor Overstated, 119 PNAS, no. 42, 2022, at 1


11 See Burgess et al., supra note 2, at 1166; Pielke, Jr. & Ritchie, supra note 9, at 5; INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, supra note 3, at 136; U.S. GLOB. CHANGE RSCH. PROGRAM, FOURTH NATIONAL CLIMATE ASSESSMENT: IMPACTS, RISKS, AND ADAPTATION IN THE UNITED STATES 6 (2018), https://nca2018.globalchange.gov/.

12 This is discussed in Roger Pielke, Jr. & Justin Ritchie, How Climate Scenarios Lost Touch with Reality, ISSUES SCI. & TECH., Summer 2021, at 75, 77, 83.

13 The criticism became widespread upon publication of Hausfather & Peters, supra note 10, and Matthew G. Burgess et al., IPCC Baseline Scenarios Have Over-Projected CO2 Emissions and Economic Growth, 16 ENV’T RSCH. LETTERS, no. 014016, 2020, at 1. The criticism was started in the scientific literature by Justin Ritchie & Hadi Dowlatabadi, Why Do Climate Change Scenarios Return to Coal?, 140 ENERGY 1276, 1276 (2017). The debate over RCP8.5 has also been waged on social media, as described in David Wallace-Wells, Beyond Catastrophe: A New Climate Reality Is Coming into View, N.Y. TIMES (Oct. 26, 2022), https://www.nytimes.com/interactive/2022/10/26/magazine/climate-change-warming-world.html.

14 These lines of evidence are reviewed by Burgess et al., supra note 2, at 1163, 1167.

15 Id. at 1167; Burgess et al., supra note 13, at 7 fig.5.

16 Current policy scenarios assume that current climate policies already in place remain, but no further policy action is taken. Stated policies are similar, but also include policies that have been announced, if not yet implemented. See INT’L ENERGY AGENCY, WORLD ENERGY OUTLOOK 2019, at 219 (Edmund Hosker ed., 2019); INT’L ENERGY AGENCY, WORLD ENERGY OUTLOOK 2022, at 411 (Edmund Hosker ed., 2022).
dollars in every major world region and no climate policy at all (including policies that exist today),\textsuperscript{17} despite the fact that 4.5°C warming would make many tropical regions have unlivable wet-bulb temperatures for over 300 days per year.\textsuperscript{18}

Recent studies, from a variety of research groups and a variety of methods, now suggest that the world is on a path that would cause between 2°C and 3°C of warming, assuming mid-range climate sensitivity to emissions (more on this below). Constant emissions from 2019 to 2100 would produce approximately 3°C of warming by 2100,\textsuperscript{19} current policies would produce 2.6–2.9°C of warming by 2100\textsuperscript{20} (similar to RCP4.5 or SSP2-4.5), pathways consistent with stated policies would produce approximately 2.2°C of warming by 2100\textsuperscript{21} (similar to SSP2-3.4), and countries meeting their pledges and targets produce pathways consistent with limiting warming by 2100 to 2°C or slightly less\textsuperscript{22} (similar to RCP2.6 or SSP1-2.6). Modeling studies simulating continued changes in the sociopolitical system that are consistent with recent history project between 2°C and 2.5°C of warming by 2100.\textsuperscript{23} Figure 1 below summarizes some of these pathways, compared to the SSP marker scenarios.

The physical climate system adds additional layers of uncertainty. There are uncertainties regarding: how sensitive the climate is to forcing;\textsuperscript{24} the degree to which declines in anthropogenic aerosol pollution (which has a cooling effect) could accelerate warming;\textsuperscript{25} and whether, when, and how fast tipping points (e.g., melting permafrost releasing methane, sea ice melt

\textsuperscript{17} Burgess et al., supra note 2, at 1167.
\textsuperscript{18} Camilo Mora et al., Global Risk of Deadly Heat, 7 NATURE CLIMATE CHANGE 501, 501, 503–04 (2017).
\textsuperscript{19} Peiran R. Liu & Adrian E. Raftery, Country-Based Rate of Emissions Reductions Should Increase by 80% Beyond Nationally Determined Contributions to Meet the 2 °C Target, 2 COMM’CNS EARTH & ENV’T, no. 29, 2021, at 1, 4.
\textsuperscript{22} See Zeke Hausfather & Frances C. Moore, Commitments Could Limit Warming to Below 2 °C, 604 NATURE 247, 247 (2022); Temperatures, supra note 20.
\textsuperscript{23} Frances C. Moore et al., Determinants of Emissions Pathways in the Coupled Climate—Social System, 603 NATURE 103, 103 (2022); Kevin Rennert et al., Comprehensive Evidence Implies a Higher Social Cost of CO2, 610 NATURE 687, 688 (2022); Dirk-Jan van de Ven et al., A Multimodel Analysis of Post-Glasgow Climate Targets and Feasibility Challenges, 13 NATURE CLIMATE CHANGE 570, 576 (2023).
\textsuperscript{24} S.C. Sherwood et al., An Assessment of Earth’s Climate Sensitivity Using Multiple Lines of Evidence, REVIEWS OF GEOPHYSICS 1, 1, 58.
\textsuperscript{25} Trude Storelvmo et al., Disentangling Greenhouse Warming and Aerosol Cooling to Reveal Earth’s Climate Sensitivity, 9 NATURE GEOSCIENCE 286, 286 (2016).
reducing albedo)\textsuperscript{26} might occur that accelerate warming beyond what models currently project. These uncertainties bring 2100 warming levels as low as 1.5°C and as high as 4°C into the realm of possibility.\textsuperscript{27}

![Diagram](image-url)

Figure 1. Fossil fuel and industry (FFI) CO₂ emissions trajectories in Shared Socioeconomic Pathway (SSP) marker scenarios,\textsuperscript{28} compared to historical observations (black).\textsuperscript{29} International Energy Agency (IEA) stated policies and announced pledges scenario projections (purple and pink, solid lines),\textsuperscript{30} and ranges of Intergovernmental Panel on Climate Change (IPCC) scenarios (purple and pink, shaded, with dashed lines showing medians) with similar FFI CO₂ emissions growth rates to IEA scenarios. The IPCC’s estimates and likely (five to ninety-five percent) warming ranges,\textsuperscript{31} above pre-industrial temperatures, are shown at right, for marker scenarios they evaluated. The scenario analysis is from Pielke, Jr. et al., Plausible 2005–2050 Emissions Scenarios Project Between 2°C and 3°C of Warming by 2100;\textsuperscript{32} and this figure is based on figure 2A in Burgess et al., Climate Change Scenarios in Fisheries and Aquatic Conservation Research.\textsuperscript{33}

The human side also carries deep uncertainties and potential for surprises. For example, climate feedbacks producing higher-than-expected warming could be negated by human-side feedbacks of high warming

\textsuperscript{26} E.g., Timothy M. Lenton et al., Climate Tipping Points—Too Risky to Bet Against, 575 NATURE 592, 592–94 (2019); see also Seaver Wang, There is No Climate Tipping Point, BREAKTHROUGH INST. (Apr. 17, 2023), https://thebreakthrough.org/journal/climate-change-banned-words/climate-tipping-point-real.


\textsuperscript{28} Byers et al., supra note 7.


\textsuperscript{31} INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2023: SYNTHESIS REPORT, supra note 5, at 4 n.5.

\textsuperscript{32} Pielke, Jr. et al., supra note 21, at 4 fig.2.

\textsuperscript{33} Burgess et al., supra note 2, at 4 fig.2A.
causing lower emissions via economic damage. Feedbacks between emissions reductions and the political feasibility of climate policies, or positive feedbacks in the technology and economics of carbon-free energy could result in faster-than-expected emissions reductions. Major geopolitical events can cause disruptions favoring higher or lower emissions (or both at the same time in different regions or sectors), as the war in Ukraine illustrates.

The plausibility of mid-range warming scenarios (and the implausibility of extreme ones) has several important policy implications. First, consumers and users of climate impact studies (i.e., policy makers, politicians, planners, private industry, etc.) should pay close attention to which scenarios are used, since extreme scenarios still predominate the scientific literature. Users of climate impact research should emphasize results from mid-range scenarios (i.e., RCP4.5, SSP2-4.5, SSP2-3.4) in their assessments of most likely future outcomes. Second and relatedly, policymakers and politicians should be aware of the existence and abundance of climate misinformation in the public sphere based on misuse of extreme scenarios (especially RCP8.5 and SSP5-8.5) or miscommunication about exploratory studies using these scenarios.

This is a type of misinformation that may be less salient than the well-studied types of misinformation that deny the physical science of climate change. Since misuse of extreme scenarios originates inside the scientific community (unlike denialism, which mostly comes from outside), it risks exacerbating recent declines in trust in the scientific community.

Finally, politicians and public figures discussing climate change should avoid framing it within the false dichotomy that it is either a non-issue or a civilization-ending catastrophe. Framing environmental issues in histrionic

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34 Dawn L. Woodard et al., Economic Carbon Cycle Feedbacks May Offset Additional Warming from Natural Feedbacks, 116 PNAS 759, 759 (2019).
35 Moore et al., supra note 23, at 103.
36 Rupert Way et al., Empirically Grounded Technology Forecasts and the Energy Transition, 6 JOULE 2057, 2057 (2022).
37 Russia’s War on Ukraine, INT’L ENERGY AGENCY, https://www.iea.org/topics/russias-war-on-ukraine (last visited Nov. 11, 2023).
39 For a discussion of misinformation about the physical science of climate change, see generally, NAOMI ORESKES & ERIK M. CONWAY, MERCHANTS OF DOUBT: HOW A HANDFUL OF SCIENTISTS OBSCURED THE TRUTH ON ISSUES FROM TOBACCO SMOKE TO GLOBAL WARMING (2010).
40 See Pielke, Jr. & Ritchie, supra note 12, at 74, 75.
41 For example, in 2022 when it seemed as though Senator Joe Manchin might not support President Biden’s climate change bill, John Podesta said “It seems odd that Manchin would choose as his legacy to be the one man who single-handedly doomed humanity.” Coral Davenport & Lisa Friedman, How One Senator Doomed the Democrats’ Climate Plan, N.Y. TIMES (July 15, 2022), https://www.nytimes.com/2022/07/15/climate/manchin-climate-change-democrats.html.
and apocalyptic terms is disempowering and harmful to youth mental health, and risks empowering dangerous demagogues, as discussed in Section V below. Moreover, as the next section describes, the weight of evidence in climate economics suggests a likely future in which climate change damages economies, but economies nonetheless continue to grow, and poor and rich countries continue to converge income, along with associated adaptation and broadly-felt well-being improvements.

II. ECONOMIC GROWTH AND INCOME CONVERGENCE WILL PROBABLY CONTINUE, BUT SLOWER THAN EXPECTED

In the context of understanding the trajectory and impacts of future climate change, economic growth is a very important parameter. GDP is positively correlated with energy demand, which is related to greenhouse gas emissions.\(^43\) GDP per capita is positively correlated with technology and public spending, both of which relate to prospects for renewable energy technology and deployment.\(^44\) GDP per capita is also positively correlated with healthcare system and infrastructure quality, and consequently GDP per capita is a key determinant of societies’ abilities to adapt to climate change.\(^45\) Several measures of environmental impact (e.g., air pollution,\(^46\) agricultural land use,\(^47\) and greenhouse gas emissions\(^48\)) seem to have a hump-shaped relationship to GDP per capita, with these impacts declining once a country reaches a certain level of affluence.\(^49\)


\(^{49}\) This phenomenon is called the “environmental Kuznets curve.” *See* David I. Stern, *The Environmental Kuznets Curve After 25 Years*, 19 J. BIOECONOMICS 7, 7–8, 24 (2017).
Predicting long-run economic growth is difficult and subject to both known and unknown uncertainties. Efforts to understand the range of possible twenty-first century economic pathways have predominantly used three types of approaches: model-driven scenarios, statistical forecasts with varying degrees of structural assumptions or naivety, and surveys of leading macroeconomists. These approaches have produced ranges of economic projections spanning roughly an order of magnitude in 2100 real (i.e., inflation-adjusted) GDP per capita. To put this uncertainty in perspective, consider that world GDP per capita has increased by roughly a factor of ten over the past two hundred years, and imagine not knowing whether the world would be as rich as it is today or as poor as it was in 1820, looking only seventy-seven years into the future (i.e., in 2100). This is equivalent to the magnitude of uncertainty that current approaches produce.

The range of twenty-first century economic outlooks in scenarios, forecasts, and expert projections is wider for today’s developing countries than it is for today’s developed countries, as income convergence is a key source of uncertainty. Today’s developing countries could experience unprecedented growth rates, aided by technology transfer from richer countries, in addition to technological improvement. Alternatively, economic headwinds such as conflict, poor governance, or climate change could continue to slow or prevent their development. For example, in the high-growth, high-convergence SSP scenario—SSP5—the Middle East and Africa reach a GDP per capita of ~125,000 2005 USD (expressed in purchasing-power-parity, or PPP, terms) in 2100, which is nearly eighty percent of the Organization for Economic Cooperation and Development (OECD)’s 2100 GDP per capita (~160,000 2005 USD). In the low-convergence “Inequality” scenario—SSP4—the Middle East and Africa reach a GDP per capita of only ~15,000 2005 USD in 2100, compared to ~110,000 2005 USD for the OECD.

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53 See Peter Christensen et al., *Uncertainty in Forecasts of Long-Run Economic Growth*, 115 PNAS 5409, 5410 (2018).
56 Byers et al., *supra* note 7.
57 *Id.*
The prospect of climate change damaging the economy adds another layer of uncertainty. The SSP scenarios do not account for damages from climate change, because this would create potential for impact studies to project damages using SSP emission scenarios that contradict the SSP scenarios’ assumptions. Statistical economic forecasts may implicitly incorporate information about past damages from climate change contained in the data the models are fit to, but this might not account for the possibility of damages accelerating or otherwise changing substantially as warming progresses. Past economic damages from climate change are also very difficult to estimate statistically. One can estimate damages for specific sectors of the economy and add them up, which usually requires making tenuous assumptions about sectors lacking information. Alternatively, one can attempt to estimate damages for the economy as a whole. The challenge here is that there is a tradeoff between controlling for omitted or unobserved variables—which favors comparing year-to-year differences in growth or affluence as they covary with temperature—and accounting for the possibility of adaptation reducing damages over long time scales. An additional challenge in estimating damages from climate change is that there is a strong correlation between temperature and affluence (i.e., richer countries exist in colder climates, on average), which means that there is little information in historical data about how countries that are rich by today’s standards (as a larger fraction of the world may be in the future) might be able to adapt to high temperatures. As a result of these uncertainties, estimates of economic damage from climate change suggest future outlooks in which 3°C of warming results in anywhere from trivial economic damage to damage on the order of twenty percent of global GDP, compared to a counterfactual without climate change. Regional damage projections are typically higher in tropical regions, with some as high as fifty percent or more with 3°C of warming (and seventy-five percent under SSP5-8.5).

The history of progress in climate adaptation is also relevant to setting the scene for future economic outlooks. Economic loss rates (i.e., damages, as a percentage of GDP) from floods, droughts, heat, cold, and wind (including cyclones and tornadoes) have all declined over the past three years. Climate damages are not included in SSP projections. See Dellink et al., supra note 51, at 201. Most damage models assume that damages as a percentage of GDP increase faster than linearly as temperature increases. See, e.g., Delavane Diaz & Frances Moore, Quantifying the Economic Risks of Climate Change, 7 NATURE CLIMATE CHANGE 774, 777 figs.2b, 2c, & 2d (2017). For description and critique of this practice, see Steve Keen, The Appallingly Bad Neoclassical Economics of Climate Change, 18 GLOBALIZATIONS 1149, 1150 (2021). This challenge is noted by Marshall Burke et al., Global Non-Linear Effect of Temperature on Economic Production, 527 NATURE 235, 235 (2015). Matthew E. Kahn et al., Long-Term Macroeconomic Effects of Climate Change: A Cross-Country Analysis, ENERGY ECON., no. 105624, 2021, at 1, 4 figs.2 & 3. Burke et al., supra note 61, at 238 fig.4b.
decades, with low- and lower-middle-income regions experiencing greater declines than high- and upper-middle-income regions; the global average loss rate declined by a factor of five over this period.\footnote{Giuseppe Formetta & Luc Feyen, \textit{Empirical Evidence of Declining Global Vulnerability to Climate-Related Hazards}, 57 GLOB. ENV’T CHANGE, no. 101920, 2019, at 1, 5–6.} Global deaths from these natural disasters have averaged ~12,000 per year over the 2020–2022 period, compared to ~500,000 in the 1920s (when the population was much smaller).\footnote{Hannah Ritchie et al., \textit{Natural Disasters}, OUR WORLD DATA, https://ourworldindata.org/natural-disasters (last visited Sept. 22, 2023).} For comparison, ~26,000 people were killed by homicide in the United States alone in 2022,\footnote{Nat’l Ctr. for Health Stat., \textit{Assault or Homicide}, CTR. FOR DISEASE CONTROL & PREVENTION, https://www.cdc.gov/nchs/fastats/homicide.htm (last visited Sept. 22, 2023).} and ~450,000 were killed globally.\footnote{Bastian Herre et al., \textit{Homicides}, OUR WORLD DATA, https://ourworldindata.org/homicides (last visited Sept. 22, 2023).} COVID-19 has killed at least 6.9 million people since 2020, globally.\footnote{WHO Coronavirus (COVID-19) Dashboard, WORLD HEALTH ORG., https://covid19.who.int/ (last visited May 30, 2023).}

Against this backdrop, there is a case to be made that the most plausible twenty-first century economic outlooks feature continued increases in affluence in all but the very poorest regions today (e.g., in countries the United Nations classifies as “Least Developed,” which have experienced very little growth over the past several decades, often due to civil conflict, state failure, and other major disruptions),\footnote{See COLLIER, \textit{supra} note 55, at 11, 17, 38, 64.} despite climate change impacts; but also rates of growth and income convergence on the slow end of the range of scenarios, forecasts, and expert opinion.

As described above, there has been a historical pattern over the past several decades of natural disaster damage rates declining. There has also been a historical pattern of governments and major agencies such as the International Monetary Fund (IMF) making positively biased economic forecasts, especially in poor regions.\footnote{See Jeffrey Frankel, \textit{Over-Optimism in Forecasts by Official Budget Agencies and Its Implications}, 27 OXFORD REV. ECON. POL’Y 536, 538 (2011); Matthew G. Burgess et al., Optimistically Biased Economic Growth Forecasts and Negatively Skewed Annual Variation 1 (Jan. 6, 2021) (unpublished manuscript) (on file at SocArXiv Papers), https://osf.io/preprints/socarxiv/vndqr; see also Burgess et al., \textit{supra} note 13, at 4.} There are several reasons for this bias, including governments having political incentives to over-project their growth,\footnote{Frankel, \textit{supra} note 70, at 540.} development agencies over-projecting the benefits of their programs,\footnote{CARLOS DE RESENDE, INDEP. EVALUATION OFF. INT’L MONETARY FUND, AN ASSESSMENT OF IMF MEDIUM-TERM FORECASTS OF GDP GROWTH 43 (2014).} negatively skewed distributions of growth rates (i.e. recessions being larger in magnitude than booms),\footnote{Burgess et al., \textit{supra} note 70, at 8.} and likely, difficulty in anticipating
major negative events with long-lasting effects that disproportionately affect developing countries. For example, who could have predicted in 2013 that Venezuela would go on to lose seventy percent of its GDP per capita by 2020?74

As Figure 2a below shows, there has been, for decades, a regular pattern of GDP per capita growth rates rising, then declining, as GDP per capita increases.75 This pattern implies convergence between middle-income and high-income countries (because middle-income countries grow faster), while some of the poorest countries fail to converge, and in some cases, fail to grow.76 The fastest GDP per capita growth rates sustained over multi-year periods in large world regions in history have occurred in today’s developed countries in the mid-twentieth century and in today’s middle-income countries (especially China) in the early 2000s.77 These periods witnessed unprecedented advances across most sectors of the economy simultaneously.78 If economic growth in the twenty-first century continues to follow the hump-shaped pattern shown in Figure 2a, this would result in an outlook similar to SSP4 (“Inequality”), characterized by slow growth and high inequality compared to other scenarios and forecasts79, as shown in Figure 2b. Burgess et al.80 showed that such an approach to economic forecasting would have historically outperformed IMF forecast accuracy at the level of income groups (i.e., aggregations of countries by income),81 and would nonetheless have been positively biased for the low-income group. This suggests that slow-growth, slow-convergence scenarios, such as SSP4, might actually have faster convergence (and therefore, faster growth on the aggregate) than a most-plausible economic outlook. In other words, while SSP4 is currently considered somewhat of a worst-case scenario for

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77 Roser et al., supra note 54.
79 Burgess et al., supra note 75, at 4 fig.3.
80 Id.
economic growth and income convergence, history suggests it could actually be somewhat of a best-case scenario.\textsuperscript{82}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure2.png}
\caption{(a) The gross domestic product (GDP) per capita compared to the GDP per capita growth rates, shown for World Bank income groups (i.e., low-income, lower-middle income, upper-middle income, high income);\textsuperscript{83} Observed from 1960–2020 (black), and projected in high-growth (SSP5, dark red) and low-growth (SSP3, light red) scenarios. Fits to the historical data that specify Burgess et al.’s differential-equation-model (DEM)\textsuperscript{84} are also shown (purple). (b) The world GDP per capita, projected to 2100 by the SSP scenarios and DEMs. The SSP scenarios are simulated using the International Futures integrated assessment model.\textsuperscript{85} This figure is adapted from figure 3a and 3b in Burgess et al.\textsuperscript{86}}
\end{figure}

It is theoretically possible that positive surprises, such as major breakthroughs in artificial intelligence or nuclear fusion, could increase twenty-first century growth beyond these historical trends.\textsuperscript{87} However, for such breakthroughs to result in high-growth economic trajectories such as SSP5, regions would need to achieve GDP per capita growth rates, compared to their GDP per capita, roughly double the rates seen historically.\textsuperscript{88} Moreover, due to the compounding nature of growth, these unprecedented growth rates would need to be realized almost immediately to reach SSP5

\textsuperscript{82} Burgess et al., \textit{supra} note 75, at 1, 3, 6.
\textsuperscript{83} World Bank Country and Lending Groups, \textit{supra} note 81.
\textsuperscript{84} Burgess et al., \textit{supra} note 75, at 2 fig.1.
\textsuperscript{86} Burgess et al., \textit{supra} note 75 at 4 figs.3a & 3b.
\textsuperscript{87} For a discussion of the types of breakthroughs that are possible, see generally, e.g., ERIK BRYNJOLFSSON & ANDREW MCAFEE, THE SECOND MACHINE AGE: WORK, PROGRESS, AND PROSPERITY IN A TIME OF BRILLIANT TECHNOLOGIES (2014). For a discussion of how these breakthroughs might make future growth higher than past trends, see Erik Brynjolfsson et al., \textit{The Productivity J-curve: How Intangibles Complement General Purpose Technologies}, 13 AM. ECON. J. 333, 334, 342, 351–57, 359 figs.5–16 (2021).
\textsuperscript{88} \textit{Supra} Figure 2a; Burgess et al., \textit{supra} note 75, at 2.
GDP per capita values by 2100.\textsuperscript{89} This seems relatively unlikely, and one also cannot ignore the possibility of unexpected calamities such as state failures, civil wars, or future pandemics depressing growth and income convergence.

Even with a relatively slow-growth, slow-convergence economic scenario as a baseline, damage from climate change would need to be substantially worse than even the highest estimates to reverse the trend of increasing affluence in most regions of the world. For example, the world GDP per capita nearly triples by 2100 in SSP3—the slowest-growth SSP scenario.\textsuperscript{90} A thirty percent damage to the GDP per capita from this baseline (a high-end damage estimate; see above) would not be nearly enough to erase all of these economic gains. The same logic can be applied regionally to suggest that climate change unlikely reverses economic progress, in all but the poorest regions. The prospect of continued progress in adaptation strengthens this conclusion. However, it is nonetheless theoretically possible for large negative surprises, such as fast and major tipping points in the climate system, or climate change combined with globally significant economic disruptions such as another global pandemic or major conflict, to allow economic progress to reverse on a large scale.\textsuperscript{91}

The twenty-first century economic outlook argued above to be most plausible has several implications for policymakers. On the positive side, the prospect of continued economic progress—in terms of both growth and convergence—should, again, motivate caution against framing climate change as either a civilization-threatening calamity or a non-issue. On the negative side, an economic outlook with slower growth and income convergence than expected carries important policy challenges. Less growth implies less government revenue and private wealth available to deploy towards financing decarbonization or adaptation, as well as social safety nets, retirements, and education.\textsuperscript{92} Slower-than-expected economic growth can fuel polarization and radicalism, as the economy seems more zero sum and gaps between expectations and reality can fuel unrest.\textsuperscript{93} If structural, long-running economic growth slowdowns are mistaken by policymakers for busts in a business cycle, corrective expansionary policies could contribute to asset bubbles or inflation.\textsuperscript{94} There are some scholars who argue that continued

\begin{itemize}
\item \textsuperscript{89} Burgess et al., supra note 75, at 2, 4.
\item \textsuperscript{90} Riahi & Krey, supra note 7.
\item \textsuperscript{92} Matthew G. Burgess et al., \textit{Prepare Developed Democracies for Long-Run Economic Slowdowns}, 5 NATURE HUM. BEHAV. 1608, 1611, 1613 (2021).
\item \textsuperscript{93} James C. Davies, \textit{Toward a Theory of Revolution}, 27 AM. SOCIO. REV. 5, 17 (1962); Burgess et al., supra note 92, at 1608, 1609, 1615 (2021).
\item \textsuperscript{94} E.g., Tim Jackson, \textit{The Post-Growth Challenge: Secular Stagnation, Inequality and the Limits to Growth}, 156 ECOLOGICAL ECON. 236, 241, 244 (2019).
\end{itemize}
economic growth cannot be environmentally sustainable in the long run.\textsuperscript{95} Though this is currently a fringe position politically, it is not mutually exclusive to the notion that slowing or halting economic growth would be challenging to the well-being and sociopolitical fabric of society.\textsuperscript{96} Policymakers should therefore take the possibility of eventual long-run stagnation seriously and prepare for it, even if continuing or increasing economic growth remains a policy goal.\textsuperscript{97}

Improving outcomes for the poorest countries—who may have a less secure outlook for economic progress—also deserves renewed attention. It is quite plausible that climate change will exacerbate the stark humanitarian challenges these countries face. For example, some experts attribute climate change as an important cause of the ongoing famine in Madagascar.\textsuperscript{98} Other studies suggest that climate change is increasing the risk of civil conflict.\textsuperscript{99} The urgency of these challenges should not get lost within the larger picture of continued economic progress and broad improvements in well-being.

\textbf{III. MAJOR INVESTMENTS ARE NEEDED IN MITIGATION, ADAPTATION, AND CARBON REMOVAL}

Mitigation, adaptation, and carbon removal are three key aspects of addressing climate change. Mitigation refers to activities that reduce global greenhouse gas emissions, and therefore decrease future warming.\textsuperscript{100} Adaptation refers to activities that help society cope with the effects of climate change without necessarily reducing emissions.\textsuperscript{101} Carbon removal describes activities that remove carbon from the atmosphere and store it in a place where it is unlikely to be released again, at least on time scales

\textsuperscript{95} See generally, e.g., GIORGIOS KALLIS ET AL., THE CASE FOR DEGROWTH 1 (2020); TIM JACKSON, PROSPERITY WITHOUT GROWTH: FOUNDATIONS FOR THE ECONOMY OF TOMORROW (2d ed. 2017); VACLAV SMIL, GROWTH: FROM MICROORGANISMS TO MEGACITIES (2019).
\textsuperscript{97} Burgess et al., supra note 92, at 1609.
\textsuperscript{99} Solomon M. Hsiang et al., Quantifying the Influence of Climate on Human Conflict, 341 SCIENCE 1212, 1212 (2013).
\textsuperscript{101} INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, supra note 3, at vii.
comparable to the residence time of carbon dioxide (CO₂) in the atmosphere, which varies from decades to thousands of years.\textsuperscript{102}

The importance of mitigation to addressing climate change is self-evident: the climate will continue to warm until greenhouse gas emissions reach net zero.\textsuperscript{103} The importance of adaptation should be self-evident too. Given that the world will not achieve net-zero emissions for several decades at least, it is inevitable that society will experience additional warming and its impacts in the coming decades. Therefore, societies should prepare for rising sea levels, warmer temperatures, and, regionally, varying increases in some types of natural disasters.\textsuperscript{104}

Carbon removal is important to a comprehensive climate strategy for two reasons. First, even if greenhouse gas emissions could be eliminated in the long run, society may want to use carbon removal to restore the pre-industrial temperature regime, which requires removing the emissions that will have accumulated by that point in time. Second, there are some types of emissions—accounting for nearly one-third of energy emissions—that will be difficult to eliminate without major technological improvements.\textsuperscript{105} These include long-distance transport, aviation, and shipping, which require highly energy-dense fuels; and steel and cement, which are produced in high-heat reactions that also generate CO₂ as a byproduct. They also include electricity demands that do not vary in sync with the availability of sunlight and wind, and thus require large amounts of storage capacity or a reliable backstop technology, such as nuclear energy to replace fossil fuels.\textsuperscript{106}

Though the past two decades have seen international progress on mitigation, adaptation, and carbon removal, each faces substantial funding and capacity gaps compared to what is needed to reach international climate targets and development goals.\textsuperscript{107} Figure 3 shows the renewable primary energy\textsuperscript{108} and carbon capture and storage (CCS)\textsuperscript{109} needs, projected by the SSP scenarios consistent with the 1.5°C (SSP1-1.9) and 2°C (SSP1-2.6) targets, as well as current policies (SSP2-4.5) and the pathway society is
currently on (SSP-3.4). In all scenarios, renewable energy increases by more than an order of magnitude, and CCS increases by more than two orders of magnitude. Adaptation gaps are less amenable to a simple graphical measure, but the IPCC estimates that they are substantial. Spending the IPCC tracks on adaptation and resilience amounts to less than ten USD per person per year in almost every world region, which is less than 0.1% of the global GDP. The IPCC notes that the vast majority of tracked climate finance goes to mitigation, rather than adaptation, and neither receives sufficient financing to achieve international climate and development objectives.

Mitigation funding gaps are a predictable consequence of the basic market failure of climate change. Economic activities that emit greenhouse gases primarily benefit the producers and consumers of the activities, while the costs of the emissions via climate change affect everyone in the world. This creates an incentive for producers and consumers to emit more greenhouse gases—and conversely, to mitigate less—than is economically or societally optimal. Carbon removal faces a similar incentive challenge. The costs are borne by the producer or buyer and the benefits are shared by everyone.

In both of these cases, the market failure requires some type of coordination or government intervention to overcome. This could come in the form of taxes (e.g., on carbon) or subsidies (e.g., on carbon removal and

\[ \text{Figure 3. Projected (a) renewable primary energy and (b) carbon capture and storage in Shared Socioeconomic Pathway (SSP) scenarios consistent with meeting the targets of limiting warming to 1.5°C (SSP-1.9) and 2°C (SSP-2.6) above pre-industrial temperatures, the current pathway continuing progress from stated policies (SSP-2.4) and current policies (SSP-2.5).} \]

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110 INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, supra note 3, at 2591.
111 INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, supra note 107, at 9, 11.
112 See supra Figure 1; Pielke, Jr. et al., supra note 21, at 1, 4, 6.
113 For review, see Burgess et al., supra note 2, at 1167, 1170.
114 This is a core idea of climate economics. See, e.g., RICHARD S.J. TOL, CLIMATE ECONOMICS: ECONOMIC ANALYSIS OF CLIMATE, CLIMATE CHANGE AND CLIMATE POLICY (3d ed., 2023).
115 Id.
carbon-free energy), other market-based incentives (e.g., cap and trade), standards, or regulations.\textsuperscript{116} Many such policies already exist in the United States, such as federal subsidies for renewable energy and carbon capture,\textsuperscript{117} state-level renewable electricity standards,\textsuperscript{118} and California’s cap-and-trade program,\textsuperscript{119} to name a few. Private firms or citizens can also cooperate on such objectives outside of government, as in the case of large investment firms coordinating on environmental, social, and governance (ESG) investing initiatives.\textsuperscript{120} The private sector is sometimes able to mobilize faster and more efficiently than government action. For example, in 2009, the Obama Administration attempted to pass the American Clean Energy and Security Act\textsuperscript{121} that would have used a cap-and-trade program to incentivize a seventeen percent reduction in greenhouse gas emissions by 2020 to below 2005 levels. The bill did not pass, but technological progress in renewable energy and natural gas (replacing coal) allowed the country to meet the proposed target anyway.\textsuperscript{122} On the other hand, coordination by large firms on initiatives that are seen as political, including ESG, has been controversial\textsuperscript{123} and raises legal questions related to antitrust.\textsuperscript{124}

Relatedly, there are now many mitigation activities whose financial benefits outweigh their costs, even without considering climate impacts.\textsuperscript{125} The IPCC estimates that these mitigation activities alone could reduce greenhouse gas emissions by approximately ten gigatonnes of CO$_2$ by 2030,\textsuperscript{126} which is roughly one-fifth of global emissions.\textsuperscript{127} Even though

\begin{footnotes}
\textsuperscript{116} Id.

\textsuperscript{117} Subsidies for both were significantly expanded under the Inflation Reduction Act. Inflation Reduction Act of 2022, 26 U.S.C. §§ 45, 45Q (2023).


\textsuperscript{120} For a recent review, see Stuart L. Gillian et al., Firms and Social Responsibility: A Review of ESG and CSR Research in Corporate Finance. 66 J. CORP. FIN., no. 101889, 2021, at 1.

\textsuperscript{121} Also known as the Waxman-Markey Bill, American Clean Energy and Security Act of 2009, H.R. 2454, 111th Cong. (2009).


\textsuperscript{123} VIVEK RAMASWAMY, WOKE, INC.: INSIDE CORPORATE AMERICA’S SOCIAL JUSTICE SCAM (2021).

\textsuperscript{124} Damian G. Didden et al., Antitrust and ESG, HARV. L. SCH. F. ON CORP. GOVERNANCE (Jan. 31, 2023), https://corpgov.law.harvard.edu/2023/01/31/antitrust-and-esg/.

\textsuperscript{125} See INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, supra note 107, at 27 fig.SPM.7.

\textsuperscript{126} Id.

\end{footnotes}
private incentives for many of these mitigation activities theoretically exist, governments could usefully support some that either face challenges from start-up costs (e.g., utility-scale solar and wind, or nuclear)\textsuperscript{128} or provide public goods (e.g., public transport).

The incentive challenges for adaptation financing should, in theory, be smaller. Unlike mitigation, the benefits of adaptation are local and immediate, which should make incentives more aligned, at least for local governments. This raises the question: why are adaptation funding gaps larger than mitigation gaps, if the incentive problems are smaller? There are several possible reasons, each of which policymakers would have options to address. First, adaptation projects involving infrastructure might be challenged by their high up-front costs. Here, coordination across regions or levels of government can be helpful, as adaptation occurs and often needs to be managed locally, but higher levels of government can gather greater resources and coordinate across regions.\textsuperscript{129} For example, one of the aims of the Infrastructure Investment and Jobs Act of 2022 is to provide funding for climate-resilient infrastructure, in addition to low-carbon infrastructure.\textsuperscript{130} Internationally, costs may present an especially challenging barrier for developing countries,\textsuperscript{131} which suggests a need for coordinated global financing for adaptation projects. Recognizing this, the parties to COP27 in 2023 established a “loss and damage” fund of four to six trillion USD per year.\textsuperscript{132} Politically, there can be a stigma around adaptation among climate activists—if it is seen as in tension with mitigation—though the IPCC rightly recognizes it as a false choice.\textsuperscript{133} For conservatives, the issue of climate change still carries taboos in some contexts.\textsuperscript{134} For these reasons and others, climate adaptation initiatives are sometimes not described as such by their enactors.\textsuperscript{135} This may make adaptation initiatives difficult to track, and thus estimates of funding gaps may be inflated.


\textsuperscript{130} 23 U.S.C. § 175 (2023).

\textsuperscript{131} INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, supra note 107.


\textsuperscript{133} The need for minimizing tradeoffs between mitigation and adaptation is emphasized, for example, in INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, supra note 107, at 25.


\textsuperscript{135} Id.
In summary, there are vast and pressing needs for investments in climate mitigation, climate adaptation, and carbon removal. These categories of investment are not mutually exclusive to each other, and each will play an important role in national and global efforts to address climate change.

IV. THE UNITED STATES NEEDS A BIPARTISAN APPROACH

Addressing climate change requires coordinated efforts, across all levels of government and sectors of the economy, sustained over several decades and beyond. In the United States (and other democracies), there is simply no realistic path to achieving such an effort without cooperation across both major parties. In other words, this Article argues that there are three options for addressing climate change in the United States: (i) take a bipartisan approach, (ii) fail to meet the scale of the challenge, or (iii) wreck democracy, and hope that the dictator is a climate hawk. Only the first option seems desirable. If the last option sounds facetious, consider that climate activists and even politicians have occasionally wondered publicly whether addressing climate change requires weakening or replacing democracy.136 In contrast, the historical record suggests that authoritarian regimes are less environmentally conscious than democracies, including when it comes to CO₂ emissions, on average.137 Democracy, of course, provides many other benefits to citizens’ rights, public good,138 and socioeconomic well-being.139

Bipartisan cooperation on climate change in the United States faces challenges. Though climate change was not polarizing among the public in the late 1980s, it has since become one of the most polarizing issues in the country.140 Special-interest groups, conservative think tanks, and Republican politicians have, over the past three decades, often distributed misinformation in the public sphere denying the basic physical science of climate change—

136 See discussion of this general phenomenon in: Nico Stehr, Exceptional Circumstances: Does Climate Change Trump Democracy?, ISSUES SCI. & TECH., Winter 2016, at 1; Cameron Abadi, What if Democracy and Climate Mitigation Are Incompatible?, FOREIGN POL’Y (Jan. 7, 2022, 12:05 AM), https://foreignpolicy.com/2022/01/07/climate-change-democracy/. In 2013, then-Liberal Party of Canada leader, now Prime Minister, Justin Trudeau, made headlines for saying that he admired China’s dictatorship’s ability to “turn their economy around on a dime” in reference to renewable energy. A clip of these remarks can be found in Canuck Politics, Justin Trudeau’s China Dictatorship Gaffe, YOUTUBE (Nov. 10, 2013), https://www.youtube.com/watch?v=T8FuHuUhNZ0.

137 For a recent review, see Johnathan Pickering et al., Democratising Sustainability Transformations: Assessing the Transformative Potential of Democratic Practices in Environmental Governance, 11 EARTH SYS. GOVERNANCE, no. 100131, 2022, at 1, 5, 7.


139 Marta Orviska et al., The Impact of Democracy on Well-Being, 115 SOC. INDICATORS RSCH. 493, 495–97, 505 (2014).

sometimes knowingly and dishonestly.\footnote{ORESKES \& CONWAY, supra note 40, at 6–7, 125–26; see also \textit{CHRIS MOONEY, THE REPUBLICAN WAR ON SCIENCE} (2007).} However, over the past decade or so, progressive rhetoric on climate change has escalated in its alarm to the point at which misinformation—in the form of alarmist rhetoric that distorts or contradicts scientific evidence—has also become increasingly common.\footnote{YGLESIAS, \textit{supra} note 39; see Pielke, Jr. \& Ritchie, \textit{supra} note 12, at 75.}

Despite these challenges, there are some emerging opportunities for the major parties to collaborate on climate change. Opinion polls show broad bipartisan belief in climate change (i.e., that it is real, and human-caused), and support for several approaches to addressing it. For instance, sixty-one percent of Americans think that Congress should be doing more to address global warming.\footnote{\textsc{Jennifer Marlon et al.}, \textit{Yale Climate Opinion Maps 2021}, \textit{YALE PROGRAM ON CLIMATE CHANGE COMM’N} (Feb. 23, 2022), https://climatecommunication.yale.edu/visualizations-data/ycom-us/.} This includes majorities in every state except Wyoming, North Dakota, and West Virginia, and it even includes majorities in many deep-red districts, such as Colorado’s District Three (fifty-seven percent, represented in Congress by Representative Lauren Boebert) and Georgia’s District Fourteen (fifty-one percent, represented in Congress by Representative Marjorie Taylor Greene).\footnote{\textit{Id}.} Sixty-nine percent of Americans, including nearly half of Republicans, favor the United States taking steps to be carbon neutral by 2050.\footnote{\textit{ALEC TYSON ET AL., PEW RSCH. CTR., AMERICANS LARGELY FAVOR U.S. TAKING STEPS TO BECOME CARBON NEUTRAL BY 2050}, at 4, 10 (2022), https://www.pewresearch.org/science/2022/03/01/americans-largely-favor-u-s-taking-steps-to-become-carbon-neutral-by-2050/.} More specific policies with broad support include renewable portfolio standards that set binding renewable electricity targets (eighty-three percent), fuel efficiency standards for cars (seventy-one percent), increasing renewable energy production (seventy to eighty percent for wind and solar), carbon taxes on corporations (seventy-three percent), and tax credits for carbon capture and storage (eighty-four percent), among others.\footnote{Matthew G. Burgess \& Renae Marshall, \textit{What if a Presidential Candidate Ran on What Most Americans Actually Wanted?}, \textit{ARC DIGITAL} (July 25, 2020), https://medium.com/arc-digital/what-if-a-presidential-candidate-ran-on-what-most-americans-actually-wanted-bd570321b428.}

This support has translated into a growing number of bipartisan legislative actions on the issue. For example, roughly one-third of state-level decarbonization bills passed between 2015 and 2020 had bipartisan sponsors, and nearly one-third were passed by Republican-controlled governments (i.e., in which Republicans controlled at least two of: the upper house, the lower house, and the Governor).\footnote{Renae Marshall \& Matthew G. Burgess, \textit{Advancing Bipartisan Decarbonization Policies: Lessons from State-Level Successes and Failures}, 171 \textit{CLIMATIC CHANGE}, no. 17, 2022, at 1, 1, 4, 12.} At the federal level, Congress has passed,
since 2020, the Further Consolidated Appropriations Act (signed by President Trump),\textsuperscript{148} the Infrastructure Investment and Jobs Act,\textsuperscript{149} and the CHIPS and Science Act,\textsuperscript{150} each of which contained tens-to-hundreds of billions of dollars in investments related to climate mitigation and adaptation. Although climate policy debates remain highly polarized,\textsuperscript{151} the prevalence of messages denying the basic physical science has declined in the media,\textsuperscript{152} and Republican politicians are increasingly public about their desires to address the issue. For instance, Representative John Curtis founded the Conservative Climate Caucus in the House of Representatives in June 2021, and it now has seventy-eight members—over one-third of the Republican caucus.\textsuperscript{153}

The economic benefits of renewable energy and its subsidies have disproportionately flowed to rural and conservative parts of the country, creating an economic constituency for climate mitigation that influences policy makers.\textsuperscript{154} Similarly, many Republican-leaning regions face acute threats from climate change, such as sea-level rise and flash-flood risk in coastal and southeastern states, and drought and wildfires in the mountain west.\textsuperscript{155}

An analysis of state-level decarbonization bills\textsuperscript{156} found that bipartisan bills disproportionately expanded consumer and business choice (e.g., offering new incentives for renewable energy) rather than restricting it (e.g., banning activities or setting binding standards), and framed elements aimed at reducing inequality in economic terms rather than in terms of race or using academic social-justice terminology (e.g., “equity,” “environmental justice,” “communities/populations of color”). An experimental study by another


\textsuperscript{151} Sedona Chinn et al., \textit{Politicization and Polarization in Climate Change News Content, 1985-2017}, 42 SCI. COMM’N 112, 122 fig.3 (2020).

\textsuperscript{152} Lucy McAllister et al., \textit{Balance as Bias, Resolute on the Retreat? Updates & Analyses of Newspaper Coverage in the United States, United Kingdom, New Zealand, Australia and Canada over the Past 15 Years}, 16 ENV’T RSCH. LETTERS, no. 94008, 2021, at 1, 9, 11–12.


\textsuperscript{155} See Flavelle, \textit{supra} note 135; see also U.S. GLOB. CHANGE RSCH. PROGRAM, supra note 11, at 31.

\textsuperscript{156} Marshall & Burgess, \textit{supra} note 147, at 1.
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Group similarly found that framing policies—including climate policies—in class terms generated more support than framing the same policies in racial terms. These results may be explained by the fact that the median U.S. voter leans left economically and right socially, most Americans oppose programs that discriminate by race, even when they are intended to address inequities, and libertarian aspects of conservatism in the United States can limit the bipartisan appeal of restrictive policies.

Another fact about the American electorate, which may be important to the success of future bipartisan cooperation, is that most Americans are proud to be American. For instance, a 2022 Gallup poll found that sixty-five percent of U.S. adults were “extremely proud” (thirty-eight percent) or “very proud” (twenty-seven percent). This may be important for two reasons. First, there is evidence from economics and political science research suggesting that investment in a shared national or civic identity is a key prerequisite to the political feasibility of public goods programs. This makes intuitive sense: Why invest in large nation-building projects if one does not believe in the nation and its identity? Second, pride in being American is negatively correlated with concern about climate change—with Democrats and progressives polling lower in the national pride and higher in climate concern. Thus, patriotism may be a key aspect of a big-tent approach to climate change, and this may be a blind spot among current climate activists, who are predominantly progressive.

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162 This is the topic of a large literature. Two of the canonical references are ALBERTO ALESINA & EDWARD L. GLAESER, FIGHTING POVERTY IN THE US AND EUROPE: A WORLD OF DIFFERENCE (2004); and ROBERT D. PUTNAM, THE UPSWING: HOW AMERICA CAME TOGETHER A CENTURY AGO AND HOW WE CAN DO IT AGAIN (2020).
163 Brenan, supra note 161; Lydia Saad, Are Americans Concerned About Global Warming?, GALLUP (Oct. 5, 2021), https://news.gallup.com/poll/355427/americans-concerned-global-warming.aspx. See infra Figure 4b.
Together, the bipartisan successes and aspects of the U.S. electorate described above provide insight into what a big-tent approach to climate change might look like in the future. First, it might use carrots (e.g., tax credits or subsidies) instead of sticks (e.g., taxes and restrictions) to provide incentives. Second, it might emphasize a shared and inclusive American identity, and draw rhetorical power from optimism about the country and what it can accomplish together. Third, and relatedly, it might focus on remediating elements of environmental inequality using material and geographic frames (even those highly correlated with race, as many major environmental inequalities are), rather than emphasizing race directly or using frames laced with academic social-justice terminology. Fourth, it might jointly emphasize mitigation, adaptation, and carbon removal. Fifth, it might take advantage of the fact that many mitigation and adaptation activities already have favorable economics, meaning that they can be sold from a growth and prosperity perspective. Lastly, a bipartisan approach to climate change might merge the Democrats’ desire to make rapid progress with Republicans’ preference for streamlining regulations on businesses to find common ground on permitting reform. Federal permitting for solar, wind, and transmission projects regularly takes six to eight years or more,

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165 Saad, *supra* note 163.

166 Brenan, *supra* note 161.


169 We analyze the permitting times in Matthew G. Burgess et al., *Supply, Demand, and Polarization Challenges Facing U.S. Climate Policies*, 14 NATURE CLIMATE CHANGE 134, 136 fig.2
incredibly, the productivity of the U.S. construction sector has decreased since the 1950s.\textsuperscript{170} Indeed, permitting reform has been a common talking point from both parties in Congress, as well as from President Biden.\textsuperscript{171}

Cooperating on climate change offers political upsides to both major parties.\textsuperscript{172} For the Democrats, it allows them to show the public that they take their “climate crisis/emergency” rhetoric seriously. If climate change is really an emergency, then logic would dictate a willingness to collaborate with anyone on addressing it. For Republicans, perceived inaction on climate change is politically costly, especially among younger voters,\textsuperscript{173} whose share of the electorate will grow as they age.

Evidence from social psychology suggests that groups in conflict with each other can reduce their level of conflict and animosity by collaborating towards a shared objective.\textsuperscript{174} This may imply that, if Democrats and Republicans can find a way to work productively together on climate change, then it might help to reduce political polarization more broadly.

V. \textbf{CATASTROPHISM AND UTOPIANISM POSE UNDERAPPRECIATED RISKS}

Failing to address climate change poses substantial security and humanitarian risks, such as increasing exposure of populations to extreme temperatures and weather, disruptions to food systems, increased risks of civil conflict, state failure, and mass migration.\textsuperscript{175} However, knee-jerk, reactionary approaches to addressing climate change, especially those based on exaggerated projections of likely impacts (e.g., based on scenarios such as RCP8.5 or SSP5-8.5\textsuperscript{176}, discussed in Section I), also could pose security and humanitarian risks. Naïve utopianism also poses security and humanitarian risks.\textsuperscript{177} Indeed, both environmental catastrophism and

\textsuperscript{170} Goolsbee & Syverson, supra note 167, at 2, 23 fig.1. See supra Figure 4c.


\textsuperscript{175} INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, supra note 3, at vii; Kemp et al., supra note 91, at 1–3, 6.

\textsuperscript{176} See supra Section I.

\textsuperscript{177} See STEVEN PINKER, THE BETTER ANGELS OF OUR NATURE: WHY VIOLENCE HAS DECLINED, at ch. 8 (2020)
utopianism have long and bloody histories in the twentieth century. Moreover, the risks of catastrophism and utopianism may be underappreciated in current climate discourses.

Catastrophism is dangerous because it creates a pretext for authoritarianism and suspending civil liberties and human rights. In emergencies, governments are often given moral license to exercise powers that they would not otherwise, such as surveillance, censorship, curfews, lockdowns, or martial law. The COVID-19 lockdowns and the post-9/11 Patriot Act provide examples in recent U.S. history of government curtailments of civil liberties in response to crises, widely deemed necessary at the time. It is worth imagining how far governments might be willing to go in curtailing civil liberties, and how much collateral suffering they might be willing to endure, if they were genuinely convinced that climate change put the fate of humanity on the line. It is especially worth considering how dangerous this scenario would be if the governments were wrong in their assessment that climate change threatened humanity’s fate. For example, in The Future Earth, Eric Holthaus imagines that the United States bans fossil fuels in 2030. Fossil fuels accounted for approximately eighty percent of U.S. primary energy consumption in 2021. Barring a transition much faster than even the path of U.S. pledges and targets, such a ban would cause devastating energy shortages and inflation.

While this may seem like a far-fetched hypothetical scenario, humanitarian crises caused by environmental catastrophism have already occurred. In the 1960s and 1970s, predictions of overpopulation causing

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178 Burgess et al., supra note 9, at 1.
179 Id.
181 For example, the United States government exercised these powers during World War II. See Arthur H. Garrison, National Security and Presidential Power: Judicial Deference and Establishing Constitutional Boundaries in World War Two and the Korean War, 39 CUMB. L. REV. 609 (2008).
environmental catastrophes and consequent humanitarian catastrophes motivated several countries to undertake coercive family planning and eugenic policies, with China’s one-child policy being a notable example.\textsuperscript{188} The predictions of catastrophic resource scarcity due to overpopulation proved inaccurate, but that did not stop an estimated one hundred million coerced abortions from taking place.\textsuperscript{189} More recently, in 2021, the government of Sri Lanka banned synthetic fertilizers and pesticides, which caused exports of key crops to collapse and food prices to nearly double, both exacerbating what was already an economic and food crisis during the pandemic.\textsuperscript{190} Far-right and eugenicist movements and intellectuals often use environmental fears as motivation for curtailing immigration and withholding aid to the poor.\textsuperscript{191} For example, Garrett Hardin—famous for coining the term “tragedy of the commons”\textsuperscript{192} and for being an outspoken white supremacist\textsuperscript{193}—argued that environmental degradation and resource scarcity called for a “lifeboat ethic,” wherein the poor would be allowed to suffer and die without assistance to spare everyone else of scarcity and suffering.\textsuperscript{194}

There is mounting evidence that climate catastrophism is damaging to youth mental health. For example, one study found forty-five percent of youth report that climate anxiety affected their daily lives and functioning, and made forty percent afraid to have children.\textsuperscript{195} The youth mental health crisis in the United States has hit young, politically liberal women and girls the hardest, with over fifty percent of liberal women under thirty years of age reporting having been diagnosed with a mental health disorder.\textsuperscript{196} Mental health outcomes are especially bad for affluent white liberal women; the sociologist Musa al-Gharbi argues that catastrophist versions of progressive

\begin{footnotesize}
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\item \textsuperscript{189} \textit{Id}.
\item \textsuperscript{190} Ted Nordhaus & Saloni Shah, \textit{In Sri Lanka, Organic Farming Went Catastrophically Wrong}, FOREIGN POL’Y (Mar. 5, 2022, 7:00 AM), https://foreignpolicy.com/2022/03/05/sri-lanka-organic-farming-crisis/.
\item \textsuperscript{191} Nils Gilman, \textit{The Coming Avocado Politics}, BREAKTHROUGH INST. (Feb. 7, 2020), https://thebreakthrough.org/journal/no-12-winter-2020/avocado-politics.
\item \textsuperscript{192} Garrett Hardin, \textit{The Tragedy of the Commons}, 162 SCIENCE 1243, 1243 (1968).
\item \textsuperscript{194} Garrett Hardin, \textit{Living on a Lifeboat}, 24 BIOSCIENCE 561, 561 (1974).
\item \textsuperscript{195} Caroline Hickman et al., \textit{Climate Anxiety in Children and Young People and Their Beliefs About Government Responses to Climate Change: A Global Survey}, 5 LANCET PLANETARY HEALTH e863, e866 (2021).
\item \textsuperscript{196} Musa al-Gharbi, \textit{How to Understand the Well-Being Gap Between Liberals and Conservatives}, AM. AFFS. (Mar. 21, 2023), https://americanaffairsjournal.org/2023/03/how-to-understand-the-well-being-gap-between-liberals-and-conservatives/.
\end{itemize}
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ideology amplified by social-media—which includes catastrophist positions on climate change—may, therefore, be a more plausible cause of these mental health statistics than material suffering or oppression.\footnote{Id.}

Utopianism is dangerous because it creates an ends-justify-means pretext for authoritarianism and abuses of civil liberties and human rights. Utopianism may need to do more damage than explicit malevolence to earn condemnation, as its harms must overcome the veneer of its good intentions. Indeed, communism—the most infamous instance of militant, naïve utopianism—may have been the single deadliest form of government in world history.\footnote{See infra Figure 5.} The famines it caused in the former Union of Soviet Socialist Republics (USSR) in the 1920s and 1930s under Lenin and Stalin, and in China in the 1950s and 1960s under Mao Zedong, killed nearly forty million people at least.\footnote{Joe Hasell & Max Roser, *Famines*, OUR WORLD DATA, https://ourworldindata.org/famines (last visited Sept. 30, 2023).} The worldwide death toll from communism is estimated to be nearly one hundred million people.\footnote{STÉPHANE COURTOIS ET AL., *THE BLACK BOOK OF COMMUNISM: CRIMES, TERROR, REPRESSIO* N 120 (Mark Kramer ed., Jonathan Murphy & Mark Kramer trans., 1999); BENJAMIN A. VALENTINO, *FINAL SOLUTIONS: MASS KILLING AND GENOCIDE IN THE 20TH CENTURY* 91 (2005).} Despite communism’s unmatched death toll, its utopian vision and intellectual roots attract many sympathizers among academics, even to this day.\footnote{Lee Jussim et al., *The Radicalization of the American Academy*, in *THE PALGRAVE HANDBOOK OF LEFT-WING EXTREMISM* tbl.1 (2023).} It is difficult to imagine modern society accepting a similar prevalence of fascist sympathizers in the academy.

\footnote{For example, Paulo Freire’s *Pedagogy of the Oppressed* is one of the most widely-assigned books in U.S. schools, despite the fact that it praises, cites, and draws on Mao Zedong and his cultural revolution. *PAULO FREIRE, PEDAGOGY OF THE OPPRESSED* 30 (Myra Bergman Ramos trans., 1970). A recent poll found that forty percent of U.S. faculty and fifty-eight percent of graduate students identified themselves as one of following: “radical,” “activist,” “Marxist” (twenty percent of graduate students), or “Socialist.”}
It is not difficult to imagine what dangerous naïve utopianism might look like in the context of climate change. It might seek to rashly ban fossil fuels before substitutes are widely available at scale; it might seek to dismantle markets and/or drastically shrink the economy pursuant to utopian visions of a post-capitalist society, and it might welcome authoritarianism and censorship in the name of preventing inaction or delay. Even if a utopian approach failed to implement illiberal oppressive policies or practices pursuing its goals, the threat of such policies or practices could harden political divisions and put bipartisan cooperation and big-tent climate politics further out of reach.

202 COURTOIS ET AL., supra note 200.
206 Alex de Waal & Aditya Sarkar, Famine Trends Dataset, Tables and Graphs, WORLD PEACE FOUND., https://sites.tufts.edu/wpf/famine/ (last visited June 3, 2023). Famines attributed to communist regimes are excluded. The midpoint is used for famines with a range of casualty estimates.
208 E.g., Jason Hickel, Is it Possible to Achieve a Good Life for All Within Planetary Boundaries?, 40 THIRD WORLD Q. 18, 24, 29 (2019).
While this Section has focused on some of the dangers of catastrophizing the threat of climate change, there are, of course, also dangers to understating the threat. For example, the possibility of difficult-to-anticipate-or-reverse tipping points in the climate system or in socioeconomic consequences of climate change merits a precautionary approach.210 Similarly, decision theory suggests that avoiding the possibility of catastrophic outcomes—even if small—should loom large in decision-making.211 The existence of special-interest-backed misinformation minimizing the issue remains a challenge. However, it is the Author’s impression that climate scholars and advocates take for granted the notion that understating the threat of climate change is much more dangerous to society than overstating it. Politicians, activists, and scholars should reflect on how strong the evidence supporting this assumption really is.

VI. CONCLUSION

Climate change is a serious issue that demands a serious approach. It touches all regions of the world and all sectors of society. The world is entering a new phase regarding climate change, in which progress on reducing emissions is evident and catastrophic scenarios are becoming less plausible, yet more needs to be done; and economic progress seems likely to continue but perhaps slower and with more inequality than most scenarios currently project. This Article has argued that this new phase demands substantial investment in all of mitigation, adaptation, and carbon removal; more attention to financial gaps in light of slowing economic growth, especially in the developing world; a bipartisan approach to addressing the issue of climate change in the U.S. (and other democracies); and a caution against catastrophism and utopianism. An approach to addressing climate change that is nuanced, discerning, and evidence-based will be best placed to succeed.

210 Kemp et al., supra note 91, at 2.

211 This is known as the dismal theorem. See Martin L. Weitzman, Fat Tails and the Social Cost of Carbon, 104 AM. ECON. REV. 544, 544, 545 (2014).