

CHAPTER 4

Adapting to Climate Change

As a result of greenhouse gas emissions since the Industrial Revolution, the climate is bound to change. Regardless of the course that events may take, the planet's average temperature will keep rising from now until the end of the 21st century. The world's nations will need to adapt to these gradual changes, so it is important to understand the conditions that will allow for the best possible adaptation.

Climate Change Hits Poor Countries Harder

Climate change will entail numerous environmental changes, including rising sea levels, more frequent heat waves, and variations in fishing and agricultural conditions.¹⁹¹ Among the many effects of climate change, the most worrisome are naturally extreme weather events that can cause human casualties. According to the IPCC, the overall warming of the atmosphere will make these events more frequent, and their intensity will increase, as shown in Table 4-1.

It should not be assumed, however, that all weather phenomena result directly from climate change. For example, studies on extreme hurricane winds in the United States and the Caribbean, on tornados in the United States, and on storm winds in Europe have failed to establish a link with anthropogenic climate change.¹⁹² The same can be said of droughts, which have changed little over the past 60 years.¹⁹³

The frequency and intensity of extreme weather events are not the only factors that determine the severity of their impacts. The IPCC's Fifth Assessment Report states that the exposure and vulnerability of physical assets should also be taken into account. Both of these factors are directly related to the level of economic development.¹⁹⁴ This explains why the poorest population

groups are disproportionately affected by these disasters, as noted in a report produced for the World Bank.¹⁹⁵

This does not mean that developed countries are spared. The IPCC states that the absolute value of economic losses related to the weather and to climate events will be higher in industrialized countries, due to the higher value of their built heritage. Fortunately, insurance against such damage is also more common. However, the same report notes the following with respect to developing countries:

Fatality rates and economic losses expressed as a proportion of GDP are higher in developing countries (high confidence). Deaths from natural disasters occur much more in developing countries. From 1970 to 2008, for example, more than 95% of deaths from natural disasters were in developing countries.¹⁹⁶

“Economic development is the best way to reduce the adverse effects of climate change in relative terms and to reduce the loss of human life.”

In other words, economic development is the best way to reduce the adverse effects of climate change in relative terms and to reduce the loss of human life. A clear example may be seen by comparing two tragic events: Hurricane Katrina, which struck the United States in 2005, and the tropical cyclone that hit the Bay of Bengal in 1970. These two Category 3 storms threatened populations of comparable size, but it is estimated that there were 150 times fewer deaths in the United States, where the level of wealth supports technologies, infrastructure and institutions that reduce people's vulnerability to climate change.¹⁹⁷

191. W. Neil Adger *et al.*, “Adaptation to Climate Change in the Developing World,” *Progress in Development Studies*, Vol. 3, No. 3, July 2003, pp. 179-195.

192. Wolfgang Cramer *et al.*, “Detection and Attribution of Observed Impacts,” in Christopher B. Field *et al.* (eds.), *Climate Change 2014: Impacts, Adaptation, and Vulnerability, Part A: Global and Sectoral Aspects, Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, IPCC, 2014, p. 998.

193. Justin Sheffield, Eric F. Wood, and Michael L. Roderick, “Little Change in Global Drought over the Past 60 years,” *Nature*, Vol. 491, No. 7424, November 15, 2012, pp. 435-438.

194. “The impacts of extreme weather events depend on the frequency and intensity of the events, as well as the exposure and vulnerability of society and assets.” Wolfgang Cramer *et al.*, *op. cit.*, footnote 192.

195. Postdam Institute for Climate Impact Research and Climate Analytics, *Turn Down the Heat: Why a 4°C Warmer World Must Be Avoided*, Report produced for the World Bank, November 2012, p. 56.

196. Virginia R. Burkett *et al.*, “Point of Departure,” in Christopher B. Field *et al.* (eds.), *Climate Change 2014: Impacts, Adaptation, and Vulnerability, Part A: Global and Sectoral Aspects, Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, IPCC, 2014, p. 187.

197. Keith H. Lockitch, “Climate Vulnerability and the Indispensable Value of Industrial Capitalism,” *Energy and Environment*, Vol. 20, No. 5, 2009, p. 737.

Table 4-1

Probability of extreme weather and climate events

PHENOMENON AND EXPECTED CHANGE	LIKELIHOOD THAT CHANGES OCCURRED (SINCE 1950)	HUMAN CONTRIBUTION TO OBSERVED CHANGES	LIKELIHOOD OF FURTHER CHANGES – EARLY 21 ST CENTURY	LIKELIHOOD OF FURTHER CHANGES – LATE 21 ST CENTURY
Warmer and/or fewer cold days and nights over most land areas	Very likely	Very likely	Likely	Virtually certain
Warmer and/or more frequent hot days and nights over most land areas	Very likely	Very likely	Probable	Virtually certain
Warm spells/heat waves: Frequency and/or duration increases over most land areas	Medium confidence	Likely	Not formally assessed	Very likely
Heavy precipitation events: Increase in the frequency, intensity and/or amount of heavy precipitation	Likely	Medium confidence	Likely	Very likely
Increases in intensity and/or duration of drought	Low confidence	Low confidence	Low confidence	Likely
Increases in intense tropical cyclone activity	(Since 1970) Low confidence	Low confidence	Low confidence	More likely than not
Increased incidence and/or magnitude of extreme high sea level	(Since 1970) Likely	Likely	Likely	Very likely

* Low confidence at a global level.

** Low confidence when it comes to long-term climate change (at the scale of centuries). Almost certain in the North Atlantic since 1970.

Source: Lisa V. Alexander et al., "Summary for Policymakers," in T. F. Stocker et al. (eds.), *Climate Change 2013: The Physical Science Basis, Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, IPCC, 2013, p. 7.

Note: The terms used for likelihoods may be interpreted as follows:

CONFIDENCE TERMINOLOGY	DEGREE OF CONFIDENCE
Medium confidence	About 5 out of 10 chance
Low confidence	About 2 out of 10 chance
Virtually certain	Over 99% likelihood
Very likely	Over 90% likelihood
Likely	Over 66% likelihood
More likely than not	Over 50% likelihood

Source: IPCC, *Climate Change 2007: Working Group I: The Physical Science Basis*, 1.6 The IPCC Assessments of Climate Change and Uncertainties, 2007..

Technology is closely linked to level of economic development. On the one hand, prosperity is what allows us to use the most advanced tools made available by scientific and technological progress. In addition, technological discoveries themselves owe much to economic growth, whose dynamic process rewards innovation.¹⁹⁸ The technology level is also a significant condition facilitating adaptation, and partly determines the resilience of societies and economies faced with the consequences of climate change. For example, knowledge of genetics have a strong influence on how climate change will affect agriculture and harvests.¹⁹⁹

Climate Change Adaptation and Living Standards

The living conditions of human beings have undergone rapid change over the past century. Life expectancy has risen substantially. Whereas it was just 31 years for humanity as a whole in 1900, and less than 50 years even in the most highly developed countries,²⁰⁰ it now stands at 68.7 years.²⁰¹ Indeed, the overall health of the human population has improved, many previously fatal diseases are now treated more effectively or have been eradicated, and infant mortality has fallen sharply. These notable changes reflect reductions in hunger, malnutrition and poverty, thanks to a widespread improvement in economic living conditions.²⁰²

Renowned author Indur M. Goklany, who worked at the IPCC and contributed to its First Assessment Report among other things, shows that these tremendous developments are closely linked to the living standards made possible by the use of fossil fuels and by the im-

pressive technological progress of the past century.²⁰³ In other words, as they seek to avert catastrophes related to excessive global warming, the nations of the world should avoid causing the kinds of human catastrophes that result from a decline in living standards.

The economic growth that raises living standards is all the more important because it allows for a better adaptation to climate change. Since the 1920s, the global mortality rate from extreme weather events has fallen by 98%.²⁰⁴ This statistic suggests that human vulnerability is due less to climate than to economic conditions.²⁰⁵

“The technology level is also a significant condition facilitating adaptation, and partly determines the resilience of societies and economies faced with the consequences of climate change.”

Despite extensive media attention, the climate change issue remains essentially a future risk. As we saw in Chapter 2, Richard Tol calculated that the overall impact of global warming has been positive up to now. An article appearing in *Nature* magazine attributed over 150,000 deaths to climate change during the year 2000.²⁰⁶ The study, which did not go uncriticized,²⁰⁷ categorized these deaths as follows:

- 77,000 of the 250,000 deaths due to protein malnutrition;
- 47,000 of the 2 million deaths due to diarrhea;
- 27,000 of the more than one million deaths due to malaria;
- 2,000 deaths caused by floods.²⁰⁸

As we can see, the three health problems accounting for most of the deaths that were attributed up to a certain point to climate change are not a concern in any industrialized country, nor even in many developing countries.

198. Indur M. Goklany, “Humanity Unbound: How Fossil Fuels Saved Humanity from Nature and Nature from Humanity,” Policy Analysis No. 715, Cato Institute, December 20, 2012. This relationship can be observed in various sectors, including pharmaceutical research. See Yanick Labrie, “How Pharmaceutical Innovation Has Revolutionized Health Care,” Economic Note, Montreal Economic Institute, June 2014.

199. Rebecca Clements *et al.*, *Technologies for Climate Change Adaptation: Agriculture Sector*, UNEP Risø Centre on Energy, Climate and Sustainable Development, August 2011, p. 110-116. The technology factor and its impact on capacities for adaptation are a focus of Goklany’s criticism of studies on the impacts of climate change. Many of these studies appear not to take recent developments into account, especially in genetics. “Generally, the adaptation technologies available in these studies are from the early 1990s or earlier vintages. Thus the food and hunger study doesn’t include consideration of adaptations that may be possible through genetically modified crops.” Parry *et al.*, “Effects of Climate Change,” p. 57, quoted in Indur M. Goklany, “What to Do about Climate Change,” Policy Analysis No. 609, Cato Institute, February 5, 2008, p. 25.

200. Thomson Prentice, “Health, History and Hard Choices: Funding Dilemmas in a Fast-Changing World,” presentation as part of the Health and Philanthropy: Leveraging Change conference, University of Indiana, August 2006, p. 7.

201. Central Intelligence Agency, World Factbook, People and Society, Life expectancy at birth.

202. Indur M. Goklany, *op. cit.*, footnote 198.

203. *Idem.*

204. Indur M. Goklany, “Wealth and Safety: The Amazing Decline in Deaths from Extreme Weather in an Era of Global Warming, 1900-2010,” Policy Study No. 393, Reason Foundation, September 2011, p. 6.

205. Keith H. Lockitch, *op. cit.*, footnote 197, p. 733.

206. Jonathan A. Patz *et al.*, “Impact of Regional Climate Change on Human Health,” *Nature*, Vol. 438, No. 7066, November 2005, p. 312.

207. Indur M. Goklany, *op. cit.*, footnote 204, p. 13

208. Jonathan A. Patz *et al.*, *op. cit.*, footnote 206.

The main cause of mortality in these three cases, and perhaps also in the fourth, has more to do with the poverty that puts entire populations at risk.

This was a clumsy move by the World Health Organization. By seeking to show that its mission also involved fighting climate change, possibly to benefit from additional funding, the WHO has ended up diminishing the importance of climate change. Indeed, according to its own analysis, if countries and societies around the world had put extensive efforts into reducing GHG emissions, this would have had the effect of saving these 150,000 victims. In contrast, normal economic development can eliminate the causes of these 150,000 deaths, and prevent not merely these, but also the 3.3 million deaths that are really at issue on this list, and among which the victims of climate change account for only 5%.

“As they seek to avert catastrophes related to excessive global warming, the nations of the world should avoid causing the kinds of human catastrophes that result from a decline in living standards.”

The IPCC’s assessment of the current consequences of climate change is far more nuanced, as we saw in Table 4-1. The effects on human health are relatively minor, and in particular are not well quantified. With medium confidence, experts state that there is a rise in heat-related deaths and a decline in cold-related deaths.²⁰⁹ Given that there are nearly 17 times more deaths related to cold than to heat,²¹⁰ it is quite possible that the overall balance is positive.

Since the adaptive capacity of human societies is directly linked to their prosperity,²¹¹ public policies and international agreements must avoid pitting global warming mitigation against the equally important goal of adapt-

209. Christopher B. Field *et al.*, “Summary for Policymakers,” in Christopher B. Field *et al.* (eds.), *Climate Change 2014: Impacts, Adaptation, and Vulnerability, Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, IPCC, 2014, p. 6. Excerpt: “At present the worldwide burden of human ill-health from climate change is relatively small compared with effects of other stressors and is not well quantified. However, there has been increased heat-related mortality and decreased cold-related mortality in some regions as a result of warming (medium confidence).”

210. Antonio Gasparrini *et al.*, “Mortality Risk Attributable to High and Low Ambient Temperature: A Multicountry Observational Study,” *The Lancet*, Vol. 386, No. 9991, July 2015, p. 372.

211. Gary W. Yohe, “Mitigative Capacity: The Mirror Image of Adaptive Capacity on the Emissions Side,” *Climatic Change*, Vol. 49, No. 3, May 2001, pp. 247-262.

ing to unavoidable climate change. With limited economic resources, choices in the fight against climate change have to be made intelligently and rationally.²¹²

Weighing the Importance of the Climate Change Fight

The aim of this *Research Paper* is not to determine the public policies that should be adopted. It is rather an assessment of the available information that is useful in the debate over these policy choices. The possibility of adaptation thanks to economic prosperity is crucially important. Another thing that must be mentioned is that fighting climate change remains one of the many political and social goals pursued by the world’s countries. The moral imperative is to improve the overall lot of human beings, taking into account every challenge we face, including the effects of climate change, but not to the exclusion of all else.²¹³

On the eve of the Paris Climate Conference, the importance and the enormity of the task involved in the fight against climate change must not overshadow more immediate problems that also need to be tackled. Some issues may go hand in hand with a reduction in GHG emissions, but others show the limits of actions centred solely on reducing such emissions. Three challenges may serve to illustrate this: infectious diseases (health), air quality (environment), and access to electricity (energy).

a) Infectious Diseases: The Case of Malaria

One of the adverse effects of climate change may be the wider spread of infectious diseases such as malaria. This potentially fatal disease is transmitted by mosquito bites, mainly in Africa, but it is fairly simple to treat.

The latest World Health Organization data show that there were 214 million cases of malaria in 2015, and 438,000 deaths were attributed to this disease. These figures, although quite striking, represent a remarkable improvement. The mortality rate from malaria has fallen by 60% since 2000, and by 65% among children.²¹⁴

With climate change, conditions favouring the proliferation of mosquitos could spread. Fighting climate change effectively could therefore slow the propagation of this disease. However, money spent on reducing emissions

212. See Post-2015 Consensus, Expert Panel; Bjørn Lomborg, *The Nobel Laureates Guide to the Smartest Targets for the World 2016-2030*, Copenhagen Consensus Center, 2015.

213. Bjørn Lomborg, “On climate change, Pope Francis isn’t listening to the world’s poor,” *New York Post*, September 23, 2015.

214. World Health Organization, Malaria, Fact sheet No. 94, October 2015.

could also be directed to the search for a vaccine that could completely eradicate the disease and save more lives.

International aid to poor countries is increasingly oriented toward projects related to climate change.²¹⁵ Malaria, however, has been functionally eradicated in societies where the GDP per capita is at least \$3,100, due to better health conditions and the better housing this standard of living provides.²¹⁶ In any event, the malaria problem could be solved in the coming decades, meaning that climate conditions in the late 21st century would have no influence on it. With the growing effectiveness of malaria prevention measures, which are rapidly reducing the infection rate, the effects of climate change are declining accordingly.

b) Air Quality

Many countries are seeking to reduce pollution levels, first and foremost for the direct well-being of their populations. Whether urban or rural, citizens have a strong interest in living in a healthy environment, and exert greater political pressure as they become wealthier. Indeed, it is understandable that people in a very poor rural area will not object to the opening of a polluting factory that provides good jobs. The need to survive and to improve their lot, even if only marginally, takes precedence over environmental quality. Meanwhile, in places where the middle class is getting stronger and families worry about the effects of poor environmental quality on their health and on the value of their homes, a closer watch is being kept on the environmental practices of industries and institutions.

As with the eradication of malaria, there is a well-documented link between living standards and indicators of environmental quality.²¹⁷ Here in Canada, it is notable that air quality has improved significantly in the past few decades along with economic and technological progress. Concentrations of various atmospheric pollutants have fallen substantially across the country.²¹⁸

215. Axel Michaelowa and Katharina Michaelowa, "Climate or Development: Is ODA Diverted from Its Original Purpose?" *Climatic Change*, Vol. 84, No. 1, September 2007, pp. 5-21.

216. Richard S. J. Tol, and Hadi Dowlatabadi, "Vector Borne Diseases, Development & Climate Change," *Integrated Assessment*, Vol. 2, No. 4, October 2001, p. 177.

217. Thomas M. Selden and Daqing Song, "Environmental Quality and Development: Is There a Kuznets Curve for Air Pollution Emissions?" *Journal of Environmental Economics and Management*, Vol. 27, No. 2, September 1994, pp. 147-162; Nemat Shafiq, "Economic Development and Environmental Quality: An Econometric Analysis," *Oxford Economic Papers*, New Series, Vol. 46, Special Issue on Environmental Economics, October 1994, pp. 757-773.

218. Environment Canada, National Air Pollution Surveillance Program (NAPS), July 9, 2013.

This trend is all the more important in that improving air quality is often used to justify tangible government actions in the fight against climate change. The sources of GHG emissions are often the same ones that belch pollutants into the air. In China, India, and various other developing countries, the battle against smog is encouraging governments to adopt targets for reducing GHG emissions.²¹⁹

"The moral imperative is to improve the overall lot of human beings, taking into account every challenge we face, including the effects of climate change, but not to the exclusion of all else."

From the standpoint of public health, the combination of these two goals is fortunate, because they are not opposed. Otherwise, priority would undoubtedly go to reducing atmospheric pollutants rather than GHG emissions. Among various factors that may affect the length and quality of life, urban air pollution far exceeds the effects of climate change. In rural areas, indoor smoke from solid fuels for heating or cooking is also a bigger problem.²²⁰

c) Access to Electricity

Rated as the foremost environmental threat,²²¹ smoke from solid fuels is often related to limited access to electricity. Access to cheap sources of electricity often makes electrical cooking and heating devices more appealing, even for low-income households. Energy poverty is still a widespread phenomenon, however. The World Health Organization estimates that 3 billion people worldwide cook their food or heat their homes using fireplaces or traditional ovens, burning wood, agricultural waste, coal or manure. Indoor air pollution leads to about 4.3 million deaths each year, primarily women and children, by causing pneumonia, strokes, heart and lung disease, and even lung cancer.²²²

Access to cheap electricity is an important method of getting out of dire poverty and improving everyday health conditions.²²³ More than 1.2 billion people world-

219. Center for Clean Air Policy, *Greenhouse Gas Mitigation in Brazil, China and India: Scenarios and Opportunities through 2025*, November 2006, p. 1.

220. Indur M. Goklany, *op. cit.*, footnote 204, p. 14.

221. Marianne Lavelle, "Cookstove Smoke Is 'Largest Environmental Threat,' Global Health Study Finds," *National Geographic*, December 13, 2012.

222. World Health Organization, Household air pollution and health, Fact sheet No. 292, March 2014.

223. Marianne Lavelle, "The Solvable Problem of Energy Poverty," *National Geographic*, September 23, 2010.

wide have no such access.²²⁴ The problem affects rural households in particular. Geographically, the majority of people without access to electricity are found in sub-Saharan Africa and Southeast Asia.²²⁵

This problem requires concrete solutions. Yet cheap electricity still comes mostly from fossil fuels. Renewable energy such as wind and solar power are almost invariably far more expensive. Even though fossil fuels emit greenhouse gases, does this justify depriving the poorest people on the planet of such essential access to living conditions favouring their health and enhanced economic prospects?

In the industrialized world, policies promoting renewable energy have led to a higher proportion of electricity being generated from solar or wind energy in some countries.²²⁶ This transition has not necessarily resulted in an environmental success story, as can be seen in the case of Germany, where it has gone hand in hand with higher production from coal-burning power plants.

“Fighting climate change should not be seen as a reason for maintaining the harsh living conditions afflicting more than a billion people.”

Regardless of whether or not it has been an environmental success, the transition has been costly. It is estimated that in 2014, the German energy revolution led to an increase of \$323 per household’s electricity bill, meaning a subsidy of \$34 billion to producers of renewable energy.²²⁷ Same thing in England, where renewable energy increased electricity bills for the English by 15% over the past decade.²²⁸

In Spain, the energy transition was achieved by granting preferential rates to producers of renewable energy. Since 2000, these implicit subsidies have amounted to more than \$40 billion.²²⁹ Lacking the political will to raise consumers’ electricity bills, the government added to its debt on financial markets by creating the

Electricity Deficit Amortisation Fund (FADE). The billions of euros this has brought in will eventually have to be repaid by Spanish taxpayers.

Renewable energy can prove an attractive solution in some cases, for example, in remote communities that cannot easily be connected to a national grid. As a general rule, however, fighting climate change should not be seen as a reason for maintaining the harsh living conditions afflicting more than a billion people.²³⁰ It is possible, and necessary, to fight climate change while keeping a clear idea of the relative importance of this battle among a broad range of issues.

Fighting Poverty and Climate Change

It is obvious that poverty is a scourge that must not be ignored, especially not under the pretext of fighting climate change. Worse yet, some policies for fighting climate change have adverse effects on the poorest of the poor, such as the production of biofuels from crops.²³¹ Poorer population groups are likelier to suffer the adverse effects of climate change precisely because of their poverty. Greater prosperity and development through strong and sustained economic growth would significantly help mitigate climate-related risks.

This thinking resonates with the broader public. A United Nations survey reveals that, among 16 priorities, climate change ranks dead last, reflecting a clear sense that future climate change is simply not the priority for poor people.²³² In other words, there is greater concern for the environment among people who are not suffering from hunger, who are not dying of easily curable diseases, who are able to find work and send their children to school.

Between now and 2085, only 13% of deaths due to famine, malaria and extreme weather events will be a result of climate change. Until then, the positive effects of climate change will likely continue to surpass the negative effects.²³³ These observations lead author Indur Goklany to draw the following conclusion:

224. Marianne Lavelle, “Five Surprising Facts about Energy Poverty,” *National Geographic*, May 30, 2013.

225. Ren21, *Renewables 2015: Global Status Report*, 2015, p. 103.

226. U.S. Energy Information Administration, *European Nations Are Increasing Electricity Generation Using No-Carbon Sources*, September 22, 2014.

227. “Green Revolution? German Brown Coal Power Output Hits New High,” *Spiegel International*, January 7, 2014; Bank of Canada, “Financial Markets Department: Year Average of Exchange Rates,” 2014.

228. Stanley Reed, “Britain plans to cut subsidy to renewable energy,” *The New York Times*, July 22, 2015.

229. Brady Yauch, “Governments rip up renewable contracts,” *Financial Post*, March 18, 2014.

230. Michael Jakob and Jan Christoph Steckel, “How Climate Change Mitigation Could Harm Development in Poor Countries,” *Wiley Interdisciplinary Reviews: Climate Change*, Vol. 5, No. 2, March/April 2014, pp. 161-168.

231. Robert Mendick, “Biofuels do more harm than good, UN warns,” *The Telegraph*, March 23, 2014.

232. United Nations poll available at the following address:

<http://data.myworld2015.org/>

233. Indur M. Goklany, “Is Climate Change the Number One Threat to Humanity?” *Wiley Interdisciplinary Reviews: Climate Change*, Vol. 3, No. 6, November/December 2012, pp. 489-508.

The warmest world, being wealthier, should also have greater capacity to address any problem, including warming. Therefore, other problems and, specifically, lowered economic development are greater threats to humanity than global warming.²³⁴

“Between now and 2085, only 13% of deaths due to famine, malaria and extreme weather events will be a result of climate change.”

This conclusion of Goklany's is also an excellent reason to be optimistic about the future and to fight our world's many problems, of which climate change is one, with determination, intelligence, and rationality.

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234. *Idem.*

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