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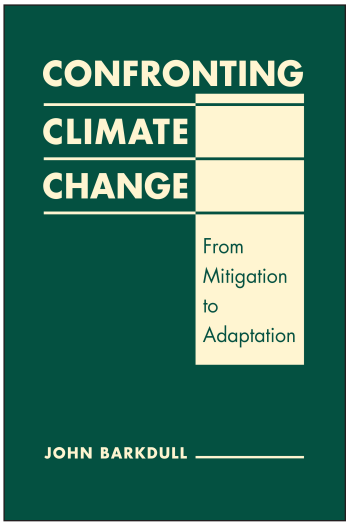
Confronting Climate Change: From Mitigation to Adaptation



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The Challenge of Climate Change

CLIMATE SCIENTISTS TOLD US DECADES AGO THAT TEMPERatures were rising due to human activities, and that this would have significant ecological and social effects.[1] In its most recent Assessment Report (AR6), the Intergovernmental Panel on Climate Change (IPCC) asserted, "Human activities, principally through emissions of greenhouse gases, have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850–1900 in 2011–2020."[2] Consequently, states the IPCC, odds of achieving the internationally agreed ambition to hold temperature rise below 1.5°C are low. Instead, current policy commitments would lead to global warming ranging from 2.1°C to 3.4°C by 2100, with 2.8°C being most likely. Moreover, AR6 asserts, there is an "implementation gap" between commitments and actual practices, meaning that global temperature will more likely reach 3.2°C above the baseline by the end of this century. The five-year Global Stocktake indicates that commitments countries have recently made could bring the expected temperature rise down to the 2.4–2.6°C range, but still sees significant shortcomings. Emissions remain too high to meet the Paris goals, and "adaptation efforts to date have focused on planning and have not yet driven the broad changes necessary to enhance adaptive capacity, strengthen resilience and reduce vulnerability."[3] Thus, despite some advances, global climate policy remains inadequate in its most important dimensions, and the systems transformations that various observers assert are required to redress this situation are remote.

International negotiations to address climate change began in the late 1980s, and with every round the sense of urgency has increased, but without sufficient policy responses. In 2007, a member of the IPCC

declared that failure to act before 2012 would mean the world had waited too long, that the coming two or three years were a "defining moment" for climate policy.[4] Over fifteen years later, the defining moments continue to pass, and the adequacy of climate action remains in doubt; the Secretary-General of the United Nations asserts that we are in an age of global boiling, on a highway to climate hell with our collective foot on the accelerator.[5] Indeed, any attention to the daily headlines informs the reader that rising temperatures and changing world climate are here.[6] Sadly, for the most part, scientific predictions have fallen short of subsequent observed changes.[7] The climate is changing faster and more profoundly than expected, more than at any time in human history. Thus, policymakers at global and national levels have mostly agreed (in principle, if not in practice) that to avert severe, dangerous effects on human society requires urgent measures to reduce the amount of warming along with equally urgent measures to prepare society for the consequences of climate change.

Accordingly, global policy formulated in such venues as the annual Conference of the Parties to the UN Framework Convention on Climate Change (COP) attempts to combine *mitigation* (reducing temperatures) with *adaptation* (various responses to soften the effects of higher temperatures). According to this policy framework, too little mitigation will mean climate changes will be so severe that sufficient adaptation is not possible. At the same time, current and future effects of climate change mean that some adaptation is already happening and more will be required. A comprehensive report notes that insufficient efforts to cut back on emissions will mean that some adaptation goals will be out of reach as the impacts increase with every increment of temperature increase. Accordingly, the world could require sufficient mitigation to maintain conditions for successful adaptation.[8] Unfortunately, neither element of climate policy has shown sufficient progress.

In the years following the 1992 Rio Earth Summit, the focus had been almost entirely on mitigation.[9] The first major agreement on climate policy, the UN Framework Convention on Climate Change (UNFCCC), negotiated at the Earth Summit, included references to adaptation, but its policy focus was squarely on reducing the sources of higher temperatures. However, as observed and future impacts were registered, adaptation rose on the global agenda, with demands for more funding, research, and capacity building. Since about 2007, high-level negotiations have seen claims that mitigation and adaptation are equally important, with both required for an adequate response to a significantly altered global climate.

Unfortunately for the mitigation + adaptation formula, global and national policies to reduce global warming below dangerous levels have shown insufficient signs of success so far, nor is there much hope for adequate reductions in the future.[10] Projections of temperature rise show that the world is on track to surpass internationally agreed thresholds within a few decades, with temperatures continuing to rise well beyond the end of this century. For decisionmakers, the evident inadequacies of mitigation policy have shifted their attention to how to live on a hotter planet. For the world, the upshot is that adaptation will be increasingly necessary, and the main question will be: How much social change will suffice to meet the challenge? That is, adapting to a much warmer world is primarily a social and political question, not a technological one.

The failure of global policy to reduce projected temperature rise sufficiently puts the onus on making major changes in the modern way of life to ameliorate the harms society will experience due to climate change.[11] Adaptation policy aims to reduce the vulnerability of society to such climate impacts as heat waves, extreme weather events, prolonged droughts, floods, and rising sea levels. It also seeks to increase *social resilience,* which is the capacity of society to recover from damages arising from climate change. But adaptation can only go so far. If temperatures rise too high, then the limits of social orders to which humans have become accustomed could be breached.[12] Although human extinction due to climate change is unlikely,[13] civilization as we know it could prove unviable, and profound social transformation would occur, whether by conscious design or as a chaotic, unplanned reaction to unprecedented climatic conditions.[14]

Can We Do It?

If adaptation to climate change is a kind of last-ditch defense against a social crisis resulting from human interference in the planet's climate, the question arises: Can we do it? Can we adapt enough and in the right ways to live in a hotter world without experiencing social chaos and the possible collapse of civilization? This is both a technical question and a political question. That is, we need to know what can be done on the ground to soften the blows of climate change. To what extent can flood protection, water conservation, changes in agricultural practices, forestry management, and the like reduce climate impacts to tolerable levels? We also need to know whether the institutions and processes for making and implementing climate policy can do the job.

Do they embody values, principles, norms, and prior commitments that prevent them from making the needed changes and transformations to sustain civilization and to achieve ambitious objectives such as fulfilling the promises of the Sustainable Development Goals (SDGs)? Do current institutions rely on decisionmaking processes and procedures that inhibit or block appropriate policies? If so, then what alternative institutions and practices can do the job? One finds in reviewing scholarly and official discourse on climate change adaptation an unfortunate tendency to project a dire—possibly catastrophic—future, but to balk at outlining what that future implies for the capacity of current institutional arrangements to consider, adopt, and implement adaptation measures sufficient to the task.

The IPCC, the entity that provides the UN with scientific reports on the state of the climate and possible policy responses, has said that rising temperatures might require reconsideration of current development pathways, and it has gone further in asserting in no uncertain terms that sustainable development in a warming world will require more democracy, equality, and social justice. These recommendations apply to adaptation as much as mitigation; the IPCC claims that injustice will hobble adaptation efforts, leaving vast numbers of people vulnerable to the worst effects of climate change.

The IPCC specifies criteria for successful adaptation, noting that adaptation solutions should be effective, feasible, and in conformity with principles of justice. Climate justice, writes the IPCC, encompasses distributive, procedural, and recognition justice. The first is about the allocation of costs and benefits from climate policy, the second is about who participates and decides, and the third is in regard to respect for and engagement with the diversity of cultures and perspectives.[15] Thus, the IPCC recommends adaptation that is fair to all stakeholders, employs legitimate decision processes, and guarantees the rights and participation of all. Adaptation that does not improve the condition of disadvantaged people is unsuccessful adaptation, which would, by the same token, stand as an indictment of the current state of the world, which is far from fair, democratic, or egalitarian. This would seem to call for a focused critique of existing global and national institutions, including the economic relationships producing vast inequality in wealth and access to decisionmaking processes. But the IPCC avoids tackling head-on the undemocratic, inequitable, unjust aspects of current global social, economic, and political institutions. Neither does it describe in detail the institutional framework that would enable successful adaptation to a considerably warmer climate.

To fill that gap requires turning attention to bodies of literature that the IPCC and other influential observers neglect, and to dissident voices outside official circles. The message coming from such sources is that sweeping social transformation is necessary to address all aspects of the climate challenge, including adapting to higher global temperatures. Whether such transformation can be enacted in time to head off social collapse is open to question. Indeed, one option is to accept that we are headed toward collapse and to prepare accordingly, which leads to consideration of such postcollapse proposals as Deep Adaptation.[16] In any case, questions of social organization become increasingly pressing, engaging issues regarding justice, equality, democracy, inclusiveness, class relations, and more.

Purpose of the Book

This book seeks to draw attention to the social and political requisites for successful adaptation to climate change. The orientation is global, focusing on international negotiations, international organizations, and the global implications of climate change. No doubt, much more could and should be said about national and local adaptation politics and policies, but this work views the issue through a global lens. This is appropriate to the present study because its central question is pitched at the broadest level: the future of civilization. Defending civilization is necessarily a collective global endeavor; this requires investigating, assessing, and evaluating research, political discourse, policy, and politics in international contexts.

The premise for the book is that efforts to reduce the sources of global warming—mainly the burning of fossil fuels—have failed and show little signs of future success. Thus, the world will heat up well beyond the internationally agreed thresholds for avoiding dangerous climate change. Consequently, adaptation to the tough new planet[17] brought about by climate change will become increasingly necessary.[18] Further, the degree of adaptation will become greater, requiring more extensive changes to how we live. In current terminology, sufficient, just adaptation to climate change might require "transformational change" of global institutions and practices. However, the barriers to transformational change can be as daunting as those to mitigation and adaptation.

As the social effects of climate change become more severe, the question will become increasingly urgent. Can current institutions implement adequate adaptation to defend the lives, property, and interests of

more than a select few of the world's inhabitants, or are today's institutions barriers to the kind of democratic, equitable, just adaptation that the IPCC and others call for?[19] This book intends to address the institutional question directly, first through a chronological analysis of the development of adaptation policy and politics, then through consideration of alternative views of institutional change to meet the climate crisis. The goal is to reveal the significant turns in adaptation negotiations that have, so far, blunted the transformational potential of adaptation to climate change. This discussion points toward recent developments in adaptation thinking in academia and among activists to recover that potential. Toward that end, various options for transformational change will be elaborated.

The Challenge of Climate Change

Two decades ago, despite scientific consensus to the contrary, controversies still raged over whether human-caused temperature rise was even happening or, instead, observed temperature changes represented a cyclical phenomenon due to various natural causes. Some skeptics claimed that left-wing activists and self-interested scientists seeking funding were exaggerating a temporary, natural tendency in the planet's climate to impose a radical agenda of social change, while opponents argued that the science was honest and clear in projecting dangerous global warming would occur. That debate is over.

Today, the scientific consensus enjoys nearly universal assent: global average temperature is rising; human activities have caused the observed temperature increase and will induce even more in the future; higher global average temperature is already having observable effects on the ecosphere and will have greater effects as the world warms; human society will be significantly affected, mostly in negative ways; and the time to act is now. In its most recent Assessment Report (AR6), the IPCC asserts, "It is unequivocal that human influence has warmed the atmosphere, ocean and land. Widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred."[20]

The evidence is compelling, and opponents of policies restricting the use of fossil fuels and other mitigation policies have turned to advocating such measures as geoengineering and carbon capture. Indeed, fifty-two Republicans in the US Congress have formed a Conservative Climate Caucus to propose policies "to reduce emissions while retaining fossil fuels."[21] Achieving successful geoengineering would mean

using massive technological interventions to cool the planet or to reinject greenhouse gases into the earth, obviating the need to cut back on burning fossil fuels and other human activities that raise global temperatures. The viability of such measures is questionable,[22] but unless various technological solutions succeed, not even the pledged goals of the 2015 Paris agreement can be met, not to speak of more ambitious objectives.[23] Yet deployment of such technologies on the scale required in time to make a significant difference faces serious challenges, and the unwanted and unplanned consequences could exceed the benefits.

Rising Temperatures

The fundamentals of the science of climate change have been known for over a century. The Earth's atmosphere contains certain gases that trap heat near the surface rather than allowing it to dissipate into space. Consequently, the planet maintains a global average temperature well above what it would be without those gases, and that means in turn climatic conditions compatible with life. In that respect, then, greenhouse gases are a blessing, without which the planet would be cold, dry, and dead. The problem, however, is that adding to the concentrations of greenhouse gases (GHG) from human sources can change the climate in unwanted ways, heating the planet to temperatures higher than ever experienced in the history of civilization.[24]

The most important of the atmospheric gases for the Earth's temperature is carbon dioxide (CO_2). When humans began to burn fossil fuels, releasing CO_2 in excess of the planet's capacity to absorb it quickly, the atmosphere retained more heat, raising global average temperatures. At first, this effect was barely detectable, but in the past several decades, a marked increase has occurred, so that global average temperature is now about 1.2ºC higher than it was in preindustrial times,[25] and significantly higher in 2023. This is due to human activities increasing the concentration of GHG, primarily CO_2, from about 280 parts per million of CO_2 and equivalents to 500 parts per million today.[26]

The world will heat further, with some warming already locked in, and some depending on which emissions pathway we take. Currently, the path is toward dangerous climate change as defined in international negotiations, specifically global average temperature rise higher than 2ºC. Despite decades of negotiations to prevent global warming, global average temperature continues to rise. As José A. Tapia Granados observes, "Indeed, the sad reality is that besides bombastic and grandiloquent words, nothing has been done to stop the worsening of

climate change since the process was discovered several decades ago."[27] Since the 1980s, every decade has been warmer than the previous one.[28] In 2021, the American West suffered through an intense heat wave that began before summer had even arrived. The European Union's Copernicus Programme reported that 2020 tied 2016 as the hottest on record, despite the cooling effects of La Niña.[29] In July 2023 the world experienced the hottest month on record even before the full effects of El Niño had been felt, and for all of 2023 global average temperature was 1.45ºC above the preindustrial level, the hottest year on record.[30]

In 2011, the International Energy Agency (IEA) stated that the world had five years to change course on energy production or it would lock in too much global greenhouse emissions to avoid dangerous climate change.[31] The critical five years have long since passed without sufficient change in the global energy infrastructure. Indeed, the IEA reports that oil demand reached record highs in 2023.[32] "Climate and earth system science," writes Henrik Enroth, "make it clear to those willing and able to pick up the message that the time has long passed when anthropogenic climate change might have been reversed, and it presently appears that the window is closing on an opportunity to avert or at least reduce consequences of global warming that scientists agree will be nothing short of catastrophic."[33]

To be sure, most newly installed power generation has been nonfossil fuel, but that in itself only changes the mix of growing energy use, without necessarily reducing the amount of fossil fuels and GHG emissions. Rather, CO_2 emissions from fossil fuels have increased steadily for decades. While some regions have shown declines in this category of GHG, the world total reached 36.7 gigatons in 2020, up from 35 gigatons a decade earlier. Accounting for carbon dioxide and equivalents brought the figure to 50 gigatons in 2020, up about 30 percent from 1990.[34] In 2022, the amount of CO_2 and equivalents reached 59 gigatons. Yet to meet internationally agreed goals for containing temperature rise would require halving GHG emissions by 2030 and achieving net zero emissions by 2050. Assessing across forty indicators of progress on climate policy, an important study concludes that "none are on track to reach 2030 targets."[35]

The official world of international organizations, nongovernmental organizations, and governments has pinned its hopes on the 2015 Paris agreement on climate change, but the accord is likely to fail in its main aims. Parties to the Paris agreement officially adopted the goal of holding global average temperature rise below 2ºC and, further, that they

should pursue efforts to hold the rise below 1.5ºC. The Paris agreement called on countries to make nationally determined contributions (NDCs) to reduce greenhouse gas emissions. But the NDC pledges to reduce GHG still leave the world on track for as much as 3ºC global average temperature rise, with even higher levels possible.[36] Morgan Bazilian and Dolf Gielen observe that NDCs "don't come close to adding up to the Paris Agreement's goals," and existing commitments are not supported in national policies.[37] Without considerably increased commitments to cuts in GHG emissions and deployment of unproven carbon capture technology, global average temperature will rise well past the dangerous level. Indeed, the 2ºC marker was arrived at politically and may represent what negotiators thought possible rather than an actual safe boundary; thus, we may already be in dangerous territory.[38]

Scientists have employed a variety of methods to estimate temperatures, including for times when no instruments to measure temperature existed. The data from various authorities show that the temperature trend turned significantly upward in the late 1960s, rising steadily since; estimates from six reputable scientific sources using different methods all report the same trend and nearly the same amount of change.[39] Certainly, fluctuations occur, but the fact that global average temperature is on a long-term upward trend is beyond dispute. Various alternative explanations have been forwarded for this trend (sunspots, natural cycles, and others), but the only one that survives serious scrutiny is that human activities—primarily burning fossil fuels—are responsible for the observed temperature rise and will be for future increases.[40]

Climate change's effects on ecosystems and societies have already been observed with the 1.2ºC temperature rise. Some societies are now experiencing harms, and the trend is toward surpassing the thresholds for dangerous climate change, whether looked at in terms of what governments have promised to do, or in terms of what is actually happening in energy use and other activities contributing to global warming. The IPCC assesses the projected temperature ranges under four scenarios, ranging from a rapid reduction of greenhouse gas emissions to unrestricted growth. With rapid, steep reductions in fossil fuel use and other sources of global warming, it is possible to hold temperature rise to about where it is today. But less optimistic assessments of future patterns suggest the global average temperature will rise as much as 5ºC.[41]

The path charted by the Paris agreement is toward about 2.8–3.0ºC rise by the end of the century. To achieve the 2ºC goal would require that countries fulfill their pledges to reduce GHG emissions, that commitments

are "ratcheted up" in future negotiations, and that geoengineering technologies are developed and deployed broadly.[42] But practical actions to achieve pledges are so far insufficient. "A five-fold acceleration in emissions reductions is needed to come close," note Bazilian and Gielen.[43] For the United States, President Joe Biden's decision to rejoin the Paris agreement helped, but a major part of his climate policy was in the failed Build Back Better legislation, killed by coal-state Senator Joe Manchin (D-WV) along with all Senate Republicans.

Decades from now, the problem could become far worse. Although most depictions of the climate future show temperature increases by the year 2100, the end of this century is not the final chapter. Especially on the high-emissions path, warming and other effects of higher GHG concentrations continue for up to a millennium. The IPCC's Fifth Assessment Report (AR5) released in 2013 employed a variety of models to project future conditions.[44] The high-emissions model (called RCP8.5) shows global average surface temperature rising to about 4ºC by 2100, then continuing to rise to 8ºC in 2300. Although low probability, the temperature rise could reach 8ºC by 2150 and climb to well over 12ºC after 2250.[45] Importantly, in this process, surface warming will continue even after the factors forcing climate change have been eliminated or held constant. The long-term equilibrium surface temperature, then, is higher than the "transient" temperature; that is, what is being experienced at a given time. The emissions and concentrations created today will result in higher temperatures in the future, even if we immediately stop all emissions and other "forcings" entirely. This is because the concentrations of GHG in the atmosphere do not drop quickly once emissions stop. CO_2 in particular remains for centuries, so whatever level is reached before the world achieves net zero emissions is what determines long-term temperatures. In addition, the oceans hold massive amounts of heat, which has reduced the surface temperature rise that would otherwise have occurred. But that heat remains in the global climate system and will contribute to warming the planet. The National Oceanic and Atmospheric Agency observes that the heat absorbed by the oceans remains in the Earth system, it will eventually warm land areas, and "heat energy in the ocean can warm the planet for decades after it was absorbed."[46]

Thus, the policy horizon of 2100 generally employed to portray the climate future can obscure the continued warming of the planet beyond that time frame. Consequently, simply reducing the rate of growth of GHG emissions or reducing emissions by less than net zero might only delay matters.

Needless to say, a 12ºC warmer world would have long since surpassed the point at which dangerous climate change is expected, and the survival of civilization would be unlikely. Paul G. Harris summarizes the current situation, "Emissions certainly are not set to fall by half within eight years, which scientists tell us is essential to limit global warming to 1.5ºC and thus avoid the worst impacts of climate change."[47] Even worse, the World Meteorological Organization projects a strong chance of surpassing 1.5ºC within this decade, a level nearly reached in 2023.[48] The trend continued into 2024, as April marked the eleventh straight month of being the hottest month on record, and the global average temperature from April 2023 to April 2024 was 1.61ºC above preindustrial temperatures.[49] While the temperature average might temporarily fall below the 1.5ºC threshold, the trend is clearly toward exceeding internationally agreed limits.

Finally, the annual report of the UN Secretary-General notes recent setbacks in climate policy, along with other elements of the Sustainable Development Goals. The report observes that, after a temporary reduction due to the Covid-19 pandemic, "global energy-related CO_2 emissions rose by 6% in 2021," and, further, existing commitments imply that "global emissions will increase by almost 14% over the current decade, leading to a climate catastrophe, unless governments and stakeholders" act immediately and collectively to head off the crisis.[50] But to hold global average temperature rise to 1.5ºC "will require revolutionary scale transformational change in global social relations affecting the human relation to the climate and the planetary environment as a whole."[51] Thus, the Secretary-General's call for immediate collective action to head off a catastrophe is likely to go unheeded.

Effects of Climate Change

The IPCC concisely explains the observed and projected effects of climate change in its most recent report.[52] Already, writes the IPCC, "Human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability," and "the most vulnerable people and systems are observed to be disproportionately affected," pushing some social and natural systems "beyond their ability to adapt."[53] Climate and weather extremes have become more frequent and intense, leading to higher heat-related human mortality, coral bleaching, damage to forests, and storm damage. In addition, ocean acidification, sea level rise, and regional

reduced precipitation have been attributed to human-induced global warming and burning of fossil fuels.

The ecological and social effects are already observed: "Climate change has caused substantial damages, and increasingly irreversible losses, in terrestrial, freshwater and coastal and open ocean marine ecosystems." Further, climate change has reduced food and water security, slowing the improvement of agriculture productivity and increasing malnutrition. Globally, climate change has had negative effects on agriculture, fisheries, the spread of infectious diseases, health, mental well-being, displacement from home communities, flooding, storm damages, infrastructure, and key economic sectors.[54]

The IPCC observes that the projected effects on social and ecological systems vary considerably due to "unsustainable development patterns" that leave 3.3 to 3.6 billion people highly vulnerable to climate change.[55] In the near term (2021–2040), when global average temperature is expected to reach and exceed 1.5ºC permanently, global warming "would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans."[56] At the lower internationally agreed threshold, then, there will be more frequent and stronger extreme weather events, biodiversity loss, sea level rise encroaching on and even submerging coastal communities, and great stress on urban infrastructure. Social consequences include more conflict and displacement as people leave areas suffering severe climate change effects. High risks begin to emerge at 1.2ºC (about where we were in 2023) and worsen as global average temperature rises by as much as 5ºC compared to preindustrial times.

In the longer term, beyond 2040, key risks are "up to multiple times higher than currently observed."[57] Biodiversity loss could threaten nearly half the world's species at higher temperatures, and at the expected nearly ~3ºC rise under current NDCs, as many as 29 percent of species would be threatened with extinction. The availability of water in regions relying on snow melt could fall by up to 20 percent at 2ºC, and 40 percent at 4ºC. At 2ºC, the long-standing internationally agreed threshold for dangerous climate change, food security risks "will be more severe, leading to malnutrition and micro-nutrient deficiencies, concentrated in Sub-Saharan Africa, South Asia, Central and South America and Small Islands."[58] Sea level rise will expose as many as a billion people to climate effects specific to coastal areas, with additional damages occurring to communities and infrastructure in permafrost areas. Economic damages will increase, although too many uncertainties in the data exist to make confident assessments of

a dollar amount. Involuntary migration, affecting the level of conflict, will increase as intense weather events, sea level rise, and lower agricultural productivity push people to seek new places to live. Finally, as temperatures rise, "multiple climate hazards will occur simultaneously, and multiple climatic and non-climatic risks will interact, resulting in compounding overall risks and risks cascading across sectors and regions."[59]

Summing up, climate scientists are increasingly confident of the consensus view that human activities have led to rising global average temperatures, with more increases to come over the next decades and centuries. Measurements from different sources employing different methods converge on the same pattern of rapid temperature rise over the past few decades, with nearly identical estimates of the amount of temperature increase. International agreements to address this challenge fall well short of what is required to avert dangerous climate change defined as no more than 2ºC increase compared to preindustrial times. The more ambitious 1.5ºC objective is all but out of reach, requiring improbable immediate reduction of GHG emissions, in turn meaning complete and rapid transformation of the global energy system.[60] Consequently, severe effects on ecological and human systems are likely to occur. The negative impacts multiply as temperatures rise, afflicting different regions and communities differently due, in part, to poverty, poor governance, and global inequality.

At higher temperatures, the capacity of modern civilization to cope is in doubt. At 4ºC, Mark Lynas claims, "Advanced civilisation, with its constantly increasing levels of material consumption, energy use and living standards—the system that we call modernity and that has brought us into this crisis by continuing to be utterly dependent on fossil fuels—this civilisation is tottering."[61] Moreover, at such high temperatures relative to the preindustrial era, natural processes could overwhelm any human efforts to moderate further increases.[62] Consequently, adaptation to a much warmer world will continue to rise on the global agenda, and the degree of adaptation necessary will rise as well.

Adaptation Concepts

This section outlines key terms for the analysis of adaptation to climate change. To this end, it analyzes and relates adaptation, vulnerability, resilience, adaptive capacity, and transformational change.[63] The adaptation framework outlined here points to the essential task of

specifying the institutional barriers to successful adaptation and the possibilities for institutional transformation to remove those barriers. But before discussing the adaptation framework, it is useful to elaborate the meaning of mitigation.

Mitigation

As noted, *mitigation* refers to efforts to prevent climate change from occurring. This means primarily reducing GHG emissions, with CO_2 the main target for reductions. However, mitigation extends beyond closing coal-fired power plants and the like. Other kinds of GHG and other factors also determine how warm the planet will become.

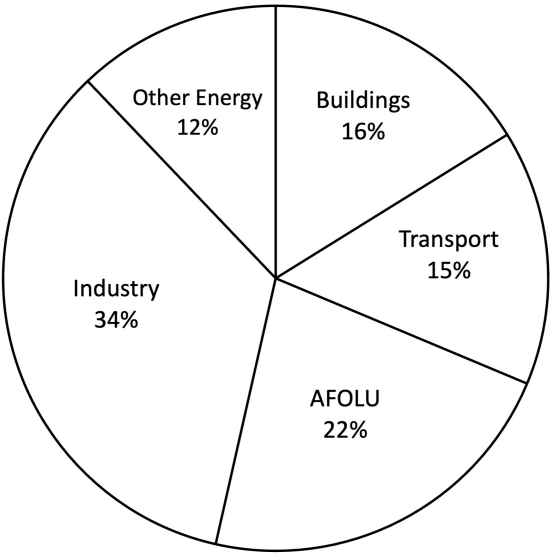
The IPCC identifies six major categories of sources of GHG emissions: electricity and heat production; agriculture, forestry, and other land use (AFOLU); buildings; transport; industry; and other energy. Electricity and heat production account for 23 percent of all GHG emissions, which the IPCC then breaks down to show the share for each of the other sectors, labeled indirect emissions. Combining the two (eliminating electricity and heat production as a separate category), AFOLU accounts for about 22 percent of all direct and indirect emissions, buildings for 16 percent, transport for 15 percent, industry for 34 percent, and other energy for 12 percent (Figure 1.1).[64]

Industry, transport, and buildings all rely heavily on direct or indirect use of fossil fuels. They also contribute other GHG such as methane. The cement industry accounts for a significant share of industry emissions. Mitigation means to reduce the GHG emissions from all of these sources.

In addition to reducing emissions, mitigation can be achieved by enhancing carbon sinks such as forests. Unfortunately, projections indicate that the most important forest in the world, the Amazon rainforest, could be headed toward a semiarid condition, even if excessive logging and land clearance were to cease.[65] Globally, the world is steadily losing forest cover, averaging 4.7 million hectares lost per year in the 2010s.[66]

Another approach is geoengineering, or the effort to employ massive technological remedies to the warming of the planet, without necessarily giving up fossil fuels and concrete or stemming deforestation. Broadly, geoengineering encompasses solar and carbon aspects. Solar geoengineering refers to efforts to limit the amount of sunlight reaching the earth's surface, while carbon geoengineering proposes using technological means to remove CO_2 from the atmosphere and inject it into the

Figure 1.1 Emissions by Source, 2019 (59 $GtCO_2$-eq.)



Source: IPCC. "Emissions Trends and Drivers," in *Climate Change 2022: Mitigation of Climate Change. Working Group III Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (Geneva: IPCC, 2022), p. 237.

Note: AFOLU = agriculture, forestry, and other land use.

ground. Although the scale of a global project to control the planet's climate is immense, the Biden administration has sponsored carbon capture projects in Texas and Louisiana, among the latest of more than 1,200 projects worldwide, so the geoengineering ball is rolling.[67]

For the current commitments embodied in international agreements to be plausible, geoengineering must succeed. But considerable doubts about the efficacy of geoengineering exist, in part because the effects of climate control would fall differently on the various countries of the world. Those facing negative consequences or becoming relatively disadvantaged might not accept the outcome without resistance.[68] Moreover, numerous negative side effects are possible, serious enough that geoengineering to cool the planet could end up doing more harm than good, besides which the costs of building enough geoengineering infrastructure to make a difference could be prohibitive.[69] Indeed, the *Washington Post* reports that Occidental Petroleum has leased 106,000 acres of land near Corpus Christi just for the planned Texas carbon capture

facility; installations around the world sufficient to matter would occupy large amounts of land.

In sum, mitigation encompasses emissions reductions in several important economic sectors, along with enhancement of carbon sinks and different forms of geoengineering. With various approaches to mitigation either falling well short or appearing infeasible, increasing attention turns to adaptation.

The Adaptation Framework

What is *adaptation* to climate change? Answering this question requires positing a definition and examining related concepts, thus enabling description and analysis of a framework for the study of adaptation.[70] This framework encompasses the sources of risk and vulnerability that necessitate adaptation; the capacities that households, communities, countries, and the world will need to develop to cope with climate threats; and the social transformations implied by adaptation to climate change. The climate challenge, from sources to effects to responses, is profoundly social. Adaptation is not about external natural causes imposing risks and costs on a distinct, separate social domain, mainly mandating technocratic solutions; it is about the social definition of what is at risk, what and who require protection, and what values are at stake in proposed responses to climate change. Certainly, technological and technical aspects exist, but vulnerability, developing adaptive capacity, achieving climate resilient development, and transformational change are inherently political, economic, social, and cultural phenomena.[71] Therefore, meanings and valuations vary by class, race, gender, and other identities.[72] Technocratic approaches, while possibly helpful in certain cases, will occur within a wider social and political context in which the meaning and significance of adaptation in all its dimensions is contested.

Table 1.1 displays definitions of adaptation from major policymaking bodies.[73] The IPCC, UN Environment Programme (UNEP), and UNFCCC see adaptation as "adjustments," while the UN Development Programme (UNDP) and UK Climate Impacts Programme (UKCIP) focus on "process," and the US government emphasizes actions to reduce risk. The common element is reducing the amount of harm from a warmer climate, while taking advantage of opportunities to benefit. Some adjustments will occur in response to experienced climatic changes such as shifting planting times as growing seasons reliably begin earlier in the year. Other adjustments can also take place in anticipation of future

Table 1.1 Definitions of Adaptation

Entity	Definition of Adaptation
Intergovernmental Panel on Climate Change (IPCC)	Adaptation, in response to current climate change, is reducing climate risks and vulnerability mostly via adjustment of existing systems. Climate-resilient development integrates adaptation measures and their enabling conditions with mitigation to advance sustainable development for all. Sixth Assessment Report (AR6)
UN Environment Programme (UNEP)	The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.
UN Framework Convention on Climate Change (UNFCCC)	Adaptation refers to adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects. It refers to changes in processes, practices, and structures to moderate potential damages or to benefit from opportunities associated with climate change.
UN Development Programme (UNDP)	Adaptation is a process by which strategies to moderate, cope with, and take advantage of the consequences of climatic events are enhanced, developed, or implemented.
UK Climate Impacts Programme (UKCIP)	Adaptation is the process or outcome of a process that leads to a reduction in harm or risk of harm, or realization of benefits, associated with climate variability and climate change.
US Fourth National Climate Assessment	Adaptation refers to actions taken at the individual, local, regional, and national levels to reduce risks from even today's changed climate conditions and to prepare for impacts from additional changes projected for the future. Adaptation is a form of risk management.

impacts such as strengthening building codes in expectation that extreme storms will occur more frequently. Regarding the process, the IPCC and various scholars have suggested establishing new policymaking bodies or inclusive decisionmaking procedures that pay greater attention to the experienced and anticipated impacts of climate change.

In the most recent IPCC report, adaptation is explained as follows:

> Adaptation plays a key role in reducing exposure and vulnerability to climate change. Adaptation in ecological systems includes autonomous adjustments through ecological and evolutionary processes. In human systems, adaptation can be anticipatory or reactive, as well as incremental and/or transformational. The latter changes the fundamental attributes of a social-ecological system in anticipation of climate change and its impacts. Adaptation is subject to hard and soft limits.[74]

Benjamin K. Sovacool and Björn-Ola Linnér identify four major areas for adaptation: infrastructural, institutional, community, and ecosystem. Respectively, they encompass such measures as building stronger water barriers, improving early warning systems, land use planning, and conservation.[75]

In addition to incremental and transformational adaptation, the IPCC has also suggested the possible need for transformational change. Transformational change addresses the institutional, ideological, and ethical contexts for adaptation decisionmaking, raising questions about economic and social institutions, as well as the beliefs and behaviors shaping a society's vulnerability and responsiveness to climate challenges. The IPCC asserts, "In cases where current development pathways are considered as the root causes of climate risk and vulnerability, transformation of wider political, economic, and social systems may be necessary."[76] It goes without saying that such profound change will disturb the status quo, including interests that benefit from existing arrangements.

Vulnerability

The degree to which adaptation is necessary depends on several factors, beginning with vulnerability.[77] An entity (individual, group, community, region, nation, the planet) faces climate risks to the extent it is vulnerable to adverse climatic changes. The IPCC defines *vulnerability* "as the propensity or predisposition to be adversely affected," encompassing "a variety of concepts and elements, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt."[78] Vulnerability, then, is an attribute of the entity being affected. Something about its makeup renders it more or less likely to be adversely affected when some external factor changes. In the context of adaptation to climate change, as global temperatures rise, the more vulnerable communities will experience greater harms than those less vulnerable due to some set of attributes pertinent to those communities. Perhaps the most often cited factor to explain differences of vulnerability is poverty. Poor communities pre-

sumably have more weaknesses that will lead to greater harms from a given rise in global average temperature than a wealthier community would experience.

Adaptation policy tends to assume that the poor developing countries, many in Africa, are most at risk, requiring help from developed countries. This orientation can have the effect of rendering adaptation a technical matter in which experts guide investment in projects benevolently funded by wealthier countries to help the poor while avoiding questions of the systemic sources of the problem. Consequently, adaptation is understood mainly as "formal public sector interventions or programs," strengthening the role of policymakers and experts, shifting responsibility to local technical solutions "rather than in social struggles," marginalizing voices of the less privileged in the climate discourse.[79] Thus, adaptation policy in international negotiations tends to reproduce the parameters of the broader development agenda, in which the policymakers and experts are mainly from the Global North, providing guidance and technical advice to less capable leaders and communities in the Global South.

Vulnerability depends, in turn, on exposure. A society or community could harbor serious weaknesses in regard to climate change, but they would never manifest if there is no experience with the hazard or threat. To illustrate, a community might be ill-prepared to cope with high winds from extreme weather events, but if it never experiences them, its vulnerability will not become apparent.[80] The climatic effects of global warming vary considerably across locales, so the form that vulnerability takes varies as well. The effects of global warming will increase as temperatures rise. A community that enjoys low vulnerability today because the risk of exposure is low might not be so well situated in the future. Thus, vulnerability is a dynamic phenomenon requiring forward-thinking policy responses.

Further, vulnerability varies according to an affected entity's capacity to respond to a negative impact, which is termed resilience.[81] The IPCC defines *resilience* "as the capacity of social, economic, and ecosystems to cope with a hazardous event or trend or disturbance, responding or reorganising in ways that maintain their essential function, identity and structure as well as biodiversity in the case of ecosystems while also maintaining the capacity for adaptation, learning, and/or transformation."[82] In the natural world, this relates to an ecosystem's capacity to restore itself to its former state after some major disturbance. For example, a forest fire dramatically changes a region's ecology. In some cases, a predictable sequence of changes follows, restoring

the forest to something like its previous state. But it could be that such a sequence never occurs and the ecosystem is permanently changed. The latter would be the less resilient, thus more vulnerable, forest. The same might apply to human societies, in which some can absorb a blow and return to some kind of preshock state, while others might be destroyed altogether. Enhancing resilience is an element of adaptation policy. Yet it is not certain that restoring a social system to its preshock condition is a desirable goal, which introduces debates over visions and values to the meaning of resilience.[83]

In sum, "In all formulations, the key parameters of vulnerability are the stress to which a system is exposed, its sensitivity, and its adaptive capacity."[84] Vulnerability, the IPCC notes, varies within and across regions due to "patterns of intersecting socio-economic development, unsustainable ocean and land use, inequity, marginalization, historical and ongoing patterns of inequity such as colonialism and governance."[85] Thus, vulnerability results from historical, social, political, economic, and cultural factors. As such, reducing vulnerability will require institutional remedies and is not merely a technical problem.

Adaptive Capacity

One element of reducing vulnerability and increasing resilience is to enhance adaptive capacity; this provides the link between vulnerability and adaptation.[86] *Adaptive capacity* is defined as "the property of a system to adjust its characteristics or behaviour, in order to expand its coping range under existing climate variability, or future climate conditions."[87] Adaptive capacity encompasses the resources needed for effective adaptation and the ability to mobilize those resources effectively. The latter includes both properly functioning policy formulation and implementation processes, and ability to overcome barriers to adaptation arising from external sources. In short, write Stephen R. Carpenter and William R. Brock, adaptive capacity is "the ability of a system to adjust to changing internal demands and external circumstances."[88]

Adaptive capacity is, in part, about gathering relevant information. This includes specification of the various social and ecological entities facing climate risks and hazards, and the options available for coping with these threats. Climate scientists, doctors, and engineers can use pertinent, quality information to recommend appropriate measures to reduce vulnerability and enhance resilience. The scholarly and policy literature has put considerable weight on the need for more and better

research, and dissemination of the findings to the public. But adopting and implementing responses is a matter for policymakers in a political context. Accordingly, adaptive capacity means turning useful information into action, an uncertain process to be sure. If, for example, the IPCC's frequently stated view that inequality is a significant barrier to successful adaptation were to be taken seriously, then major changes would follow in social policy, taxation, income redistribution, wages, profits, and all the other elements of today's global civilization that have led to unprecedented wealth alongside deep poverty. But against entrenched interests, such changes are unlikely to occur. This would suggest that the adaptive capacity of current global institutions is low, no matter the quantity and quality of information about the problem. Needless to say, knowing that inequality undermines adaptive capacity has not led to extensive changes in institutions and practices.

Assessing adaptive capacity (and related dimensions of adaptation) requires first identifying the system of interest, whether at the local, regional, or global level.[89] This book is pitched primarily at the broadest level of concern; namely, civilization as we know it. Thus, the system of interest is of a global scale, and it has certain valued attributes that successful adaptation would preserve and enhance. Consequently, the question of whether today's prevailing institutions and practices possess sufficient adaptive capacity is, in some respects, about whether the global order is at risk and, if so, whether it can save itself.

Adaptive capacity requires key actors to accept that climate risks exist and that they are responsible for taking steps to cope with climate change effects. By the same token, contrary ideologies, vested interests, political ambitions, and other priorities can reduce adaptive capacity, leading to suboptimal adaptation policies. As Nick Brooks and W. Neil Adger observe, "Large scale structural economic factors and prevailing ideologies, therefore, play a vital role in determining which adaptations are feasible."[90] Thus, the major barriers to sufficient and effective adaptation lie in social and economic relationships and the ideas that support them.

What is the large-scale economic structure today, and what is the prevailing associated ideology? For now, suffice it to say that both structure and ideology can be captured in the word *neoliberalism,*[91] the predominant social and economic orientation of global and national affairs for the past four decades. Of course, the term *neoliberalism* is not synonymous with civilization, which existed before the current iteration of economic and social policy. Whether civilization as we know it can survive this neoliberal phase is at issue.

Do today's neoliberal structure and ideology have sufficient adaptive capacity and, thus, are they suited to long-term successful adaptation to climate change? If not, then transformational change of the global order would be required to meet the challenge. Significantly, adaptive capacity is about a system's ability to cope with external changes (a changing global climate, for instance) and to manage internal changes as well. Thus, questioning the adaptive capacity of today's prevailing institutions and ideologies is about more than their ability to cope with a changing climate. It is also about whether a system has the resources and capacities to change itself; that is, whether a system has the attributes and resources necessary to change internally so as to cope with the external challenge. On one hand, the power of entrenched interests, the weight of global institutions, and the pervasiveness of neoliberal ideology would suggest that today's social and economic order faces barriers too great to achieve internal transformation. Thus, the current ecological crisis might be beyond the adaptive capacity of any form of capitalist system. On the other hand, a broad historical perspective suggests that global capitalism has overcome limits on its development, including ecological limits, and might do so again.[92] Moreover, the fact that capitalism exists in a longer historical record indicates that broad social transformations can and do occur, and there is no reason to believe that capitalism is the last chapter in the story of humanity.

Transformation

Reducing vulnerability, enhancing resilience, and increasing adaptive capacity require political, social, economic, cultural, and institutional responses.[93] If today's global order lacks the adaptive capacity to prevent the collapse of civilization, then political, social, economic, and cultural institutions must look very different from current configurations. Consequently, calls for transformation are ubiquitous in the scholarly and policy literature on climate change. The IPCC's most recent report, for example, recommends transformational adaptation that will enable fulfillment of the Sustainable Development Goals.[94]

What constitutes the term *transformation?* Definitions vary widely, ranging from relatively small changes in a local community's decision-making processes to sweeping global changes in the institutions and values of the modern world. The meaning of transformation will be explored in depth in Chapter 4. Here, it is sufficient to note two contexts in which the IPCC has employed the term: transformational adaptation and transformational change.

Both incremental and transformational adaptation are about the measures taken to enhance resilience, reduce vulnerability, and increase adaptive capacity. Incremental and transformational adaptation lie on a continuum, "with no sharp division between them."[95] Nonetheless, useful distinctions exist. Incremental adaptation, which modifies existing systems without changing their basic features, refers to such actions as building a seawall to protect coastal installations as sea level rises. Transformational adaptation would encompass such measures as modifying land use regulations and instituting a managed retreat from the coast as sea level rises. Incremental adaptation maintains existing institutions and ways of life with marginal changes to limit the harms and take advantage of whatever opportunities climate change might create. It would not include significant redistribution of wealth and income, new forms of decisionmaking, or fundamentally different values. Transformational adaptation does call on societies to make significant changes such as relocating the community and changing economic pursuits. Together, incremental and transformational adaptation constitute the menu of options available to reduce social vulnerability to climate change. Selecting and implementing these forms of adaptation is contested: "A critical question then is how a better understanding of the political processes inherent in adaptation can help facilitate transformational adaptation, or alter the fundamental attributes and processes in society driving vulnerability (as well as rising emissions)."[96]

However, the IPCC recognizes that institutional factors might thwart both incremental and transformational adaptation measures.[97] Current development pathways, the IPCC says, could foreclose adaptation options that would limit adverse effects of climate change. Usually unstated in IPCC reports is that current development pathways are based on endless economic growth, markets, capital investment for profit, and the rest of the neoliberal prescription. Consequently, enabling appropriate, effective incremental and transformational adaptation could require fundamental reconfiguration of those institutions to the extent that they reduce society's capacity to respond. Institutional reforms that would enable making decisions and taking effective actions to put communities, countries, and the world on new development pathways is termed *transformational change*.

While avoiding a detailed description of the institutions, ideological paradigms, values, and development pathways standing in the way of both incremental and transformational adaptation, the IPCC does recognize that transforming them will be disruptive and divisive. In AR5, the IPCC wrote, "Transformational change can threaten vested interests, or

prioritize the interests of some over the well-being of others, and it is never a neutral process, and it follows that transformation must be negotiated in the 'political sphere.'"[98] The concept of transformational change, while less prominent in AR6 than in AR5, provides an avenue to thinking about the aspects of prevalent global institutions that now and in the future will hinder adaptation to a much-changed climate. In other words, current institutions might face hard limits on their capacity for adaptation. To identify, choose, and implement necessary adaptation measures beyond the hard limits of existing institutions, then, could entail different institutions that do not face those hard limits. For example, if the commitment to endless economic growth driven by the profit motive is the institutional feature disabling appropriate incremental and transformational adaptation, then that commitment must give way to economic imperatives in line with climate adaptation needs; degrowth, for example.

In sum, the IPCC has employed the term *transformation* in two ways, one to refer to the measures taken to adapt society to a changed climate, the other to refer to the broader institutional framework within which decisions about adaptation are made. In most instances, incremental adaptations can be implemented without transforming social institutions, but that might not be true of transformational adaptations. As the climate crisis becomes more acute, the need for transformational adaptation will rise, and thus the adaptive capacity of current development pathways and institutions will come into question. Responding might require transformational change. Thus, the climate crisis poses the deepest questions regarding what kind of society we want.

Climate-Resilient Development

Building on a concept introduced in AR5, the IPCC lays greater stress in AR6 on climate-resilient development (CRD). Broadly, climate-resilient development seeks to integrate mitigation, adaptation, and sustainable development to enhance human and ecological well-being. The IPCC notes, "Current development pathways combined with the observed impacts of climate change, are leading away from, rather than towards, sustainable development."[99] Further, inequalities arising from gender, poverty, race, ethnicity, location, religion, and age increase vulnerability and reduce the adaptive capacity of societies and communities. Integrating various aspects of adaptation, the IPCC suggests that combining adaptation, mitigation, and sustainable development can make "all three more effective," as mitigation reduces the hazard while

the other two reduce exposure and vulnerability. Adaptation and development work together to protect societies from climate change, as adaptation overcomes barriers to development while development expands the resources available to respond.[100] Choices made in the immediate future will determine future pathways, so time is growing short to transition to CRD.

Achieving CRD mandates rapid systems transitions in energy, industry, urban areas and infrastructure, land and ecosystems, and society. Such transitions, the IPCC asserts, "can widen the solution space and accelerate and deepen the implementation of sustainable development, adaptation, and mitigation actions by equipping actors and decision-makers with more effective options."[101] However, this will require considering a broad range of priorities, policies, and practices, moving beyond technical solutions and specific projects to giving attention to "the role of non-climate policies, social norms, lifestyles, power relationships and worldviews in enabling climate action and sustainable development."[102] Thus, AR6 is considerably more concerned than previous reports with questions of justice and equity. Yet what one does not find in the executive summary to the chapter on CRD, nor much anywhere else in the 3,675 pages of the full report, is elaboration of the characteristics of current development pathways blocking CRD, nor what would constitute a future post-transition society enabling CRD for all.[103]

The Stakes

What is at stake in the climate policy debate? Leaving aside those who deny that a problem even exists, the least alarmist view is that societies will have to adjust to serious, but manageable, effects of changing climate patterns, with those changes advancing gradually over the coming decades.[104] Some estimates of the economic impact of climate change, for instance, suggest that it could result in a reduction of potential world output by less than a few percentage points.[105] A small reduction in the growth of world output would not indicate the need for sweeping institutional reform. In the absence of significant economic effects, changes in other institutions and practices are likely to be incremental as well. Certainly, some regions and communities will experience greater impacts than others, but assistance can be provided to them while the broader social and economic framework continues as before.

However, many analysts project a much more dangerous future. For them, the observed effects of rising global temperature and expectations

of higher temperatures in coming years indicate that the impacts will be disruptive, requiring major adaptation efforts in every region of the world and in every sector. Recent statements by climate scientists and other experts assert that a global crisis is coming unless rapid, deep reductions in GHG emissions are implemented along with many other measures to protect the ecosphere. An article signed by more than 11,000 scientists stated that the world needed to change its priorities from increasing economic output to sustainability, ensuring provision of basic needs to all people, and reducing inequality.[106]

Failing to do so, say some, could result in the collapse of civilization. Johan Rockström, a leading figure in research on sustainability, observes that we live on a small planet on which growth has become unsustainable and we are crashing through planetary boundaries, requiring a grand transformation if we are to remain within the planet's necessary conditions for civilization.[107] Transgressing planetary boundaries means that the Holocene conditions favorable to human civilization will no longer exist. The internationally agreed 2ºC threshold presumably would provide tolerable conditions for the continuation of civilization more or less as we know it. Failing to stay somewhere near that limit as a maximum would produce a climate incompatible with modern society. This is not a prediction of human extinction, but it could suggest a return to the Stone Age. Some observers do consider extinction of the human species, along with many other species, to be a real possibility.

If the problem is grave, the response must match the challenge, meaning transformation of global institutions, which has been well and frequently expressed regarding mitigation. Targeting one aspect of the problem, Peter Dauvergne writes, "The unsustainability of global wealth creation is the underlying reason for the coming crisis of planetary instability."[108] Confronting the accumulation of wealth in a few hands would represent a revolutionary moment in world history, and that is only one aspect of the many social, economic, and cultural changes that would be required to achieve long-term sustainability. For another, the global ideology of consumerism would come into question. Leslie Sklair observes, that shopping, advertising and consumerism have been among the most successful and influential social forces in history."[109] Sklair further asserts that "the transnational capitalist class can be held responsible for ecological unsustainability because of its insatiable appetite for economic growth, and that, through the culture-ideology of consumerism, it exerts tremendous pressure on everyone on the planet towards consuming finite resources."[110] Consequently, if the crisis is to be severe enough to threaten civilization, then the response

would demand challenging the growth imperative and its essential counterpart in the global ideology of consumerism. This is straightforward regarding mitigation, but adaptation too could call for significant institutional transformation.[111]

Theory and Climate Politics and Policy

How are we to understand adaptation to climate change theoretically? Approaches to the global politics of climate change adaptation encompass general theories of international relations (IR) and theories focusing on global environmental politics. The general theories—realism, liberal institutionalism, constructivism—tend to see the environment as an issue area like security and international political economy. Thus, the success or failure of adaptation to climate change would be understood as the outcome of the same forces, such as the balance of power, that explain wars, foreign trade, monetary relations, and the entire agenda of international relations. Other theories see unique attributes of environmental policy and politics, calling for theories that are explicitly ecological in orientation. For some, the environment is entwined with human society; theory should recognize the ecological basis for human society and that the unit of analysis is a socioecological system. The environment is not an issue area for political leaders to manage. Rather, it constitutes the social world.[112]

IR Theories

Influential general theories of international relations emphasize different aspects of global affairs: power, interests, institutions, cognitive factors, and class relations. Contending IR theories imply significantly different expectations regarding the future of climate policy and adaptation to climate change.[113]

Realists focus on power, arguing that the anarchy of the international political system requires states (the most important actors) to defend their security and survival against the military threats of other states. The upshot is that the balance of power explains behaviors and outcomes in world affairs. The rise of global environmental challenges changes little because security-seeking states must prioritize military preparedness and other enhancements of their power. When international cooperation does occur on nonsecurity issues, it is because powerful states cajole and pressure other states to abide by the norms and

principles they favor in a given issue area. However, such collaboration is likely to be fleeting, swept away when the balance of power shifts to a less favorable configuration, or an international security crisis demands states' attention and efforts.[114] A realist point of view would thus suggest considerable skepticism that a decades-long global program to mitigate and adapt to climate change is feasible. Indeed, by 2100, we can expect that a major international security crisis, perhaps a world war, will have destroyed whatever climate policy framework states can manage to implement. If the war itself does not ruin civilization as we know it, the lack of measures to address climate change and the probability that the postwar climate situation would be even worse would finish the job. In any case, for realism, nothing changes in the essential character of world politics: the struggle for survival and power abides, and it thwarts effective responses to a plethora of social, economic, environmental, and political problems. Thus, realist theory would predict that global policy to mitigate and adapt to climate change will be, to the extent it requires international cooperation, weak, short-lived, and low priority compared to security and economic strength. Such adaptation as occurs would be mainly national and local responses to adverse effects, meaning the large funding requirements of poor and developing countries likely would not be met.

Liberal institutionalism is another important mainstream theory, not as pessimistic as realism and more open to the possibility of system change. Liberal institutionalism, like realism, begins analysis by positing an international system dominated by states. However, the theory sees other significant actors, such as multinational corporations, nongovernmental organizations, intergovernmental organizations, and social movements. Moreover, liberal institutionalism suggests that states can and do pursue the national interest through cooperative arrangements of various kinds. Importantly, liberal institutionalism is open to the idea that the international system changes, so the play of power and the threat of war is not the eternal destiny of humanity.

Much of liberal institutionalist research has focused on "international regimes"[115] as the mechanism for overcoming barriers to cooperation and stabilizing collective efforts to cope with common problems. International regimes institutionalize norms, rules, principles, and procedures that facilitate cooperation in a given issue area. States establish them because they are rational actors and they see cooperation as the rational way to achieve their interests. Thus, liberal institutionalism is more optimistic than realism because it has a different view of rational behavior, not because it expects altruistic behavior by

states. In this framework, the climate challenge is an issue area in which an international regime can enable cooperative efforts to mitigate and adapt.[116] Whether institutions do in fact come into being, how they change, and whether they are effective are empirical questions and, regarding climate change, evidence of international institutions making a difference is scarce.

Constructivism emphasizes cognitive factors in the making of world politics. The premise is that human beings form social relations and produce meaning collectively, and failing to take account of that aspect of social life hinders understanding of how international politics are constituted and changed.[117] For constructivism, the material factors stressed in other theories are significant only in regard to how they are defined, understood, and evaluated in social interactions. For example, consider the end of the Cold War. In 1987, the two superpowers held their nuclear arsenals on high alert and relied on mutual assured destruction to deter the other from attacking. This seemed to represent a prime example of how power resources determine relations between states. Yet in a few years, the nuclear antagonists had completely redefined their understandings of one another and had taken their forces off high alert. Nothing in the material circumstances had changed; the change was entirely in the realm of identity and meaning. The United States and the Commonwealth of Independent States that succeeded the Soviet Union came to see one another as friendly rivals rather than bitter enemies, which in turn altered understandings of the importance of material power resources.

Constructivism challenges both realism and liberal institutionalism and their shared assumption of rational actors pursuing their interests. Interests are not given by material factors; they are the product of definitions of self and other, normative consensus and conflicts, and common understandings of appropriate behavior in a given context. Consequently, the critical task for IR theory is to explain and account for interests, not to assume them, and this requires attention to the social construction of reality. For constructivism, revealing the cognitive foundations for identity and interest does most of the work, and analysis of rational action by self-interested states and other actors becomes a rather uninteresting afterthought. Indeed, a more interesting question is how norms become so strong that they constitute background conditions for appropriate social action, taken for granted rather than negotiated anew as issues arise.

Constructivism has addressed various aspects of the climate issue. Examining the character of scientific knowledge indicates that the gap

between uncertain scientific understanding of climate change confronts public expectations that science can provide clear, objective, reliable, and authoritative knowledge about important questions.[118] Further, constructivist analysis investigates the manner in which "post-truth" ideas such as climate denialism emerge.[119] In other work, constructivism informs understanding of institutional fragmentation as "normative contestation for strategic social construction."[120] Specifically, the Asia-Pacific Partnership on Clean Development and Climate arose to contest the normative dominance of the UNFCCC with new competing norms, discourses, policies, and ideas. Another influential line of research explores the role of "epistemic communities" in the development of environmental policy and in fostering international cooperation.[121] An epistemic community exists when a body of informed experts reaches a consensus on the nature of a problem and on what should be done about it. The epistemic community exerts influence on policymakers so states arrive at a consensus on which they can agree to take collective action. Presumably, the epistemic community of climate scientists and other experts would provide the knowledge about the causes and effects of climate change, and the appropriate measures to cope with it.

Finally, the diverse, far-ranging body of research going under the broad heading of critical theory, including world-systems theory, Marxism, feminism, and others, investigates the ideological and material aspects of global capitalism that produce ecological crises. These perspectives assert that most theoretical orientations to world affairs reinforce the status quo by not questioning the social relations giving rise to inequality, poverty, racism, sexism, and other injustices. Mainstream research tends to take the world as it is and to conduct analysis of the behavior of individuals, firms, states, and other actors using such tools as statistics to discern patterns, as well as cause and effect. By contrast, critical theory asks how these actors and social relations came into existence, it questions unjust aspects of the existing social order, and it posits possibilities for change and transformation.[122] Envisioning alternative historical trajectories and potential futures is not feasible within the confines of empirical social science reliant on observation of the existing state of affairs. Yet, argue critical theorists, discerning the hidden motors of history, projecting where the world is going, and suggesting where it could go is an essential part of social theory, including research on the social, economic, political, and cultural aspects of climate change. As Matthew Paterson observes, alternative theories "allow us to talk about capitalism, which helps us to place the politics of global

warming in a context other than the abstracted formal anarchy of realists and liberal institutionalists."[123]

Ecological Theories

Some students of global environmental politics have argued that the environment presents unique theoretical challenges that cannot be encompassed in international relations theories aimed at explaining all issues in terms of the attributes of the state system. Thus, green theory has emerged, often drawing on other theoretical currents while maintaining the distinct character of environmental politics. Green theory suggests that the environment is more than an issue area; it is an essential prior condition for human society to function, and as such it must be part of the theoretical constructs for comprehending environmental politics. "Marx's account of capitalist production only makes sense when we start to fill in its background conditions of possibility," one of which is a natural world capable of providing natural resources and livable conditions.[124] Green IR theory challenges the mainstream theoretical view that sees the environment as another issue area like all others in four ways. Green IR theory questions the implicit normative content of mainstream theory, casting doubt on its claims to objectivity. In addition, green IR theory observes that rationalist approaches such as liberal institutionalism have not been very successful at explaining global environmental politics. Green IR theory also reveals the actors and institutions that stand in the way of ecological policies, in particular industry-dominated international regimes. Finally, challenging the state-centric orientation of rationalist theory, green IR theory documents the important roles of nonstate actors in environmental norms, policy, and action.

Green theory deploys a number of important concepts to understand global environmental politics. The tragedy of the commons portrays the contradiction between individual incentives and desirable collective outcomes. The tragedy of the commons draws on rational choice models to explain why environmental degradation and overuse of resources occur. The explanation implies, in turn, policy prescriptions. The *commons* refers to any collectively held resource to which access is not limited and overuse can occur. A pasture land, for instance, that is held in common would be available to all farmers wanting to allow their herds to graze. But self-interested maximization of the use of the pasture can result in degradation until no grass remains. Likewise, fishing on the high seas and various other resource

issues follow the same logic. The capacity of the planet's atmosphere to absorb GHG is also a common asset, which we are overexploiting, resulting in rising temperatures. The policy responses include such measures as establishing authoritative management of the commons (perhaps even a government), creating individual property rights, and strengthening norms of appropriate behavior.

The concept of externalities points to another problem especially pertinent to environmental issues. In some cases of environmental harms, the problem is that costs are imposed on third parties. A factory produces goods that customers buy, and ideally, the costs of production would be fully reflected in the price of the commodity. But if the factory can dump pollutants on others at little or no cost, it can cut its prices so as to beat the competition, and the price will not reflect all the costs of production. The factory owner and the customer benefit at the expense of those bearing the cost of the pollution. Many environmental issues entail externalities such as transborder air pollution. Adaptation to climate change displays the characteristics of externalities, in that the parties primarily responsible for causing the problem can transfer the costs to those enduring the greatest impacts, those who usually contributed little to causing the problem.

Environmental issues have raised the question of whether economic growth can continue endlessly or, instead, the global economy faces limits to growth. Capitalism, which requires profits to function, appears to need constant economic growth to avoid a crisis. Yet resource and environmental limits might mean that growth cannot continue without end. If growth depends on resource use, then running out of important resources, such as oil, could halt economic growth. By the same token, climate change could create such disruption for human society that normal business cannot carry on as usual.

Beyond limits to economic growth, scientists have asked whether human activities will transcend planetary boundaries, possibly threatening human civilization or even the survival of the species. Of nine critical planetary boundaries, several, including climate change and the loss of biodiversity, have been crossed. Failing to reverse the trends toward crossing more planetary boundaries will be dangerous.

The concept of sustainable development seeks a way to meet these challenges. Sustainable development calls for development that serves the needs of current generations while protecting the rights of future generations. The goal is to conserve resources and rely on renewables so that future generations will have what they need to enjoy a dignified life.

By the 1990s, several forms of green theory had developed. One strand of green theory mounted a critique of capitalism and Soviet-style communism. Both, greens argued, were committed to an ecologically harmful policy of industrialization and growth. Greens rejected the idea that nature was a storehouse of resources for human use, and that nature should be manipulated to provide for human needs, a failing they saw in industrial society, whether capitalist or socialist. Another strand of green theory, drawing on environmental ethics and philosophy, questioned the devaluing of nonhuman creatures and ecosystems; ecocentric and biocentric theory asserts that humans have obligations to treat nature properly.[125] Critical theorists have also addressed the instrumental reason that drives technological industrialism. *Instrumental reason* seeks technical solutions to largely unexamined social ends such as more production. The critical perspective, by contrast, questions whether the ends sought are truly rational in regard to human needs and values. An obsession with growth and development that leads to ecological crisis and possible collapse of human civilization is obviously not rational.[126]

But the fact that so many people are still in need poses a dilemma for green theory. If ecological protection requires zero growth, then how are the pressing needs of those in extreme poverty to be met? Is not economic growth the most feasible answer to poverty today? The green response is that more democracy might improve distributive justice while also curbing ecologically destructive economic growth.[127] Thus, some green theorists have emphasized a more open democratic process by which social ends are chosen and pursued, and this point of view has been incorporated in the IPCC's reports. Further, green theory has increasingly focused on the transnational nature of ecological challenges. This research has produced new conceptions of environmental justice, rights, democracy, activism, citizenship, and governance. Green theory has emphasized the need for environmental justice, which requires inclusiveness, broad participation, application of the precautionary principle, fairness in distributing risks, and compensation for those suffering environmental harms.[128]

Green theory from the left, here labeled ecosocialism, encompasses a wide range of perspectives on how best to address the ecological challenge. As noted, liberal institutionalism considers environmental problems to be issues requiring international cooperation among states, and it often calls for more democracy and appropriate regulation of economic activity. Such views can entail significant reforms, but they do not challenge the fundamentals of the global political economy. Ecosocialism, by contrast, asserts that the ecological crisis cannot be

met within existing institutions, that transformation of the global system is necessary to head off ecological collapse. "Capitalism," writes Chris Williams, "is an economic system profoundly and irrevocably at odds with a sustainable planet as it requires ever-greater material and energy throughput to keep expanding."[129]

Several major propositions define the ecosocialist orientation. First, ecosocialists offer a critique of capitalism, intending to show that capitalism creates the ecological crisis and is inherently incapable of solving it. Second, Marxist ecosocialists recover important statements in Karl Marx's work, and themselves advance the development of Marxist thought, to show that Marx and Marxism encompass ecological concerns. Third, ecosocialists argue that the choice before the world is stark: either make a planned transition to a sustainable socialist society, or face the collapse of civilization due to ecological crisis.

Ecosocialists tend to agree that the world has entered a new geological epoch known as the Anthropocene.[130] From the end of the last Ice Age until recently, the world had been in the Holocene, a time with a relatively mild and stable climate that has facilitated the development of agriculture and the rise of civilization. Now, scientists suggest, human impact on the environment has become so great that the planet has entered a new geological era. Humans have changed the climate and changed the global environment in other ways that can be detected just as could previous changes from one period of natural history to the next. The question is whether the Anthropocene will be as compatible with human civilization and survival as the Holocene. Ecosocialists have serious doubts, especially if capitalism remains the prevailing socioeconomic system. Global capitalism will exacerbate the trends that have brought the world to the Anthropocene and cannot solve the problems that will arise in this new world.

Ecosocialist thought highlights that modern capitalist society rests on a consensus on the growth imperative. Capital, of course, demands the conditions for capital accumulation. The state serves this need. Labor, seeking higher wages and more jobs, agrees with capital that the avenue for achieving those ends is economic growth, and it joins capital in demanding that the state maintain pro-growth policies. Thus, the main players in a capitalist society prioritize growth over environment, and support for environmentally sound policies is weak. However, the development of capitalist production and accumulation inevitably begins to reduce working class incomes and impose ever greater environmental costs on communities. As Peter Newell observes, "Perhaps more than any other environmental issue, climate change has forced

centre stage the question of the compatibility of capitalism's structural requirement to grow with efforts to keep global warming within tolerable limits."[131] Thus, while expanding production sustains capitalism for the short term, in the long term it creates crisis conditions.

As noted, the first wave of green theory criticized Marxism as well as liberal theory for promoting maximum production of goods and services as the path to a good society. Critics found in Marx's own writings justification for the idea that Marxism celebrated socialism because of its superiority over capitalism in productivity, even though production would be for working people rather than for capitalists. Consequently, critics said, Marxist thought was as guilty of promoting unrestrained exploitation of nature as theories supporting capitalism. Prominent Marxists responded to this critique. They discerned in the work of Marx and other Marxist authors—notably, Marx's lifelong collaborator, Friedrich Engels—resources for a Marxist ecology. John Bellamy Foster and Brett Clark have written at length about Marx's work on the metabolic rift that capitalism creates between society and nature.[132] They cite pithy remarks that Marx and Engels made about capitalism's propensity to degrade the soil and heedlessly exploit nature to accumulate capital. For example, Engels wrote, "Let us not, however, flatter ourselves overmuch on account of our human victories over nature. For each victory nature takes its revenge on us."[133]

Yet these mainly Western ecosocialist Marxists had to address the reality of societies that claimed to be based on Marxist principles, such as the Soviet Union, that also had dismal environmental records. The Chernobyl nuclear accident lifted the veil on environmental damage in the Soviet Union. Marxists asserted that this sorry record did not reflect Marx's views, rather the distortion of Marxism initiated by Joseph Stalin. But the negative example of "actually existing socialism" compiling such a poor environmental record was hard to deny. China's rush toward economic expansion while claiming to be socialist has presented further problems for advocates of ecosocialism.

Even so, ecosocialism insists that capitalism cannot resolve the ecological crisis, at least not in a humane, rational manner. The entire flawed system must be replaced. This will probably require a complete revolution in the hitherto existing mode of production, and simultaneously a revolution in the whole contemporary order, excising the profit motive from society in favor of economic relations that serve the vast majority of workers whose labor is essential to production. Corporate ownership of land must be abolished, and a conscious plan to utilize science and technology in harmony with nature must be implemented.

Despite the poor environmental records of ostensibly socialist societies, the coming ecological crisis induced by capitalism will require an ecosocialist alternative if civilization is to survive.

Advocates claim the society built on ecosocialist principles that would replace capitalism would be truly sustainable. It would embrace renewable energy, efficient use of nonrenewable resources, waste reduction, and production for rational needs rather than artificially created wants. It would end the diversion of material resources to immense, mutually destructive defense spending. A sustainable ecosocialist society would be democratic—debating, adopting, and implementing measures chosen by the majority rather than a handful of corporate, military, and political elites. This would all certainly constitute transformational change. The question of feasibility, however, becomes central to such a program.

Plan of the Book

The central concern of this book is the institutional requisites for effective, equitable adaptation to climate change. The premise for the work is that efforts to reduce global warming have largely failed so far and are likely to see little more success in the future. Consequently, the burden of responding to climate change will fall increasingly on the adaptation side of the ledger. This has become more fully recognized in policy negotiations as well as scholarly literature. While adaptation at one time might have been seen as a less demanding response to global warming than mitigation, it has become clear that adaptation could require profound transformation of global social, political, and economic institutions. However, this transformative potential of adaptation has often been obscured in official discourse.

The approach taken in this book is to recount the development of policy and politics concerning adaptation, to show the points at which adaptation has been tamed and put in service to the institutional status quo, whereas its transformative implications might have been, and still could be, put front and center. Chapter 2 examines the early years of adaptation policy from the landmark 1992 Rio conference through the adoption of the Cancun Adaptation Framework in 2010. Chapter 3 examines the years from Cancun through the important 2015 Paris conference to the present. Chapter 4 considers in depth various understandings of transformation, focusing on institutional change. Chapter 5 examines the relationship between adapta-

tion and capitalism, finding that proposals for some form of ecological modernization are unlikely to meet the challenge. Chapter 6 surveys and analyzes proposals for social transformation, such as ecosocialism, that seek to preserve civilization while putting it on a new, more ecologically sound foundation. The seventh and final chapter considers whether the climate crisis portends an end to civilization and what adaptation means in such a context.

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