Introduction: climate change and ethics

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This book is an interdisciplinary collection of mainly normative essays written by philosophers, scientists, legal scholars, and an economist. The complex intergenerational ethical issues that climate change raises have been the subjects of a significant body of recent scholarship.[1] The original scholarship collected in this volume is distinctive in that this is the first second-generation collection of essays to appear on the ethics of climate change. The contributors to this volume engage and respond to the first-generation literature, and because climate change is perhaps the largest collective action problem ever confronted by humanity, several contributors argue for new ways of conceptualizing our ethical obligations in order to address a problem of this scope and difficulty. This volume is also the first in which a group of scholars critically engages the outcomes of the Copenhagen climate conference (Conference of the Parties 15) in which the nations of the world once again tried to reach an agreement about how to slow or stop anthropogenic climate change.

It is well understood that the Earth's climate is changing as a result of human activity. More specifically, the climate is changing because of the inefficient consumption of fossil fuels and rapid deforestation. A changing climate will place present and future human populations in jeopardy and the poor will be most adversely impacted. By climatologists, geologists, oceanographers, and other scientists working on problems related to climate change this is well understood. To many in the business community these are facts that have been incorporated into current operations and long-term strategic plans. To many policymakers at the local, state or provincial, and federal levels, these are facts that demand sound public policy. But to a vocal minority such claims are no more than the rantings of muddle-headed environmentalists and wealthy liberals. Skepticism about harmful, anthropogenic climate change, and the need for mitigation and adaption,

[1] The bibliography at the end of this volume provides a select overview of that literature.

is expressed by small businessmen, physicians, graduate students, politicians, and even some research scientists. A recent Gallup Poll found that 40 percent of Americans were "only a little" or "not at all" concerned about global warming.[2] Approximately the same percentage (39 percent) believe that there is "a lot of disagreement" among climate scientists about whether the Earth has been warming in recent years and (42 percent) about whether human activity causes climate change.[3] Remarks by conservative commentators in the media imply that anthropogenic climate change is a myth perpetrated by liberals with guilty consciences and that redeploying resources to combat climate change will cause more harm than good.[4]

Each of the contributors to this book grounds his or her arguments on the premise that anthropogenic climate change has been occurring, continues to occur, and poses a significant threat to human populations. But such a premise is one that remains contentious outside the scientific community, academia, and the boardrooms of corporations. Readers of this book who are either skeptical of climate change, or unsure of what to think, may be unwilling to grant the premise. For this reason it is necessary to spend some time assessing current scientific opinion on climate change.

1 IS THERE A SCIENTIFIC CONSENSUS REGARDING GLOBAL CLIMATE CHANGE?

Views expressed on science may be divided into three broad categories. First, there is the peer-reviewed research that appears in leading scientific journals. This work is typically vetted by editors and external peer reviewers who have expertise on the precise issues being addressed. The editorial boards of these journals are populated by senior academic and government scientists. Second, there are summaries of such research, concurring statements, and policy statements prepared for use by policymakers and the general public by teams of scientists. This includes the work of the Intergovernmental Panel on Climate Change (IPCC) as well as that of the American Association for the Advancement of Science, the National Research Council of the National Academy of Sciences, and the European Science Foundation. Third, there are opinion pieces in newspapers, blogs,

[2] Gallup Poll completed between March 5 and 8, 2009. N = 1,012 adults nationwide. MoE ± 3 (for all adults). Available at www.pollingreport.com/enviro.htm.

[3] *Newsweek* Poll conducted by Princeton Survey Research Associates International, August 1–2, 2007. N = 1,002 adults nationwide. MoE ± 4 (for all adults). Available at www.pollingreport.com/enviro.htm.

[4] For examples, consult the editorial pages of the *Wall Street Journal* (the *Journal*'s science reporters do not echo the stance of the editorial page writers) or *The Glenn Beck Program* on Fox News Channel.

industry-sponsored position papers, and even vanity journals published with the intention of advancing an ideological perspective rather than advancing science.[5]

Critics of the view that there is a consensus on climate change typically appeal to sources in the third category. Instead of advancing their position via credible scientific papers, critics typically broadcast their message through the pronouncements of think tanks and self-proclaimed experts. In fact, according to one review of this debate, nearly all climate change skeptics are "economists, business people or politicians, not scientists."[6] In its article, "Meet the Global Warming Skeptics," the magazine *New Scientist* examines the connections of many of the prominent climate change skeptics. The authors note that the Competitive Enterprise Institute, a free-market lobby organization, is made up of two lawyers, an economist, a political scientist, a graduate in business studies, and a mathematician. Similarly, the American Enterprise Institute, another free-market lobbying organization, has only one natural scientist, a chemist. Both of these lobby groups are funded by ExxonMobil, as are the George C. Marshall Institute and the International Policy Network, leading think tanks promoting global climate change skepticism.[7] The tobacco industry used similar techniques in an effort to promote its agenda and undermine public health efforts regarding the dangers of smoking.[8] Indeed, former US Senator and former US Undersecretary of State Timothy Wirth argues that climate change deniers "patterned what they did after the tobacco industry. Both figured, sow enough doubt, call the science uncertain and in dispute. That's had a huge impact on both the public and Congress."[9]

[5] For an overview of the climate change denial industry, see Sharon Begley, "The Truth About Denial," *Newsweek*, August 13, 2007. Available at www.newsweek.com/id/32482; and "Meet the Global Warming Skeptics," *New Scientist*, 2486 (February 12, 2005): 40. For an example of a vanity journal publication on climate change, see "Environmental Effects of Increased Atmospheric Carbon Dioxide," *Journal of American Physicians and Surgeons*, 12(3) (Fall 2007). Available at www.jpands.org/vol12n03/robinson.pdf. This journal is not listed in major scientific databases such as PubMed or ISI Web of Knowledge. However, the article is featured prominently on the pages of the Heartland Institute, a "free market" think tank and a center of climate change skepticism. See www.heartland.org/policybot/results/22434/Environmental_Effects_of_Increased_Atmospheric_Carbon_Dioxide_updated.html.

[6] Fred Pearce, "Climate Change: Menace or Myth?," *New Scientist*, 2486 (February 12, 2005): 38.

[7] *New Scientist*,"Meet the Global Warming Skeptics," 40.

[8] For an overview, see, for example, Allan M. Brandt, *The Cigarette Century: The Rise, Fall, and Deadly Persistence of the Product That Defined America* (New York: Basic Books, 2009). Creationists use similar methods to cast doubt on Darwinian evolutionary theory. For an assessment of their arguments, see, for example, Philip Kitcher, *Abusing Science: The Case Against Creationism* (Cambridge, MA: MIT Press, 1983).

[9] Begley, "The Truth About Denial."

An analogy may help us to better understand the influence of these non-scientifically grounded lobbying efforts. Imagine for a moment that you had to make a life or death medical decision about a loved one. Imagine, for example, that you are contemplating approving a new procedure for the treatment of heart valve disease in your child. Although the procedure is new, there is a clear consensus in the peer-reviewed medical journals about the usefulness and safety of the procedure. However, the opposite view is represented in the various other sources including vanity journals, the opinion pages of some magazines, and some research bought and paid for by companies that stand to lose financially if the procedure is widely adopted. Upon which sources would you rely to make an informed judgment? Obviously most people would rely on the consensus opinion of research published in respected peer-reviewed medical journals. The analogy is not far-fetched since a radically altered climate is likely to adversely impact the welfare of future children.

But is there really a consensus in the scientific literature regarding climate change? Are climate scientists really in agreement on this question? What evidence is there for such conclusions? Before answering these questions, it will be helpful to briefly review some recent history. In the 1980s scientists noticed that the Earth's climate was changing. In the late 1980s the Intergovernmental Panel on Climate Change (IPCC) was formed in order to investigate these changes.[10] The IPCC quickly gained credibility by offering cautious conclusions concerning climate change that were grounded in rigorous scientific studies.[11] The third IPCC climate change report, released in 2001, confirmed that the majority of Earth scientists were convinced that climate change was happening and that the release of anthropogenic greenhouse gases (GHGs), such as carbon dioxide and methane, was the main cause. Does the peer-reviewed scientific literature support these conclusions? It does so unequivocally. In an important study of the scientific literature Naomi Oreskes examined 928 articles on climate change published in peer-reviewed journals between 1993 and 2003.[12] She found that *none* of these articles disagreed with the main conclusions of the IPCC. According to Oreskes, "there is a scientific consensus on the reality of anthropogenic climate change.

[10] Spencer R. Weart, *The Discovery of Global Warming* (Cambridge University Press, 2003), 160.
[11] Ibid., p. 162.
[12] Naomi Oreskes, "Beyond the Ivory Tower: The Scientific Consensus on Climate Change," *Science*, 306 (December 3, 2004): 1686.

Climate scientists have repeatedly tried to make this clear. It is time for the rest of us to listen."[13]

More recently Peter Doran and Maggie Kendall Zimmerman surveyed Earth scientists with academic affiliations along with those at state geologic surveys, at US federal research facilities, and at US Department of Energy national laboratories about their views on climate change.[14] Of the 3,146 Earth scientists who completed the survey, 90 percent believe that global temperature levels have risen in comparison to pre-1800s levels and 82 percent believe that "human activity is a significant contributing factor in changing mean global temperatures."[15] Among those surveyed, "the most specialized and knowledgeable respondents (with regard to climate change) are those who listed climate science as their area of expertise and who also have published more than 50% of their recent peer-reviewed papers on the subject of climate change."[16] Of these specialists, 96.2 percent (76 of 79) believe that global temperature levels have risen in comparison to pre-1800s levels" and 97.4 percent (75 of 77) believe that "human activity is a significant contributing factor in changing mean global temperatures."[17]

The two areas of expertise in the survey with the smallest percentage of participants indicating that they believed that climate change resulted from anthropogenic activity were those in economic geology, the study of the Earth for economic gain, with 47 percent (48 of 103), and meteorology, which tends to focus on short-term climate patterns, with 64 percent (23 of 36).[18] Doran and Kendall Zimmerman reach the following conclusion: "It seems that the debate on the authenticity of global warming and the role played by human activity is largely nonexistent among those who understand the nuances and scientific basis of long-term climate processes."[19]

To revisit our medical analogy, imagine that 97 percent of pediatric cardiothoracic surgeons share a judgment about the usefulness and safety of the heart procedure you are considering for your child, but only 47 percent of pharmacologists working for industry and 64 percent of dermatologists agree. Upon whose judgment will you rely? The consensus opinion of those physicians who perform the procedure and attend continuing medical education classes that review best practices in pediatric heart surgery, or

[13] Ibid. See, also, her recent book with Erik M. Conway, *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming* (New York: Bloomsbury Press, 2010).

[14] Peter Doran and Maggie Kendall Zimmerman, "Examining the Scientific Consensus on Climate Change," *EOS*, 20(3) (January 20, 2009): 21–22.

[15] Ibid., 21. [16] Ibid. [17] Ibid. [18] Ibid., 22. [19] Ibid.

the somewhat mixed opinions of non-specialists (some of whom may lose work if the procedure is widely adopted)?

It is not surprising then that the findings of the IPCC regarding global climate change have been endorsed by most major scientific organizations including the Academies of Science for the G8+5 in a joint statement.[20] This includes the National Science Academies of Brazil, Canada, China, France, Germany, India, Italy, Japan, Mexico, Russia, South Africa, the UK, and the USA. Additionally, the IPCC's findings have received concurring assessments from the American Association for the Advancement of Science, the National Research Council, the European Science Foundation, the American Geophysical Union, the European Federation of Geologists, the European Geosciences Union, the Australian Meteorological and Oceanographic Society, the American Meteorological Society, the Australian Meteorological and Oceanographic Society, the American Chemical Society, the American Physical Society, the American Statistical Association, and others.[21]

Leading global companies have also recognized that a scientific consensus exists regarding anthropogenic climate change and have taken proactive measures to address GHG emissions.[22] These include Alcan, Alcoa, BP, BHP Billiton, Dow Chemical, Iberdrola, Novo Nordisk, Scottish Power, Royal Dutch Shell, STMicroelectronics, and Weyerhauser, among others.[23] As early as 1997, then Alcoa Chairman and Chief Executive Officer Paul O'Neil recognized the scientific consensus on climate change and directed his team to reduce GHG emissions.[24] (O'Neil later served as US Treasury Secretary in 2001–2002.) During his tenure as president of Shell Oil Company, John Hofmeister criticized those who still argue that the science is unclear. "We have to deal with greenhouse gases," he said at a 2006 speech at the National Press Club. "From Shell's point of view, the debate is over. When 98 percent of scientists agree, who is Shell to say, 'Let's debate the science'?" On another occasion he stated, "It's a waste of time to debate it.

[20] "Joint Science Academies' Statement: Climate Change Adaptation and the Transition to a Low Carbon Society" (June 2008). Available at www.nationalacademies.org/includes/climatechangestatement.pdf.

[21] Links to the original documents may be found at Wikipedia contributors, "Scientific Opinion on Climate Change," *Wikipedia, The Free Encyclopedia*, en.wikipedia.org/w/index.php?title=Scientific_opinion_on_climate_change&oldid=278716034.

[22] For a discussion of the ethical obligations of businesses regarding climate change, see Denis G. Arnold and Keith Bustos, "Business, Ethics, and Global Climate Change," *Business and Professional Ethics Journal*, 22(2/3) (Summer/Fall 2005): 103–130.

[23] *Business Week*, "The Race Against Climate Change: How Top Companies Are Reducing Emissions of CO_2 and Other Greenhouse Gases," December 12, 2005.

[24] Alcoa, *1997 Annual Report*, 4.

Policymakers have a responsibility to address it. The nation needs public policy. We'll adjust."[25] John Chambers, chairman and chief executive officer of Cisco, has said, "It [climate change] is not a question of if. It is." He added, "There is no doubt in hardly any of the well-educated minds that if we don't act quickly, we are going to have a tremendous problem on our hands."[26] According to Chambers, "Mitigating the impacts of climate change is critical to the world's economic and social stability."[27]

We have seen that there is a clear consensus in the scientific community regarding climate change that has been endorsed not merely by environmental organizations but by leading corporations and governmental agencies. But what is the consensus view of climate change and its impact on the planet? These questions will be answered in the next section.

2 ENERGY CONSUMPTION AND CLIMATE CHANGE

The production and consumption of fossil fuels produces GHG emissions (e.g., carbon dioxide, methane, and nitrous oxide) that alter the energy balance of the Earth's climate and contribute to climate change. According to the US Energy Information Administration (EIA), if current laws and policies remain unchanged, global energy consumption is projected to increase by "50% from 462 quadrillion British thermal units (Btu) in 2005 to 563 Btu in 2030."[28] Demand is projected to rise by 85 percent in non-Organization for Economic Co-operation and Development (OECD) countries and by 19 percent in OECD countries, with the difference between the two groups primarily resulting from the projected economic growth in non-OECD countries.[29] While fossil fuels are expected to continue to supply much of the energy used worldwide, the rising costs of liquid fossil fuels are projected to drive their share from 37 percent in 2005 to 33 percent in 2030 due to projected increases in oil prices.[30] Still, demand for fossil fuel liquids is expected to increase from 84.3 million barrels per day in 2005 to 112.5 million barrels per day in 2030.[31]

[25] Associated Press, "Shell Oil Chief: U.S. Needs Global Warming Plan," September 8, 2006. Available at www.msnbc.msn.com/id/14733060/.
[26] Michael Kanellos, "Cisco CEO Takes Jab at Climate Change Deniers," CNET News, February 20, 2008.
[27] Antony Savvas, "NASA and Cisco Build Climate Change Reporting Platform," ComputerWeekly.com, March 4, 2009. Available at www.computerweekly.com/Articles/2009/03/04/235132/nasa-and-cisco-build-climate-change-reporting-platform.htm.
[28] Energy Information Administration (2008), "International Energy Outlook 2008: Highlights," www.eia.doe.gov/oiaf/ieo/pdf/highlights.pdf.
[29] Ibid., 1. [30] Ibid. [31] Ibid., 2.

According to the EIA, world electricity generation is expected to nearly double, increasing from about 17.3 trillion kilowatt hours (kW h) in 2005, to 24.4 trillion kW h in 2015, and finally 33.3 trillion kW h in 2030.[32] Sustained economic growth in non-OECD countries is expected to drive increased energy consumption in these nations by an average of 4.0 percent annually from 2005 to 2030. This is compared to a projected average increase of 1.3 percent annually for OECD countries over the same period.[33] Coal and natural gas are projected to account for the largest increases in fuel consumption for energy production, with a 3.1 percent projected annual growth rate for coal and a 3.75 percent annual growth rate for natural gas.[34]

The IPCC reports that between its Third Assessment Report (TAR) in 2001 and the Fourth Assessment Report (FAR) in 2007, new observations and modeling have "led to improvements in the quantitative estimate of radiative forcing."[35] (The impact of the warming or cooling properties of GHGs is measured in radiative forcing.) In particular, the IPCC's Fourth Assessment Report indicates with "very high confidence" that significant changes in the Earth's climate have occurred as a result of GHG emissions – as well as of deforestation and other anthropogenic factors – since 1750 and have resulted in warming.[36] Among these changes are an increase in the global atmospheric concentration of carbon dioxide from a pre-industrial value of about 280 ppm to 379 ppm in 2005, of methane from of about 715 ppb to 1,774 ppb in 2005, and of nitrous oxide from a preindustrial value of about 270 ppb to 319 ppb.[37] From 1995 to 2005 carbon dioxide radiative forcing increased by 20 percent, the largest change in at least the last 200 years.[38] "The combined radiative forcing due to increases in carbon dioxide, methane, and nitrous oxide is +2.30 W m^{-2}, and its rate of increase during the industrial era is *very likely* to have been unprecedented in more than 10,000 years."[39]

Given these findings the US Environmental Protection Agency (EPA) has stated that the "science clearly shows that concentrations of these gases are at unprecedented levels as a result of human emissions, and these high levels are very likely the cause of the increase in average temperatures and other changes in our climate."[40] The IPCC has also predicted future

[32] Ibid., 3. [33] Ibid. [34] Ibid., 4.
[35] "IPCC, 2007: Summary for Policymakers," in S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, and H. L. Miller (eds), *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (New York: Cambridge University Press, 2007), 2.
[36] Ibid., 2–3 ff. [37] Ibid., 2–3 [38] Ibid., 4. [39] Ibid.
[40] US Environmental Protection Agency, "EPA Finds Greenhouse Gases Pose Threat to Public Health, Welfare/Proposed Finding Comes in Response to 2007 Supreme Court Ruling," April 17, 2009.

changes to the Earth's climate. These changes include "A warming of about 0.2°C per decade for the next two decades"[41] resulting in heatwaves,[42] heavy precipitation at high latitudes and decreases in precipitation in subtropical regions,[43] more intense typhoons and hurricanes,[44] and sea-level rises. It is well understood in the scientific community that global warming and sea-level rise will "continue for centuries due to the time scales associated with climate processes and feedbacks, even if greenhouse gas concentrations were to be stabilized."[45] It should also be pointed out that these predictions reflect conservative estimates based on consensus forecasting rather than the more pessimistic outcomes predicted by some scientists and recently reported to be occurring.[46]

The forecasted impact of climate change on ecosystems and human populations is substantial and largely negative. Negative forecasts include significant increases in droughts, floods, and coastal flooding; more severe weather events; loss of fisheries; widespread species extinctions; and widespread migration away from low-lying coastal regions and other high-risk areas.[47] The major risks to human health include the following:

- increases in malnutrition and consequent disorders, with implications for child growth and development;
- increased deaths, disease, and injury due to heatwaves, floods, storms, fires, and droughts;
- the increased burden of diarrheal disease;
- the increased frequency of cardiorespiratory diseases due to higher concentrations of ground-level ozone related to climate change;
- the altered spatial distribution of some infectious disease vectors.[48]

Given these scientific predictions one can understand why the EPA ruled that "greenhouse gases contribute to air pollution that may endanger public health or welfare."[49] In addition to adverse impacts on human populations, climate change will adversely impact other species. The IPCC estimates that 20–30 percent of plant and animal species assessed are very likely "to

[41] "IPCC, 2007: Summary for Policymakers," in M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden, and C. E. Hanson (eds), *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge University Press, 2007), 12.
[42] Ibid., 15. [43] Ibid., 16. [44] Ibid. [45] Ibid.
[46] Julienne Stroeve, Marika M. Holland, Walt Meier, Ted Scambos, and Mark Serreze, "Arctic Sea Ice Decline: Faster Than Forecast," *Geophyical Research Letters*, 34, L09501, doi:10.1029/2007GL029703. See also Sharon Begley, "Climate Pessimists Were Right," *Wall Street Journal*, February 9, 2007, B1.
[47] "IPCC, 2007: Summary for Policymakers," in M. L. Parry *et al.*, 11–12. [48] Ibid., 12.
[49] US Environmental Protection Agency, "EPA Finds Greenhouse Gases Pose Threat to Public Health" (April 17, 2009).

be at increased risk of extinction if increases in global average temperature exceed 1.5–2.5°C."[50]

3 ONE PLANET: ETHICAL ISSUES

Energy consumption, and the impact of that consumption on climate change, raise a range of important ethical issues regarding responsibility and, historically, accountability for the causes of climate change, duties to future generations and to the millions of species that coinhabit Earth with humans, and the just distribution of the costs of mitigation and adaptation.

In Chapter 1, "Energy, ethics, and the transformation of nature," Dale Jamieson grapples with the question of what choices we ought to make in order to respond to the challenge of anthropogenic climate change. He begins by providing an overview of the history of energy usage and then asks which transformations of nature for energy production are morally acceptable. He argues that no matter which alternative energy choices we choose as a means of addressing climate change, we will be confronted by difficult choices that require incentives for adopting a coherent and consistent energy policy and personal sacrifices – we will need to "grasp the nettle." He sees humanity's best hope as a highly motivated, global citizens' movement that leads to effective political action. In Chapter 2, "Is no one responsible for global environmental tragedy? Climate change as a challenge to our ethical concepts," Stephen Gardiner engages Jamieson's view, defended in Chapter 1 and in numerous other essays, that a new value system grounded in a respect for nature is needed to adequately confront the global environmental crisis. Gardiner agrees that climate change presents a daunting challenge to conventional ethical thinking, but argues that the focus should not be on re-envisioning our ethical systems as much as it should be on delegating political responsibility for collective action and holding political actors accountable for their responses to climate change. As Gardiner acknowledges, his position is not so much an alternative to Jamieson's position as it is a complementary position.

In Chapter 3, "Greenhouse gas emission and the domination of posterity," John Nolt argues that our emissions of GHG constitute unjust domination of future generations, analogous in many morally significant respects to certain historical instances of domination of people, such as those based on race or gender, that are now almost universally condemned. Further, he argues that no benefits that we may bequeath to future

[50] "IPCC, 2007: Summary for Policymakers," in M. L. Parry *et al.*, 11.