Climate Change, Torn between Myth and Fact

Constantin Cranganu

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By

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Cambridge Scholars Publishing

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This book first published 2021

Cambridge Scholars Publishing

Lady Stephenson Library, Newcastle upon Tyne, NE6 2PA, UK

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

ISBN (10): 1-5275-7155-6
ISBN (13): 978-1-5275-7155-6

Qu'on ne dise pas que je n'ai rien dit de nouveau,
la disposition des matières est nouvelle.
Quand on joue à la paume c'est une même balle
dont joue l'un et l'autre, mais l'un la place mieux.

Pascal, *Pensées*,
fragment 575, édition Sellier

I dedicate this book to the skeptics—victims of bigotry without horizon and intellectual intolerance. They are the guiding lights of the human race. Because knowledge always starts with skepticism and ends with self-confidence.

TABLE OF CONTENTS

List of Figures ... xv

List of Tables ... xxii

List of Abbreviations ... xxiii

Foreword ... xxv

Acknowledgments ... xxix

Credo ... xxx

Chapter 1 ... 1
The Transition to 100% *Green* Energy—An Exercise in Magical Thinking
- The problem of energy power density ... 3
- Shockley-Queisser boundary problem ... 5
- Betz limit problem ... 5
- The problem of renewable energy storage ... 5
- The problem of resources needed to build batteries and installations producing renewable energy ... 6
- Wind farms and climate problems ... 9
- Evolution or revolution? ... 10
- Conclusions ... 12

Chapter 2 ... 14
The Sound and the Fury: The American Democratic Socialists and the Green New Deal
- Green New Deal and climate contradictions ... 17
- Conclusions ... 18

Chapter 3 ... 20
Europeans are not Worried about Global Warming. Climate Realism or Climate Socialism?
- Conclusions ... 27

Chapter 4 28
About the Inconsistency of “Critical Points” in the Evolution of Complex Natural Systems
Conclusions........ 32

Chapter 5 34
How Catastrophic is Climate Change?
Give us the enemy back! (Pascal Bruckner) 35
How catastrophic is climate change? 36
Some “morbid” comparisons 41
Conclusion 42

Chapter 6 44
Is There a Population Limit that the Earth can Support for a Decent Living?
Prophets vs. Wizards........ 47
The descendants of Malthus........ 49
Optimistic wizards see things differently........ 51
What more do eco-pessimists tell us? 52
Conclusions........ 53

Chapter 7 55
Planet of the Humans—An Unexpected and Virulent Critique of “Green” Energies
Conclusions........ 58

Chapter 8 60
Groupthink or Groups of Thinkers? About the Principle “Fifty million Frenchmen Can’t be Wrong”
The principle “fifty million Frenchmen can’t be wrong”........ 62
How did Groupthink work in that experiment? 63
Conclusions........ 65

Chapter 9 66
Science Police and Defiance of Consensus
Science police in the journal *Nature* 66
Science police on Wikipedia........ 68
Science police in universities........ 69

Chapter 10 73
The Prisoner's Dilemma and Global Warming
"Travelers without a ticket" 75
Conclusions 77

Chapter 11 78
Climate Change and its Role in the Emergence and Development of Human Civilization: Implications for a Probable Future
Conclusions 82
What awaits us in the future? 83

Chapter 12 84
When the Weather Becomes Climate
Climate does not mean the same thing to everyone 88
When the weather (aka temperature) becomes (wrongly) climate 80
Conclusions 93

Chapter 13 95
The Fourth Energy Transition and the Labor Pains
The labor pains 96
Conclusions 101

Chapter 14 103
When Children Become Experts in Climate Change …

Chapter 15 106
A Significant Decision: We do not Live in the Anthropocene but in the Meghalayan!
What happens to the Anthropocene? 108
Conclusions 109

Chapter 16 111
Welcome to the Fabulous *Anthropocene Era*!

Chapter 17 115
"Ask Not What We Can Do for Climate Change, but Ask What Climate Change Can Do for Us"

Chapter 18 119
A Stairway to (Low-Carbon) Heaven
a. The agreement is not legally binding for the signatory countries . 121
b. The objectives of the agreement are difficult to achieve, probably impossible 122
c. The money will not be enough 122
d. The agreement does not provide for a cap-and-trade or carbon tax scheme 123
e. Professor James Hansen states that the Paris talks are a fraud: mere words without value—no action, only promises 123
f. History is repeating sometimes... 124

Chapter 19 127
Munk's Enigma – Implications for Climate Change
How is the global ocean level measured? 129
What can be said about sea-level changes in antiquity? 131
Is time missing? Ancient eclipses, tides, and the effects of the last glaciation 132
An attempt to solve Munk's enigma 135
. . . But the enigma persists 136
Melting glaciers, sea level, and the water pattern in the bathtub 138
Conclusions.. 139

Chapter 20 141
The Global Crisis and Nature's Mutiny. What is Gained When Something is Lost?
What was lost during the Little Ice Age?.. 144
What was gained during the Little Ice Age?..................................... 148
Don Quixote and the Little Ice Age 150
Little Ice Age, the first fake news and the first clickbait headlines .. 151
Conclusions.. 153

Chapter 21 155
Is There an Average Temperature of the Planet? About the Simpson Paradox and its Implications
Extensive variables and intensive variables..................................... 156
The Simpson paradox—is the average of averages an average?....... 158
Conclusions.. 162

Chapter 22 163
Electric Vehicles and Their Dependence on Big Oil
Electric vehicles and anthropogenic global warming 165
Conclusions 168

Chapter 23 169
It is Difficult to Make Predictions, Especially About the Future . . .
More energy = More wealth 170
Will there be, however, a “decoupling” between energy demand and society’s wealth? 170
The evolution of the energy mix 173
Will CO_2 emissions be reduced due to the increase in renewable energies? 175
What will happen to oil? 176
Conclusions 177

Chapter 24 178
Does Global Warming Mean Less or More Snow?
At first . . . less snow 178
Then . . . more snow 181
Conclusion 188

Chapter 25 189
“4 Per Mille”—A French Climate Initiative Without any Chance of Success
Conclusions 194

Chapter 26 195
From New Amsterdam to New York—A Story About Furs and Climate Change
From the New Amsterdam 196
. . . to New York 198
Epilogue 198
Conclusions 200

Chapter 27 201
Are There, However, Benefits of Climate Change?
1. Increasing the *greening* of the planet 202
2. Deaths caused by extreme weather events 204
3. Cold waves—a politically incorrect reality 205
4. Global warming and wildfires 208

What else do politicians and eco-activists propose? Carbon tax! 210
Conclusions 211

Chapter 28 213
"Overheated" Climate Models and Their Fantastic Predictions
Mongolian climate change 214
What's wrong with the Burke model? 218
Conclusions 219

Chapter 29 220
A Paradox: When Renewable Energy Becomes Cheaper, Electricity Becomes More Expensive!
Conclusions 225

Chapter 30 228
Chicken Little Syndrome
Chicken Little and global cooling 229
Chicken Little and global warming 229
Chicken Little and global cooling (again) 229
Chicken Little and global warming (again) 231
How is the *Chicken Little* syndrome currently manifested and treated? 232
Chicken Little syndrome and confirmation bias 233
Conclusions 234

Chapter 31 236
The Sixth Extinction of Life on Earth? About the Magic Power of Numbers
Sixth Extinction = Revelation? About the magical power of numbers on imagination and emotions 240
Conclusions 242

Chapter 32 243
The Replication Crisis, Biased Publication, and Canonization of Fake Facts in Scientific Studies
Is it possible to impose a quality control of the sciences that legitimize major political decisions? 248
The peer-review process 248
The author's comment-reply process 249
Conclusions 249

Chapter 33 252
About Agnotology with Two Case Studies: Hydraulic Fracturing and the Consensus of the 97% Experts who Agree with Anthropogenic Global Warming
Hydraulic fracturing (fracking) 253
The consensus of the 97% of experts who agree with anthropogenic global warming 255
Philosophical arguments 255
Statistical arguments 258
Cui prodest? 261
Conclusions 261

Chapter 34 263
Gaslighting and the Power of Manipulation
The utterance of blatant lies uttered without any embarrassment 265
Denying things said, even though you have evidence that they actually said them 265
Sentimental blackmail 265
Moral wear using the Chinese drop 265
Post-factum praise to increase your confusion 266
Trying to line up other people against you 266
"You're crazy!" 266
Gaslighting and climate change 267
Conclusions 268

Chapter 35 270
Two Recent Climate Manipulations: The Polar Bear that Starves to Death and Walruses that Commit "Suicide" because of Global Warming
The polar bear that starves to death because of global warming 271
Netflix, Sir David Attenborough, and the walruses' "suicide" 274
When the media bubble starts bursting 276
Conclusions 279

Chapter 36 281
The Earth's Thermostat has Been set to "Habitable" for Billions of Years. Have People Managed to Ruin it in the Last 200 Years?
Is there any concrete evidence of the operation of the planetary thermostat? 285
Has the planetary thermostat ever been broken down in the past? 286
Have people managed to break the planetary thermostat in the last 200 years? 287
Conclusions 288

Notes 289

Index 347

LIST OF FIGURES

Figure 1.1. Average power densities, in W/m^2, of the most widely used sources of electricity generation. The hatched portions indicate values between the minimum and maximum estimates.

Figure 1.2. Increased demand for metals for electric vehicles in 2030 compared to 2015.

Figure 3.1. The distribution of the most critical issues facing the EU in 2020.

Figure 3.2. A survey conducted by the Pew Research Center in January 2019 listed public policy priorities for the Donald Trump administration and the United States Congress. Climate change ranks second to last in the public interest rankings. Similar situations were registered in 2017 and 2018. The priorities of interest for the American public 2019 are, in order, the economy, medical costs, education, and terrorism.

Figure 3.3. A survey conducted by the Pew Research Center in January 2021 listed public policy priorities for the Joe Biden Administration and the United States Congress. Climate change ranks 15th out of 19 options. The priority of interests for the American public in 2021 are, in order, the economy, dealing with coronavirus outbreak, jobs, and terrorism.

Figure 3.4. Global top priorities based on the votes of more than 9.7 million people surveyed by the UN in 2015.

Figure 5.1. Deaths caused by climate disasters between 1900 and 15 July 2020. Graph made by the author using data from EM-DAT.

Figure 5.2. Annual global deaths caused by natural causes, per decade (1900–2015).

Figure 6.1. Population evolution (in billions) from 1800 to 2019. Two scenarios, one “low” and one “high,” estimate the number of people in 2100.

Figure 11.1. Millennial temperature fluctuations in the Santa Barbara Basin, California (left) and Greenland glaciers (middle). The data are obtained

from the analysis of oxygen isotopes in planktonic sediments and glacial cores. The pattern of the two graphs is similar. It is easy to notice that the last 12,000 interglacial years or so of the Holocene mark the existence of a warm and stable climate compared to the previous glacial period, or the Pleistocene.

Figure 12.1. The maximum–minimum temperature sensor (MMTS) was installed by NOAA in Ardmore, Oklahoma on a street corner in full view of multiple heatsinks and within a few feet of the traffic intersection at City Hall. This is a typical example of minimum quality (CRN 5) of temperature measurements. The phenomenon of the urban thermal island is predominant in such a location.

Figure 12.2. Distribution of the quality of weather station locations used by NOAA to measure and record maximum and minimum temperatures. Of the 1007 stations examined, 92.1% produce erroneous temperatures ≥1°C to 5°C higher than the North American Regional Reanalysis (NARR) temperatures. (Based on data from Fall et al., 2011.)

Figure 13.1. In the past, people have used energy sources with a higher power density, which produce more energy per unit of mass and require less land for production. Renewable energies have a lower density than fossil fuels (brown). This means that the current move toward the global adoption of renewable energy will significantly increase the footprint of global energy production through larger production areas of lower power density, while preventing nuclear energy expansion.

Figure 15.1. New Holocene-era subdivisions (Meghalayan, Northgrippian, and Greenlandian) were officially approved in July 2018.

Figure 15.2. A portion of the Indian speleothem that was sectioned and analyzed layer by layer to identify the early Meghalayan age, 4,200 years ago.

Figure 19.1. The evolution model of the GMSL assumed by Munk is based on published data and models.

Figure 19.2. GMSL tide measurements between 1900 and 2001. The red dots are data obtained from Church et al. (2004), and the blue ones from Jevrejeva et al. (2006). The growth rates are personal estimates. Modified from Cazenave and Llovel, (2010).

Figure 19.3. The analysis of ancient eclipses derived from the Babylonian, Chinese, Arab and Greek eclipses suggests a slowdown of the earth's rotation sufficient to produce a time error ΔT of ~ 5 hours (18,000 seconds) from 700 BC to AD 1990. Modified from Stephenson and Morrison (1995).

Figure 19.4. Near the base of the earth's mantle, there are two structures the size of some continents, made of hot and compressed rocks. They are called blobs.

Figure 21.1. The variation of the global mean temperature since 1880. The blue bars of uncertainty indicate the 95% confidence range.

Figure 21.2. Scatterplot of the temperature (°C) recorded at various latitudes (°) in two different geographical regions (simulated data) as an illustration of the Simpson paradox: the trend that is observed within each region is reversed when they are combined (modified)[5].

Figure 22.1. Emissions of electric vehicles by country, in gCO_2e km.

Figure 22.2. Comparisons between electric and internal combustion vehicles based on fuel efficiency.

Figure 23.1. After more than half a century of rapid growth, global primary energy demand will be capped around 2030. This is the compound annual growth rate (CAGR) of energy demand.

Figure 23.2. Energy demand by sectors, on the right, and regional energy demand, on the left.

Figure 23.3. Primary energy consumption between 1970 and 2019, and predictions until 2040, according to BP 2019.

Figure 23.4. Primary energy demands in 2035 and 2050, respectively, according to the prediction of McKinsey & Co (2019). Fossil energy will decrease from 75% in 2035 to 65% in 2050. Electricity consumption will double by 2050, and the share of renewable energy (i.e., wind, solar, biomass, hydro and nuclear) will increase from 25% in 2025 to 34% in 2050.

Figure 23.5. Selected sources of electricity and their share in the period 2010–2050, according to EIA 2019. The prediction refers only to the United States.

Figure 23.6. Four energy scenarios proposed by BP. Primary energy consumption for each fuel type (left); CO_2 emissions allocated to each scenario (right).

Figure 24.1. Between 1967 and 2019, there is a growing trend of snow-covered areas in the northern hemisphere.

Figure 24.2. Between 1967 and 2019, there is a growing trend of snow-covered areas on the North American continent.

Figure 24.3. Between 1967 and 2019, there is a growing trend of snow-covered areas in the Eurasian area.

Figure 24.4. The total mass of snow accumulated in the northern hemisphere (excluding the mountains) between October 2017 and May 2020 mostly exceeds the average of the 1982–2012 period (modified from the World Meteorological Organization, Global Cryosphere Watch).

Figure 24.5. Image of the northern hemisphere captured on April 20, 2018. The ice-covered area of the North Pole is in the center. On the left, the North American continent and the Baja California Peninsula can be seen. The image was captured by the new NOAA-20 satellite at an altitude of 824 km.

Figure 24.6. Snow canyon (17 m high) in Murodo Snow Corridor in Tateyama, Japan, 2018.

Figure 25.1. Schematic diagram of the French “4 per mille” initiative.

Figure 26-1. The official entrance to the City Hall of Manhattan, with the two names of the city.

Figure 26.2. This shows the expeditions of the first explorers of the North American east coast together with the reconstructed temperature variation. The thick line indicates the temperature deviation from the average value of the period 1961–1980. The dotted line segment represents the instrumentally recorded temperature data (IRT).

Figure 27.1. A significant “greening” of the earth has taken place in the last 33 years. Vegetation growth occurred in areas representing between 25% and 50% of the land area. The decrease of vegetation was registered on only

4% of the surface. The fertilization produced by carbon dioxide explains 70% of the greening effect.

Figure 27.2. The world is a greener place than it was 20 years ago, and two of the top CO_2 emitters on the planet are the counterintuitive source: China and India.

Figure 27.3. Heatwaves do not become more frequent due to global warming. The official index of heatwaves in the US in the period 1895–2015, together with the variation of global CO_2 emissions is shown here.

Figure 27.4. Cold waves, not heatwaves, are the real climate killer. This shows the fraction of all-cause mortality attributable to moderate and extreme hot and cold temperature by country.

Figure 27.5. Since 1920, the United States has seen around a 93% decrease in deaths from extreme weather events. Modest global warming was recorded in the same period (1920–2008).

Figure 27.6. Predictions of increased deaths caused by heatwaves vs. predictions of a simultaneous decrease in deaths caused by cold waves in Europe in the 2080s. Four scenarios for increasing global warming are presented. In any scenario, more lives will be saved from death by freezing than those lost due to heatwaves (modified from Ciscar et al., 2009).

Figure 27.7. Areas burned in wildfires and temperature variation.

Figure 27.8. Wildfire statistics, 1990–2020. Data reflect wildland fires and acres burned nationwide, including wildland fires on federal and nonfederal lands.

Figure 28.1. GDP/capita projections, following climate change from 2010 to 2099.

Figure 28.2. GDP/capita evolution in Israel as a result of climate change from 2010 to 2099.

Figure 28.3. National GDP for selected countries.

Figure 29.1. Electricity prices in Germany increased by 51% between 2006 and 2018.

Figure 29.2. Electricity prices in California increased by 30% (six times more than in the rest of the US) during the development of its solar energy, 2011–2019.

Figure 29.3. Decreasing the economic value of wind and solar energy as their share in the energy mix increases (modified from Hirth, 2013).

Figure 32.1. Five-year averaged values of the annual mean (1979–2016) tropical bulk mid-troposphere temperatures as depicted by the average of 102 IPCC CMIP5 climate models (red) in 32 institutional groups (dotted lines). The 1979–2016 linear trend of an all-time series intersects at zero in 1979. Observations are displayed with symbols: green circles—average of four balloon datasets, blue squares—three satellite datasets, and purple diamonds—three reanalyses. Since 1996, there has been a significant difference between the models containing anthropogenic greenhouse gases and the three sets of observations.

Figure 35.1. Maps of polar bear subpopulations in Canada between 2010 and 2018.

Figure 35.2 Capture from the series "Our Planet," Episode 2, of the moment when a first walrus falls from an 80 m high rock.

Figure 35.3. Identical images showing the moment of the deadfall of a walrus in the series **Seven Worlds, One Planet**, BBC (left) and the series **Our Planet**, Netflix (right).

Figure 35.4. Capture from the BBC series **Seven Worlds, One Planet**, in which three polar bears can be distinguished near the rock populated by suicidal walruses. On November 19, 2020, new footage revealed that Netflix faked walrus climate deaths.

Figure 35.5. United States Fish & Wildlife press release about Pacific walrus status in 2017.

Figure 36.1. Carbon exchanges between terrestrial reservoirs and sinks. Over intervals of millions of years, carbon exchange among rocks and surface reservoirs can lead to significant changes in atmospheric CO_2 concentration.

Figure 36.2. The coastal outcrop exposure in Ellis Bay on Anticosti Island, Quebec, preserves rocks stored during the Hirnantian glaciation (445 million years ago). Recent research on the rocks here confirms the functioning of the planetary thermostat.

LIST OF TABLES

Table 5.1. Overall number of deaths and death rates for different types of natural disasters, 1900–1989 and 1990–2010.

Table 5.2. WHO classification of the top 26 risk factors based on the overall importance of the disease (measured by years of life with disabilities, DALY) and mortality for the year 2000.

Table 5.3. WHO classification of the first 20 deadly diseases in 2016. Unlike in 2000, climate change is no longer a significant cause.

Table 33.1. Data showing the breakdown of the abstracts reviewed by Cook et al. (2013) by the level of endorsement of the climate consensus (from Legates et al., 2015).

Table 36.1. The largest reservoirs of carbon on earth are rocks and sediments. The (preindustrial) atmosphere holds the minimum amount of carbon.

LIST OF ABBREVIATIONS

AGW	Anthropogenic global warming
APOC	Anglo-Persian Oil Company
BP	British Petroleum
CAGR	Compound annual growth rate
CMIP5	Coupled Model Intercomparison Project fifth phase
COP	Conference of the Parties
CPI	Climate Policy Institute
CRN	Climate Reference Network
CRS	Congressional Research Service
CRU	Climate Research Unit
EIA	[The U.S.] Energy Information Administration
EM-DAT	Emergency Events Database
GBR	Great Barrier Reef
GDP	Gross domestic product
GISS	Goddard Institute for Space Studies
GMS	Global mean sea level
GMT	Global mean temperature
HadCRUT	Hadley Centre/Climatic Research Unit Temperature
ICS	International Commission on Stratigraphy
IEA	International Energy Agency
IHME	Institute for Health Metrics and Evaluation
INDC	Intended Nationally Determined Contributions
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
IRT	Instrumentally recorded temperature
ISO	International Organization for Standardization
IUD	Intrauterine device
IUGS	International Union of Geological Sciences
LIA	Little Ice Age
MGW	Modern global warming
MMTS	Maximum–minimum temperature sensor
MWP	Medieval Warm Period
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization

NGO	Nongovernmental organization
NOAA	National Oceanic and Atmospheric Administration
PNAS	Proceedings of the National Academy of Sciences of the United States of America
PSMSL	Permanent Service for Mean Sea Level
RER	Rare earth elements
UN	United Nations
USHCN	U.S. Historical Climatology Network
WHO	World Health Organization
WMO	World Meteorological Organization

FOREWORD

At the end of the twentieth century, humanity faced severe natural phenomena that disrupted societies that had previously been prosperous, and full of ambition and remarkable achievements.

Hurricanes, tsunamis, coastal accidents, excessive rainfall alongside extremely dry seasons, the loss of Antarctic and continental ice masses, floods, landslides, and more began to endanger humanity like never before. Scientists began to study what was behind these natural hazards and realized that many had anthropogenic causes.

The United Nations (UN) was the first to raise the alarm. They insisted that urgent action must be taken if the observed climate change had causes other than natural ones. The First Climate Conference held in 1992 in Rio de Janeiro, as well the Conference of the Parties (COP) held in Berlin in 1995 other locations until the 25th conference in Madrid in 2019, spoke of the need to reduce greenhouse gas emissions. These emissions were generated in the industrial age in which humanity is still living. At each of these events, the number of participants continuously increased, with more heads of state and government attending each year. These meetings urged countries worldwide to commit to not letting the global temperature rise more than 1.5°C. At a high level meeting of December 11, 2020, the European Union adopted an agreement to decrease its CO_2 emissions by 55% from the 1990 level, by 2030. An agreement that imposed hard-to-respect obligations and huge costs, involving both wealthy and impoverished countries.

The beginning of the twenty-first century faced numerous dilemmas. The scientific community became divided over the issue of climate change. Part of the community began to write and talk about the large impact that natural processes have on climate changes, ignoring the weight of anthropogenic causes and human activities as a whole. On the contrary, the other side of the community insisted that the use of fossil fuels, coal-fired power plants, industrial activities, expanding air travel, and increased road traffic are the leading causes of increasing greenhouse gas emissions.
A media, economic, geopolitical war has been triggered.

Arguments have been requested and are still requested: pros and cons, causes and effects . . .

Against this background of uncertainty, Constantin Cranganu, a Romanian professor at the City University of New York and an international expert in climate change, has committed to providing pro and con arguments about the current climate change debate.

His contributions, published initially on the Contributors.ro platform in Romania, are proof of his current rooting in reality and expression of his participation in the agora's life. A volunteering activity that honors.

Bookstores in Romania already have his volume *Climate Change—A (Sometimes) Politically Incorrect Guide* (Integral Publishers, 2020). Readers have received it with much interest, as proved by sales.

Cambridge Scholars Publishing is publishing a revised and improved form of that book to make it accessible in English to a much wider audience. This is that book.

This new book discusses:

1. **Climate change as a natural and/or anthropogenic phenomenon**, as well as its causes and effects.
2. **Climate change and forms of energy**, such as fossil fuels and renewable sources. This section also includes recommended climate policies from the UN and the European Union (EU).
3. **Limitation of global warming and climate agreements**, such as the Conferences of the Parties (COP). This section also includes information about climate change mitigation and adaptation, as well as revolutionary technologies in the fight against climate change.
4. **Climate change as a problem** or a problem similar to others.
5. **Evident discrepancies** between public opinion polls and official climate change policies.
6. **About the role of manipulations produced by the media**. This section discusses why and how the media manipulates information about climate change, and presents some significant examples.

The author's point of view, original and authoritative, is clearly expressed in the *Credo* chapter. Even its only reading can give us convincing conclusions about the problem of climate change. We selected a few paragraphs:

> … climate science (climatology) is not a discipline per se. It is a multidisciplinary field of study in which meteorology, geology, geophysics, astrophysics, paleontology, botany, zoology, glaciology, atmospheric physics, physical, chemical, and biological oceanography, ecology, and cosmology are found.

> … media describe climate change using the language of imminent dangers or catastrophes as if it were "the biggest problem facing humanity," bigger than any other.
>
> … such media reports distract the public attention from what science informs us credibly. Further, it diminishes many other ways of thinking, feeling, and knowing about the climate, which are essential elements in making personal and collective decisions.

Regardless of the climate change causes and their effects on the daily life of people everywhere, our position takes into account two aspects:

At the beginning of December 2020, during a program to promote debate on topics of acute actuality, the Romanian Academy (National Committee of Geologists of Romania) launched Prof. Constantin Cranganu's book, *Climate Change—A (Sometimes) Politically Incorrect Guide* (Integral Publishers). The debate's conclusion closely aligned with the Romanian Academy's position posted on the institution's website (www.acad.ro). This position recommends:

1. Strive to **mitigate** global warming by reducing greenhouse gas emissions, increasing energy management performance, reconsidering land use, controlling polluting industries, and more.
2. Work to **adapt to climate change** to limit the damage caused by it and find preventive measures through beneficial investments and constant communication with society as a whole.

In the same context, only a few weeks before, one of us (NA) had the opportunity to moderate a national debate in Romania about Prof. Cranganu's book. The debate was attended by national leaders and policymakers from Romania who expressed a vivid interest in *Climate Change—A (Sometimes) Politically Incorrect Guide.*

Therefore, we consider Prof. Constantin Cranganu a top specialist on the topic of climate change. His ideas intertwine with the top issues of national and international debates on the subject.

The volume we present and recommend to readers contains the issues found in many public debates about climate change. On the platform Contributors.ro, you can also read (with translation) many appreciative reviews and comments about the author's contributions.

Cambridge Scholars Publishing is launching this book that we hope will attract a considerable number of English-speaking thinkers to the discussion on climate change. The publisher discovered the author and thought that his writing could be both a challenge to old knowledge and creating new challenges. People are waiting to understand the phenomena that the entire planet faces, and this book will provide answers for them.

Dear readers, we invite you to read, *sine ira et studio*, this exciting text, which has convinced us that today, in the world in which we live, we must know about climate change through both myth and fact …

Nicolae Anastasiu
Professor Emeritus of Sedimentology
University of Bucharest
Member of the Romanian Academy

Emil Constantinescu
Professor Emeritus of Mineralogy
University of Bucharest
Former President of Romania

Acknowledgments

I am grateful to my former university professors from Romania, Nicolae Anastasiu and Emil Constantinescu, for their insightful and well constructed *Foreword*. I also owe great thanks to David Deming at the University of Oklahoma and David Seidemann at CUNY Brooklyn College, who thoughtfully read parts of the manuscript and offered suggestions to improve it.

I thank the numerous cohorts of Brooklyn College students who, between 2004 and 2017, attended my *Climate Change* course and seminar, challenging me constantly with their inquiries and, sometimes, politically incorrect opinions.

For carefully reading, checking the references and making suggestions to particular sections or chapters, I thank Gill Pavey. Finally, my whole gratitude goes to my supporting family: my beloved children, Dan Crânganu and Andreea Nguyen (neé Crânganu), my amazing grandchildren, Samuel, Benjamin, Cate, Luke, and Ana, and my wonderful wife, Veturia Crânganu.

CREDO

I believe that humans, a transient, relatively new species of *thinking reed*, have a well-marked place in the synergistic mechanism of the following five "gears" of the complex and chaotic system called climate: lithosphere, hydrosphere, biosphere, cryosphere, and atmosphere. Therefore, climate science (climatology) is not a discipline per se. It is a multidisciplinary field of study in which meteorology, geology, geophysics, astrophysics, paleontology, botany, zoology, glaciology, atmospheric physics, physical, chemical and biological oceanography, ecology, and cosmology are found.

I believe that the physical manifestations of climate change and, consequently, local meteorological effects, vary in a large part due to the compositional modifications of the atmosphere. These are controlled by random dynamic changes, including human activities, such as anthropogenic greenhouse gas emissions, population growth, land-use changes, aerosol pollution, and more. These activities contribute to both regional and global climate change, where they overlap to dramatically change natural climate variability.

I believe that the risks of climate change must be taken seriously and acted on responsibly. Humanity will be much better off if we succeed in minimizing these risks by reducing the vulnerability of those exposed to them and minimizing future changes in the atmosphere's composition.

I believe that the way the way climate change mitigation and adaptation have been presented in international conversations, in particular through the Kyoto Protocol, the International Panel on Climate Change (IPCC) reports, and the latest Paris Climate Agreement, is not the only solution. I do not think these approaches are the best, either. It bothers me that the media often describes climate change using the same language used for imminent dangers and catastrophes. The media claims that climate change is *the biggest problem facing humanity*, bigger than any other.

I believe that such media reports distract public attention from credible science. Further, they diminish other ways of thinking, feeling, and knowing about the climate, all of which are essential elements in making personal and collective decisions about climate change.

I believe that climate change is a moderate global problem in an ocean of other bigger and smaller problems. But it is not *the Problem*. Climate change means change and not the end of the world, in my opinion.

I believe that we need to approach climate change with much more imagination, using the issue as a platform to address unrelated but essential human needs. Only then will we be able to address humanity's spiritual, ethical, and psychological needs.

I believe that if we want to combat the anthropogenic component of climate change, a long-term perspective should be introduced into national and international policies. There should be a plan for the future. But the verb "to plan" does not always have a pleasant connotation, especially regarding planning economies, because this language evokes authoritarian images on the one hand and ineptitude on the other. Heavy planning has become outdated for two reasons. It was oppressive, and it failed. If humanity were to go back to long-term planning, what new form should it have?

I believe that we are witnessing a hegemony (tyranny?) exercised by climatological predictions imposed on or against social life's various realities and imagery about the future. Climate models are now regarded as the true predictors of the changes that the climate could undergo. This has led to a hegemony that affects social and political discourse on the future of climate change.

I believe the main problem regarding conversations on climate change is related to the relationship between risk and uncertainty. Climate change policies are completely about risks and how to manage them. To paraphrase the philosopher Karl Popper, *we cannot know the future, because if we knew it, there would be no future*. The long-term approach to combating global climate change must be viewed against a background of uncertainty. It is often possible to attach probabilities to future events, but in this case, the current knowledge needed to make predictions is lacking, and large areas of uncertainty surround the issue. What political strategies are needed to address these climate changes?

I believe there is not a unique perspective or privileged viewpoint from which the continuously shifting, implicitly complex concept of climate change can be fully understood. The Intergovernmental Panel on Climate Change (IPCC) reports that first introduced the reality of climate change into social realities have presented an impressive scientific consensus on the global climate's physical transformations. And I believe in this reality. Engaging in climate change disputes transports us beyond the physical transformations observed, modeled, and predicted by researchers. Science can solve climate mysteries, but it will not help us unveil the meaning of climate change to humanity. Therefore, I believe that the world needs new ways of looking at this phenomenon because the current outlook considers only the human influences on climate change and their political meanings.

I believe this perspective suffers from harmful reductionisms that shrink the immense complexity behind climate change to a binary caricature, where professional experts are pinned against skeptic experts, believers against climate atheists, and progressive liberals against reactionary conservatives.

I believe that scientists with Malthusian-apocalyptic tendencies, environmental activists, and journalists are sick with “civilization malaise,” an insidious mutation caused by a “civilization at a crossroads” sentiment. This statement is not an *ad hominem* attack. It is a critique of an ecological ideology that has become the dominant movement of the last decades, where it has been associated with many young people’s political attitudes and ethical behavior. Environmentalism has the attributes of a new secular religion, one in which nature has become the new God, and unmitigated climate change will become the new Apocalypse. Thus, sins against God have been replaced with crimes against nature. And the priests of the new religion? Of course, they are the “97% of experts who agree on the anthropogenic global warming.”

I agree with the psychologist Abraham Maslow who said that “if the only tool you have is a hammer, you will treat everything as if it were a nail.” If all you study is climate change, you will treat everything as if it were caused by anthropogenic global warming.

This book is both a plea and an invitation to consider climate change from multiple perspectives, such as (geo)physical, social, cultural, psychological, mythological, economic, and judicial ones. Even if these perspectives reflect politically incorrect images, this book can serve as a valuable and necessary guide to better understand the mental structures and systems of preferences, beliefs, and ideologies found in the world.

In an unpublished introduction to his book *Animal Farm* (1945), George Orwell wrote,

> If liberty means anything at all, it means the right to tell people what they do not want to hear.

And this is a right that we must defend at all costs, even if we are not politically correct or do not agree with the views of others.

My book aims to be, among other things, an illustration of freedom of speech in the Orwellian sense.

CHAPTER 1

THE TRANSITION TO 100% *GREEN* ENERGY—AN EXERCISE IN MAGICAL THINKING

In February 2019, when I first presented the megaproject *Green New Deal,*[1] proposed by several Democratic members of the United States Congress, to the readers of the Contributors.ro platform, I hesitated over the title. Although I initially intended to discuss the *Green* … project as an exercise in magical thinking, I eventually decided to use the name of the famous Faulknerian novel *The Sound and the Fury*. I hoped that the proposal for the Green New Deal would remain a daring attempt to spectacularly launch the young Alexandria Ocasio-Cortez's career during the congressional elections on November 3, 2020.

It looks like I was wrong. Ideas launched by the Green New Deal megaproject included achieving 100% of electricity from renewable sources by 2035, 100% zero-emission vehicles by 2030, and net-zero global greenhouse gas emissions by 2050, among others. These ideas spread with the speed of an uncontrolled virus and managed to magically "infect," among others, the leaders of the European Green Deal, the government of the United Kingdom, the governor of California, various environmental nongovernmental organizations (NGOs), and more.

Magical thinking is defined as a causal relationship between actions (religious rituals, prayers, sacrifices, etc.) and an expected benefit or reward. A classic example of this can be seen in some countries every year in December, when children polish their shoes on December 5 and ask St. Nicholas to notice their efforts so they can receive a reward placed in their clean shoes. In the Green New Deal's case magical thinking involves the sacrifice, more or less ritually, of fossil fuels on the altar of climate change. Here, the expected reward is saving the planet from the climate apocalypse, which can be done by replacing fossil fuels with renewable energy, particularly solar and wind energy. In this case, people believe that if renewable energy is implemented, then the world will receive its "reward," which is predicted to happen sometime between 2030 and 2050.

This chapter aims to demonstrate that the transition from fossil fuel-based economies to new "green" economies is suffering from magical thinking syndrome in the form of a tragic discontinuity between the immediate reality and the unattainable expectations of the next 10 to 30 years.

A meta-study published in September 2020 was titled *Energy and Climate Policy—An Evaluation of Global Climate Expenditure 2011–2018*.[2] The authors mainly used the *Global Landscape of Climate Finance* reports published annually since 2010 by the Climate Policy Institute (CPI) as data. Additionally, another 254 studies and articles describing the state of transition to *green* economies were used in this study.

According to CPI reports, **between 2011 and 2018 a total of USD 3.666 trillion was spent on climate change projects**. Of this amount, **55% (USD 2.030 trillion)** was spent implementing solar and wind energy. According to global energy reports, the contribution of wind and solar power to global energy consumption increased from **0.5% to 3%** during that period. Simultaneously, coal, oil, and natural gas provided **85%** of global energy consumption, and hydropower and nuclear energy provided **12%**.

The interpretation of this data in future projections proves that relying on solar and wind energy is not enough to mitigate climate change. It is magical thinking to think that it will. One must consider the following question:

> If humanity has spent over USD 2 trillion in the last eight years to increase the contribution of wind and solar energy to global energy consumption from 0.5% to 3%, how much money will it cost, and how many years will it take to reach 100%?

A possible answer must consider the global population, as it is currently and as it might be in the future, as well as the growing size of modern economies. Under these conditions, the scale at which the transition to 100% renewable energy will take place matters enormously. Using an analogy from physics, changing a system will be met with various inertial and resistance forces. For example, a large moving truck is harder to stop or turn than a toy.

Today's reality needs to be seen clearly. Fossil fuels provide humankind with 85% of electricity, heat, and transport energy. This is a percentage that has fallen insignificantly from 86% in the last two decades.[3] And to achieve this slight decrease, humankind has spent over USD 3.6 trillion!

The total replacement of fossil fuels in the next 20 to 30 years would require renewable energy's global production to increase at least 90 times its current amount.[4] Is this possible? For comparison, it took half a century to increase oil and gas production ten times. Aside from the exorbitant costs, to believe that the development of solar and wind energy can increase this quickly is a fantasy produced by magical thinking.[5]

Another observation I have made is that the sun and wind are free. So why aren't solar and wind energy cheaper than fossil fuel-based energy? The answer is that oil, natural gas, and coal have the following three characteristics that do not exist in sun and wind energy production:

1. **Natural concentration** (fossil fuel energy can be contained in a small space)
2. **Natural storage** (fossil fuels do not require batteries)
3. **Natural abundance** (sun and wind energy depend on many variables, such as the time of day, latitude, geography, or meteorology)

These three criteria are also satisfied—although limited—in the case of nuclear energy, which could be considered a true renewable energy. However, political and economic debate over the topic has concluded that uranium is not a renewable energy source.

There are other issues associated with the transition to 100% renewable energies that illustrate magical thinking.

The problem of energy power density

To compare different energy options, the power density of each energy, or how much energy is produced per unit area (W/m^2), must be observed. This value proves that some energy technologies are less dense than others. The evolution of human society is directly linked to the transition from less dense energies of biomass (wood, straw, animal dung, etc.) to denser ones (e.g., coal, hydrocarbons, uranium). The fact that the energy generated by fossil fuels has an incomparably higher power density to that produced by renewable energy, coupled with their abundance and cheapness, represents the main cause of the Industrial Revolution's triumph. The use of fossil fuels in this era also facilitated an unprecedented increase in welfare, average life expectancy, technological advances, agricultural production, population, and more.

Figure 1.1 compares the average power densities of the leading energy sources used to produce electricity.

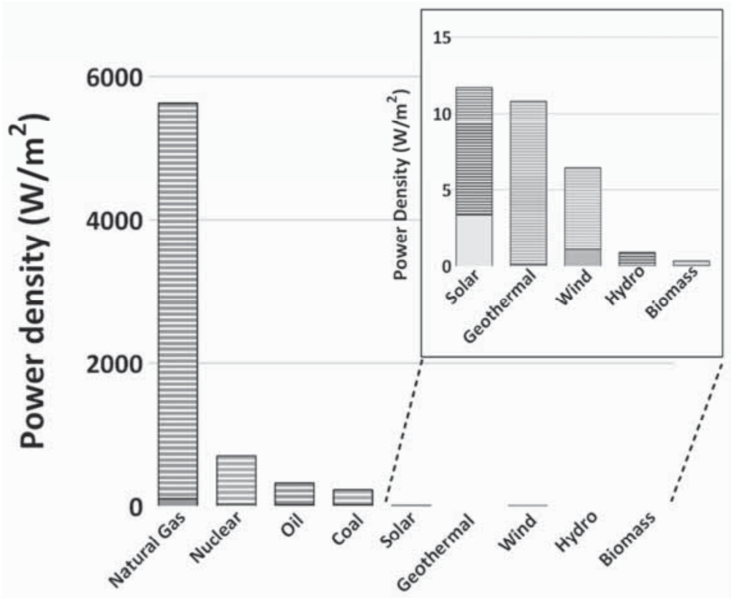


Figure 1.1. Average power densities, in W/m^2, of the most widely used sources in electricity generation. The hatched portions indicate values between the minimum and maximum estimates.[2]

The average power densities of nonrenewable energies are about three orders of magnitude greater than those of renewable energies (e.g., solar, geothermal, wind, hydro, and biomass). In other words, nonrenewable energies produce about a thousand times more power per unit area. Natural gas far exceeds all other sources of electricity in terms of power density. In the renewable energy category, solar power has the highest power density. However, solar energy's average power density is much lower than that of fossil or nuclear energy.

The energy transition put forward by the Green New Deal gives supporters an anachronistic reversal of the trend of economic progress that has been established for centuries. Replacing sources of high energy density (fossil fuels) with sources that have a much lower power density (wind and sun) requires more land area. Consequently, the average energy footprint per capita, which corresponds to the environmental footprint of each person, will increase accordingly if this transition of energies occurs. The entire planet is considered by some to be overpopulated, which is worrying considering how much land the world has left to provide for a growing population and more energy demands.

The considerable difference between the power densities of fossil and renewable energy was created by nature, and it is immune to the aspirations of magical thinking or government subsidies. Regardless of what governments, the Paris Agreement signatories, the 97% of experts who believe in anthropogenic global warming, Greta Thunberg, and others desire, the amount of energy that can be produced by sunlight or wind cannot defy the laws of physics. The efficiency of photovoltaic cells or wind turbines can only be so much. And here are two other insoluble problems that I did not encounter in the magic thinking exercises.

Shockley-Queisser boundary problem

For silicon photovoltaic (PV) cells, there is an approximately 34% limit imposed on the maximum theoretical efficiency of a photon ability to be converted into an electron. Today's best commercial voltaic panel technologies have reached just over 26% conversion efficiency, which is close to the mentioned limit. Although future research will uncover new, better-performing nonsilicon solutions, they will have similar physical limitations. Additionally, none are currently in production but hopefully, they will be cheaper.[6] In other words, working toward increasing solar energy production by nine times is an exercise in magical thinking.

Betz limit problem

Wind turbines meet their limit of maximum capture of the wind's kinetic energy at 60%. Current commercial turbines exceed 40%. That is, as with solar energy, an increase in wind energy can occur, but it will eventually reach its physical limit, which is not what is necessary to meet current climate change goals.

The problem of renewable energy storage

The benefits of solar and wind energy production are confronted by an Achilles heel, or how to store produced energy.

When people hear about energy storage, they immediately think of rechargeable batteries, such as those in electric vehicles. But this type of battery accounts for less than 1% of global energy storage. Accumulation lakes still store 96% of global energy, which is decades old but well known.

In the case of hydrocarbons, it costs less than $1 to store a barrel of crude oil or natural gas (in energy equivalent terms) for two months. Coal storage costs even less. Therefore, on average, the United States has up to two months of national energy reserves in the form of hydrocarbons and coal for any time of year.

In the case of batteries, the situation is completely different. Storage costs about $200 for an equivalent amount of energy. Instead of two months, all American batteries in United States electricity networks, in addition to the one million batteries that are in electric vehicles, can store only *two hours* of national energy demand.[7]

The amount that it would cost for Tesla, the world's best-known manufacturer of batteries, to store an equivalent amount of energy to one barrel of crude oil is USD 200,000. And the weight together would be over 9,000 kg. The same barrel of crude oil would weigh about 135 kg and could be stored at a cost of only $20.[8]

So how many batteries should be manufactured to store the energy required by the United States economy, not for two months, but only for two days? Let's look back to Tesla and its factory, Gigafactory, in Nevada.[9] Costing $5 billion, it is the largest battery factory in the world, with an annual production of 24 GWh/year. It means that all Tesla batteries manufactured in one year can store *three minutes* of energy consumed annually in the United States (4,222 TWh/year). To store all the energy that would be consumed in just *two days* in the United States, it would take Gigafactory to produce batteries for 1,000 years. There is just no way that these batteries could provide storage for a year. This is magical thinking.

The problem of resources needed to build batteries and installations producing renewable energy

Assuming, even though it sounds absurd, that battery manufacturers around the world could produce the batteries needed to store renewable energy, another insolvable problem arises with the procurement of the components necessary to store renewable energy.

Because the transition to 100% renewable energy requires a significant increase in production and storage, respectively, Mills (2020) points out that there will be an "unprecedented increase" in global mining, leading to the radicalization of environmental and labor issues concerning mining markets. It will also dramatically increase the vulnerability of the energy supply chain in the United States.[10]

According to Mills' (2020) analysis, the construction of solar panels, wind turbines, and batteries for electric vehicles requires, on average, more than ten times more materials than what is needed to manufacture fossil fuel-consuming cars that would produce the same amount of energy.

To put that to scale, a single battery of an electric vehicle contains more cobalt than 1,000 smartphones, and the arms of a single wind turbine have more plastic than 5 million smartphones. And a network of solar panels that can power a computing center uses more glass than 50 million smartphones.

The British government made an important statement in 2007 under Prime Minister Gordon Brown: "Wind energy to power UK by 2020, government says."[11] 2020 has come and gone, but "every home in the UK" is not (yet) powered only by wind and sun.

Under Prime Minister Boris Johnson, the British government "upgraded" its 2007 counterpart's statement: "Wind farms could power every home by 2030."[12] This outstanding commitment means that in the next ten years, the wind power of Great Britain will increase four times the current level to reach 40 GW. The cost will be almost £50 billion, an amount equivalent to installing a turbine every single day for the next decade (i.e., around 3,650 new turbines). And then there are the batteries to consider. If London is to rely on batteries alone for just one week, it will have to buy every battery manufactured in the world over the next two years. It is also worth noting that electricity cannot provide the heat needed by heavy industry. For example, cement plants and steelworks operate at temperatures above 1000 °C.

Recently, Prime Minister Boris Johnson made another important statement: "UK plans to ban fossil fuel vehicles by 2030."[13] Yet the prime minister is seemingly ignoring a serious warning expressed by a group of British geological experts in 2019. If the 31.5 million petrol and diesel vehicles in the United Kingdom are to be banned and replaced with electric cars, it would require

> … just under two times the total annual world cobalt production, nearly the entire world production of neodymium, three quarters the world's lithium production and at least half of the world's copper production during 2018 […] If we are to extrapolate this analysis to the currently projected estimate of 2 billion cars worldwide, based on 2018 figures, annual production would have to increase for neodymium and dysprosium by 70%, copper output would need to more than double and cobalt output would need to increase at least three and a half times for the entire period from now until 2050 to satisfy the demand.[14]

Replacing fossil fuels with renewable energy, according to current programs, will significantly increase the mining of various critical minerals around the world. In addition to base metals (e.g., Li, Co, Ni, Al, Fe, Pb, Mn, Ag, Zn, Mo, and Cr), wind farms and solar power, as well as batteries, require rare earth elements (RER): 15 elements from the lanthanide group with atomic numbers between 57 and 71.

The battery of an electric vehicle weighs around 450 kg. In general, such a battery contains 12 kg of lithium, 14 kg of cobalt, 28 kg of nickel, 50 kg of graphite, 40 kg of copper, and about 180 kg of steel, aluminum, and various plastic components. To obtain only the first five elements that are part of a battery of over 450 kg, it is necessary to extract about 41,000 kg of ore by mining. If we add the quantities of stripping rock that needs to be removed to reach the ore, it turns out that for a single 450 kg battery, more than *225,000 kg* of rock must be excavated. The calculation of this number and the 16 million batteries that will need to be installed by 2030 on the new electric vehicles is left to you. I also invite the reader to keep in mind that the above tonnage is underestimated because it does not include the amount of excavated rock needed to extract steel from iron ore, copper used in wiring, or rare earths (e.g., neodymium and dysprosium) used in magnets and electric motors. And the ecological disaster of these mining activities will have to be discussed separately.

During the life of an electric battery, each kilometer traveled "consumes" 1.4 kg of rock. Using an internal combustion engine, about 0.05 kg of rocks/km is "consumed."

The manufacture of renewable energy production consumes fossil fuels (e.g., coal, oil, and natural gas) to produce the necessary cement, steel, plastic, and purified elements. To produce a single battery, the equivalent energy of 100 barrels of oil is consumed. And this battery can store the equivalent energy of only a single barrel of oil.

In 2017, The World Bank published a 112-page study, titled "The growing role of minerals and metals for a low carbon future," which addressed some of the many challenges facing the move toward low carbon dioxide emissions in coming years:

> Using wind, solar, and energy storage batteries as proxies, the study examines which metals will likely rise in demand to be able to deliver on a carbon-constrained future. Metals which could see a growing market include aluminum (including its key constituent, bauxite), cobalt, copper, iron ore, lead, lithium, nickel, manganese, the platinum group of metals, rare earth metals including cadmium, molybdenum, neodymium, and indium—silver, steel, titanium, and zinc.[22]

A study recently published by three British researchers gave important predictions about the increasing demand for critical minerals in 2030 compared to 2015 due to the massive adoption of electric vehicles (EV), which is shown in Figure 1.2.[14] The sale of about 16 million EVs in 2030 will increase Li's demand by 3,700% and the demand for Co by 1,838%. There will also be a 68% increase in demand for Li and Co in China, which will buy 21% of the new EVs, 75% of which will be electric buses.

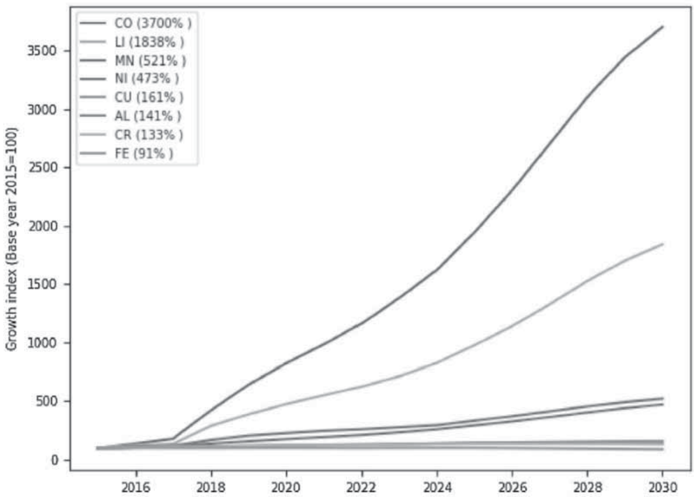


Figure 1.2. Increased demand for metals for electric vehicles in 2030 compared to 2015.[14]

In this chapter, I do not discuss the geopolitical issues, the preservation of biodiversity, and the national energy security related to increasing the role of minerals and metals in the transition to "green" economies.

According to data published in 2020, planetary road transport is responsible for 11.9% of total greenhouse gas emissions.[16] This means that if we could electrify the **entire** road transport **sector** (cars, lorries, buses, motorcycles, etc.), the impact of the more than 2 billion vehicles currently powered by fossil fuels would mean a reduction in global emissions by 11.9%. Is this percentage high? Or is it low? It just depends on who you ask.

Wind farms and climate problems

Although environmentalists love promoting wind energy as a major method of influencing the global climate, the reality of wind farms' operation also hides some paradoxical details about the negative influences on local and regional climate change. For example, Abbasi et al. (2016)

explains that "large-scale wind farms with tall wind turbines can influence on the weather, possibly on the climate, due to the combined effect of the wind velocity deficit they create, changes in the atmospheric turbulence pattern they cause, and landscape roughness they enhance."[15]

Wind turbines' negative impacts can influence the local weather and climate in three aspects: temperature, wind, and precipitation.

For example, wind farms increase the average soil and subsoil temperature downstream of turbines at night by increasing the atmosphere's turbulence. Researchers have shown that "using wind turbines to meet 10% or more of global energy demand in 2100 could cause surface warming exceeding 1°C over land installations."[17] Another study presents an unexpected situation. "If US electricity demand was met with US-based wind power, the wind farm array would need to operate for more than a century before the warming effect over the Continental US caused by [the wind farms] would be smaller than the reduced warming effect from lowering [CO_2] emissions."[18]

Wind farms also influence and change the wind pattern through the wake effect, which mainly reduces the wind speed at the turbines' exit, thus reducing the efficiency of the turbines placed downstream (the amount of energy generated). In the case of offshore farms, this effect can extend over relatively large areas. Also, the simulation of the impacts of large wind farms suggests that "the induced perturbations involve substantial changes in the track and development of cyclones over the North Atlantic, and the magnitude of the perturbations rises above the level of forecasting uncertainty."[19]

Evolution or revolution?

The current trend to 100% renewable energy is a *transition* process whose end is not yet in sight. Both wind and solar power are not recent inventions. The modern wind turbine is about 50 years old, and its birth was made possible by mainly using hydrocarbon-based fiberglass. Modern solar technology has a similar age to the invention of the lithium-ion battery, the core of the current energy storage devices. The battery is the brainchild of Dr. M. Stanley Whittingham, who, in the 1970s, worked at ExxonMobil's Clinton, New Jersey, corporate research lab.

Although half a century has passed, no disruptive technological leap has been made in the case of the two renewable technologies and storage batteries, something to be comparable to the invention of the transistor or the internet. However, through an exercise in magical thinking, governments in North America, Europe, and other geographical areas have adopted various Green New Deal or similar programs designed, they believe, to solve an apocalyptic climate crisis!

To speed up this transition that does not have a secure end, and in the absence of disruptive inventions, those governments eager to adopt new “green” policies have chosen the simple but inefficient way to spend vast sums of public money in the form of subsidies.

Despite visible limitations and the inefficiency of renewable energy compared to fossil fuels, some governments continue to believe that subsidies will bring about a miraculous leap forward and, through a classic exercise in magical thinking, wind and sun will become cheaper, more abundant, more scalable, safer, and more than fossil fuels.

In addition to the fact that buyers of a Tesla car receive a $7,500 subsidy from the federal government, and some states, such as California, add up to an additional $7,000 in subsidies, Tesla also benefits from more than $420 million by selling *green* certificates to other automakers.[20] The situation is also found in the case of subsidies for wind and solar energy.

I have written many times that renewable energies will be able to replace fossil fuels quickly and winningly only when they become cheaper and more reliable WITHOUT SUBSIDIES. What we need is not a slow *evolution*, generously “anointed” with public money. We need a *revolution* in the form of scientific and technological miracles generated by fundamental research. The invention of cars was not the result of subsidizing horse breeders or carriage owners. The invention of the internet did not result from subsidizing rotary phones. The invention of the transistor did not benefit from subsidies granted to vacuum tube manufacturers. The success of Tesla cars is largely due to the subsidies received. But, for a fair evaluation, let’s compare the growth rate of Tesla, which sold over 500,000 vehicles in the first six years of production, with the Ford Mustang launch 56 years ago. Ford sold 2.5 million Mustangs in the first six years without subsidies.

An *energy revolution* would require a disruptive technology that made existing ones too useless or too expensive.

When London was covered by the carpets of horse manure produced as a result of using carts and carriages, the disruptive invention was the automobile. Today, eight million people live in London, and no horse manure can be seen on its streets.

When whale oil was the most sought after fuel for home lighting in the United States in the 1700s and 1800s, killing whales provided jobs for 70,000 people. Of course, there were no NGOs or other environmental groups in those days to protest the barbaric killing of animals. No one at that time wondered what would happen when all the whales were killed. And what saved the whales? A disruptive technology invented in the state of

Pennsylvania in 1859 at the first oil drill in Titusville. And the first product of this new technology, kerosene, proved to be cheaper and of better quality in American lamp lighting than whale oil. And as far as I know, “Colonel” Edwin L. Drake, the head of the workers who drilled the borehole at Titusville, received $0.00 in subsidies from the federal government.

When cars proved to be polluting, and Los Angeles was covered in smog in the 1960s, a cheap solution would have been to ban traffic and force everyone to stay home or travel by bicycle, carriage, and horseback. But a disruptive invention emerged in the form of the catalytic converter and today, it is possible to have more people driving more cars without dramatic air quality changes.

More recently, Google technology has made libraries virtually useless. You can find all the free information you need with a few clicks on your laptop or phone. Gradually, libraries will become museums of classic books on paper.

And the list of disruptive inventions, not publicly subsidized as was the case of Tesla, is much longer: hydraulic fracturing, iPhone, Amazon, Facebook, Twitter, YouTube, Wikipedia, Netflix, Uber, etc.

If politicians want to impose Green New Deal policies at all costs, it is advisable to pay more attention to simple but effective “climate adaptations.” For example, heat waves can be counteracted by installing air conditioners, and cold waves can be attenuated by electric or gas radiators. Infrastructure vulnerable to hurricanes or floods can be strengthened and secured for long periods. Planting trees, expanding green spaces, and creating artificial lakes not only makes cities more pleasant for citizens but also drastically reduces temperature peaks.

What unpleasantly surprised me while studying the USD 3.66 trillion list spent globally in 2011–2018 on climate policies was the finding that, while wind and solar energy used 55% of that amount, climate adaptation projects accounted for only 5% ($190 billion).

Renewable energies are still waiting for the revolution of disruptive technologies. Or, as Bill Gates recently warned:

> Climate Change Is an Even Harder Problem Than the Pandemic. We’re short about two dozen great innovations.[21]

Conclusions

Climate change has been an objective reality for billions of years. There are only two climates on earth: glaciation and interglaciation, which have succeeded and will inexorably succeed each other. The fact is that the interglaciation period that we live in started 11,200 years ago, and we have taken advantage of it and continue to take advantage of it. The climate crisis is a subjective "reality," caused by:

- An unfounded faith in the existence of an ideal concentration of CO_2.
- A Babelian attitude of our contemporaries regarding their abilities to control and modify the climate as they wish.

Today, we are witnessing a spectacular contradiction of the wisdom: But it is not the times under the helm of man, but the poor man under the times … (translated from Miron Costin, 1633–1691).

I see the expressions of magical thinking in these manifestations, such as suggested by Mills (2019)[5] that we have been able to land a man on the moon in eight years. So, we would certainly be able to achieve a transition to 100% renewable energy in the next decade.

But the energy transformation of the global economy, from 3% to 100% renewable, is not comparable to "putting a few people on the moon a few times. It is like putting all of humanity on the moon, permanently."[5]

Chapter 2

The Sound and the Fury: The American Democratic Socialists and the Green New Deal

Socialism may begin with the best of intentions,
but it always ends with the Gestapo.

Sen. Tom Cotton, 2019
(paraphrasing W. Churchill, *Gestapo Speech*, 1945)

The Communist Manifesto, published in 1848 by K. Marx and F. Engels, begins with a terrifying statement: “A spectre is haunting Europe—the spectre of communism.”

As if humanity had learned nothing about the “benefits” of communism in the last 100 years, a similar specter began to dazzle through the bastion of American capitalism and democracy: *socialism*. What seemed an eccentricity in 2016 on the part of independent senator Bernie Sanders, self-proclaimed as a Democratic Socialist, became, in 2019, a much more pronounced trend among Democratic representatives and senators elected in 2018.

The activation of socialism immediately intensified after Democrats took over the House of Representatives following the November 2018 elections. And the first moment of public delirium was created with President Trump’s speech to the nation on February 5, 2019.

People were outraged that President Donald Trump did not even mention climate change but instead found the time and words to declare without hesitation that:

> Tonight, we renew our determination that America will never be a socialist country.

Two Democratic lawmakers, Alexandria Ocasio-Cortez (New York), the youngest member of the House of Representatives at the time, and

Senator Edward Markey (Massachusetts), introduced a draft resolution on February 8, 2019. It was the federal government's duty to create a Green New Deal to discuss and vote on in Congress.[1] Immediately, another 95 senators and Democratic deputies hurried to support the initiative of the two colleagues.[2]

The starting point on which the new project was built is an apocalyptic idea, expressed by Ocasio-Cortez: "The world will end in twelve years if we do not address the issue of climate change.[12]" It was only a step from here to the onset of an ecological hysteria, with many eco-socialist components. The Green New Deal provides extraordinary measures that are very unlikely to be achieved, tantamount to an aberration that Nancy Pelosi herself, the Speaker of the House of Representatives, condescendingly berated: "The green dream or whatever they call it, nobody knows what it is, but they're for it, right?"[10]

The list proposed by Ocasio-Cortez contains a mixture of climate objectives and a populist-socialist agenda:

- electricity: 100% obtained from renewable sources by 2035
- vehicles: 100% zero-emission by 2030
- buildings: 100% energy-modernized (zero energy) by 2030
- reduction of anthropogenic greenhouse gas emissions by 40–60% compared to the levels of 2010 by 2030
- net-zero global greenhouse gas emissions by 2050
- universal medical insurance
- millions of new guaranteed jobs, with high salaries
- stronger unions
- an antimonopoly, domestic, and international clause

I found it very interesting that the Green New Deal agenda does not contain a carbon tax, which has been a mantra for environmental movements. Maybe this is because former President Barack Obama did not introduce this tax in 2009 when he opted for the cap-and-trade option, but I do not know. However, the mixture of climatic objectives with populist-socialist ones indicates an attempt to rebrand the old ecology ideology by adorning it with more colorful feathers, plucked from the plumage of socialism.

What the Green New Deal is trying to convey is an everything-plus-reduction-carbon-strategy. We are witnessing the marriage between ecological policies and economic policies in the twenty-first century.[3] Keeping them separate is not proof of intellectual rigor. It is instead an anachronism that the Democratic Socialists are striving to eliminate.

For example, our high CO_2 emissions are not just due to the burning of fossil fuels or the production of electricity from coal. The construction of infrastructure also produces them. For every person on the planet, there are over 1,000 tons of built environment, such as roads, office buildings, thermal or hydropower plants, cars, trains, or heavy trucks. In addition to all of this, we must add the daily activities that increase our carbon footprint, such as going to work, moving to a new job, traveling with the family during the holidays, using phones and computers, producing and procuring food, or surviving during "polar vortices." In turn, these activities involve other human footprints in water consumption, the use of pesticides and soils, and the degradation of some habitats. To be human during this period, on this planet, means to produce a climatic impact. Changing or attenuating it involves a severe metamorphosis of our current way of life.

My second example is related to one of the Green New Deal's objectives: millions of guaranteed and well-paid new jobs.

Eliminating emissions from burning fossil fuels to produce electricity and fuels is equivalent to eliminating the hydrocarbon and coal industries. In the United States alone, in 2015, the number of people employed in the oil and gas industry was 10.3 million people.[4] Laying them off would create an economic disaster similar to or perhaps more significant than the supposed climatic one. How this social problem could be solved is not explained in the Green New Deal project.

Of course, "Green New dealers" would like to spend trillions of dollars on their aberrant climate dreams and other trillions for their populist obsessions (universal medical insurance, millions of new guaranteed and well-paid jobs, stronger unions). A conservative estimate of the cost involved in introducing Green New Deal legislation amounts to $6.6 trillion USD per year.[5] The annoying part is that most ordinary people in America do not want to spend a dime on renewable energy, especially when it comes to their own money. In the November 2018 elections, the citizens of Washington, a solid Democratic state, rejected a carbon tax with a margin of 12%.

The supposed creation of new jobs through the Green New Deal's destructive proposals is essentially Bastiat's broken window fallacy.[6] The new American administration, the American Democratic Socialists who initiated the Green New Deal, as well as the European legislators who approved the European Green Deal, propose eliminating fossil fuels (0% CO_2 emissions by 2030–2050) and replacing them by so-called renewable energies.

For example, in the United States alone, 10.3 million people working in the hydrocarbon and coal industries will lose their jobs if these "green" policies are implemented. What will those people and their families do? I have not read anything clear and convincing about their future.

The proposals promoting renewable energies provide an excellent illustration of Bastiat's parable: We will break the old energetic "windows" to give employment to the ecological "glaziers." This situation is essentially the same as when people believe that broken windows will stimulate economic activity, without realizing the unpredictable negative consequences that the situation will cause.

Pennsylvania's experiment with alternative energies proves the truth of Bastiat's parable. Policies that create "green jobs" hurt the entire economy.

In 2010, Democratic Gov. Ed Rendell spent an additional $1 billion of state money, in addition to federal grants received from the Obama Administration, to create new green jobs. With these funds, he could employ only 8,300 people, meaning that the Pennsylvania taxpayers supported each of these green jobs with over $120,000![7]

A study published by researchers from Universidad Rey Juan Carlos in Madrid found that for every new green job created by various government programs in Spain, 2.2 "old" jobs were destroyed in the real economy.[8]

Another report presented similar consequences to Bastiat's parable in the United Kingdom. For every new green job created in the renewable energy sector and funded by government programs, 3.7 jobs were forgone elsewhere in the economy. Researchers also added: "Funding of renewable energy policies imposes extra taxes and higher energy bills on households and industry."[9]

Green New Deal and climate contradictions

In the past, Marxists liked to talk about the fundamental contradictions of capitalism. Today, they must also consider the inconsistencies of Green New Deal climate policies.

If climate problems are so severe, even apocalyptic (e.g., "the world will end in twelve years if we do not address the issue of climate change"),[12] why not consider climate change as an event that will destroy the world, equivalent to an alien invasion? Why not declare a climate war and give a planetary order to force us to adopt economic and political measures comparable to war socialism?[10]

Let's choose between capitalism and climate![11]

Let's not bother with the construction of new windmills or subsidies for renewables. Let's immediately declare a state of war, nationally and globally, to urgently set up a climate police to measure and rationalize the carbon footprint of every citizen of the planet to abolish, as Alexandria Ocasio-Cortez demands, the billionaires.[12] And with the money confiscated from them and increased taxes, let's put thousands of billions into solar energy through megagreen infrastructure projects around the planet. Oh, and let's not forget that we will also have to impose economic sanctions on China and India if they build new coal-fired power plants. How do you like this plan?

To some people, pompous but hollow statements such as those uttered by the Democratic Socialists cause panic and push politicians to accept hasty, poorly designed climate policies without asking about the costs of implementing those policies.

According to the latest major report published by the United Nation's Intergovernmental Panel on Climate Change (IPCC),[13] if no action is taken to stop climate change, the resulting impact will mean a 0.2% to 2% reduction in global revenues over the next 50 years. By 2070, however, personal income will be about 200 to 500% higher than at present. That is, the climate impact would be equivalent to the losses we could have from a single economic recession in the next half century.

Alternatively, climate change could be seen as something similar to global poverty, which is a severe problem—but one that can be solved patiently and calmly, without panicking apocalyptically and without embracing extremist, socialist solutions.

Conclusions

A climate Armageddon will not happen in the next twelve years, as the Democratic Socialists in the United States Congress believe, even if the world does not meet all the goals set out in the Green New Deal. Some of us remember similar false alarms from the last century. For example:

In the 1960s, environmentalists were worried that the world would starve to death.

In the 1980s, people were frightened by acid rain, a "killer" of the planet's forests. Even if there was some reason for alarm, panicked solutions would eventually lead to a terrible and exaggeratedly expensive result.

This type of alarmist approach has not produced the expected progress for climate change mitigation for decades. More intelligence, innovation, and ingenuity are needed, not leftist, bankrupt ideology. More research into renewable energy is beneficial. If we manage, through innovations and fewer subsidies, to succeed in making renewable energy cheaper than fossil energy, everybody will switch, and we will have a closed case.

Let's take a closer look at science and ignore the alarmist propaganda, however. The world will *not* end in the next twelve years. Therefore, our decisions should not only be apolitical but also smarter.

And let's not forget: climate change means change, not the end of the world.

Chapter 3

Europeans are not Worried about Global Warming. Climate Realism or Climate Socialism?

The welfare of humanity is
always the alibi of tyrants.

Albert Camus

In September 2020, the Institute of Labor Economics (IZA) in Bonn published a 47-page study entitled "Do Europeans care about climate change? An illustration of the importance of data on human feelings."[1] The study's authors, Adam Nowakowski (Bocconi University, Italy) and Andrew J. Oswald (University of Warwick, UK), statistically analyzed the responses of 70,000 randomly selected Europeans from 29 nations about their level of concern about climate change, aka anthropogenic global warming.

The data used in this study came from two recent sources: the *European Social Survey* (ESS)[2] done in 2016 with 40,000 responses and the *Eurobarometer Survey* (ES)[3] done in 2019 with 30,000 responses. The two surveys covered several areas of interest to the continent's inhabitants, including climate change. The climate questions were:

- How worried are you about climate change? (scale 1: Not at all … 5: Extremely worried)
- Imagine that a large number of people have limited their energy consumption. What is the probability that this would reduce climate change? (probability scale 0–10)
- What do you think are the two most important issues facing your country at the moment? (Choose a maximum of two answers from the list: crime; economic situation; inflation; taxation; unemployment; terrorism; housing; public debt; immigration; health and social security; education system; pensions; environmental, climate, and energy issues)

The statistical analysis of the 70,000 responses provided a reality less expected in some political circles and contrary to current political correctness:

1. Europeans do not have high levels of concern about climate change—**only 1 in 20, or 5%, describe themselves as extremely concerned.**
2. Europe's citizens are more concerned about issues close to home, such as health, social security, inflation, the general economic situation, and unemployment.
3. Europeans are not very convinced that energy consumers' joint action will have a real impact on climate change.
4. Women, young people, college graduates, and urbanites have higher levels of concern about climate change, while men, the elderly, and those with a low education level are the least concerned.
5. Citizens living in the warmer, southern countries of the continent are more concerned about climate change than people in the colder northern countries.

Overall, the 70,000 Europeans surveyed ranked climate change, along with environmental and energy issues, on their list of priorities following health and social security (1st place), rising prices, inflation, the cost of living (all in 2nd place), the economic situation (3rd place), and unemployment (4th place).

As unexpected as these results may be for some, the study's authors point out that the real average level of concern for Europeans may be lower due to an infamous problem encountered in opinion polls—social desirability bias, or the tendency of respondents to feel pressured to answer "politically correct" questions to please those around them.[4]

The authors of the study were surprised by their results and drew attention to the immediate consequences:

> As Europe has some of the highest education levels in the world, the continent makes a natural testing ground for an empirical inquiry of this kind. If Europeans are not severely worried and are unconvinced of an urgent need for change, there is perhaps little reason to have optimism about most other parts of the world (p. 4).[1]

In November 2020, *European Commission – Public Opinion* published another survey result: *Standard Eurobarometer 93 – Summer 2020 – Public opinion in the European Union, First results*.[5] The participants included 33 counties: 27 European Union (EU) members, along with the United Kingdom, 5 EU candidate countries (Albania, Montenegro, North Macedonia, Serbia, and Turkey), plus the Turkish Cypriot community living in the part of the country that is not controlled by the government of the Republic of Cyprus.

Question #5 of the survey asked the participants to indicate "the two most important issues facing the EU at the moment." The answers are presented below in Figure 3.1:

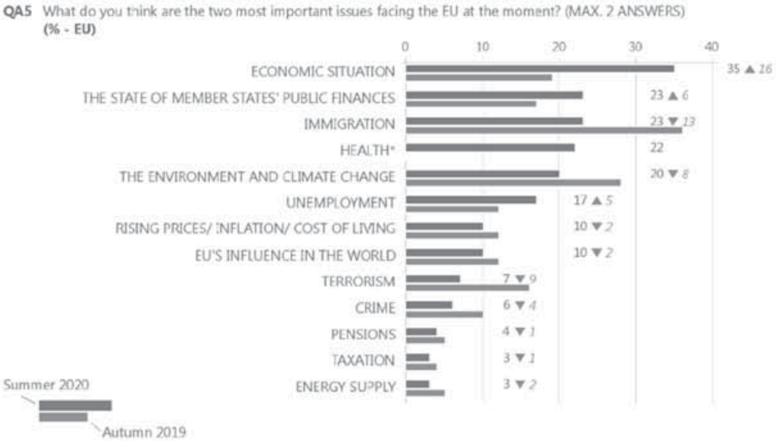


Figure 3.1. The distribution of the most critical issues facing the EU in 2020.[1]

Economic, financial, immigration, and health situations worry most Europeans. Even though climate change was aggregated with the environment in this study, both issues issue only occupied fifth place (20%), similar to the IZA 2020 report and registered a decrease of 8% with respect to autumn 2019. At the national level, only three countries listed the environment and climate change as their most important issue: Sweden (49%), Denmark (44%), and Luxembourg (36%).

Europeans are not the only people in the world who are not (very) worried about climate change. Just one additional example from the United States of America, shown in Figure 3.2, comes from a Pew Research Center survey published in 2019, which found that climate change is ranked second to last in a list of eighteen items, making these issues even less of a priority than in Europe.

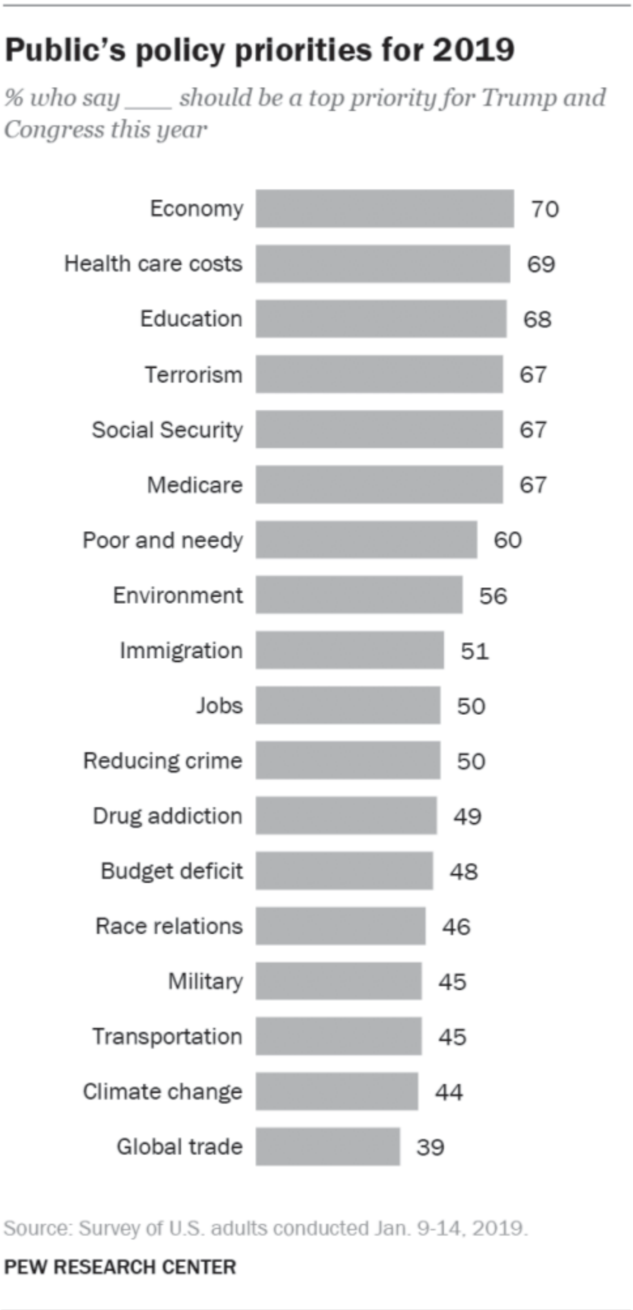

Public's policy priorities for 2019
% who say ___ should be a top priority for Trump and Congress this year
Economy
70
Health care costs
69
Education
68
Terrorism
67
Social Security
67
Medicare
67
Poor and needy
60
Environment
56
Immigration
51
Jobs
50
Reducing crime
50
Drug addiction
49
Budget deficit
48
Race relations
46
Military
45
Transportation
45
Climate change
44
Global trade
39
Source: Survey of U.S. adults conducted Jan. 9-14, 2019.
PEW RESEARCH CENTER

Figure 3.2 (previous page). A survey conducted by the Pew Research Center_in January 2019 listed public policy priorities for the Donald Trump administration and the United States Congress. Climate change ranks second to last in the public interest rankings. Similar situations were registered in 2017 and 2018. The priority of interests for the American public in 2019 are, in order, the economy, healthcare costs, education, and terrorism.[6]

On January 28, 2021, the Pew Research Center published their annual survey about public policy priorities for the Joe Biden Administration and the United States Congress. The new survey outlined a major gap—45 percentage points—between Democrats and Republicans regarding actions on climate change. While 59% of Democrat respondents said dealing with global climate change should be a top priority, only 14% of Republicans shared that concern. Overall, climate change ranks 15th out of 19 options. Apparently, the new position is better that that of 2019, but the new percentage (38%) of people worried about climate change is smaller than the percentage (44%) for 2019.[7]

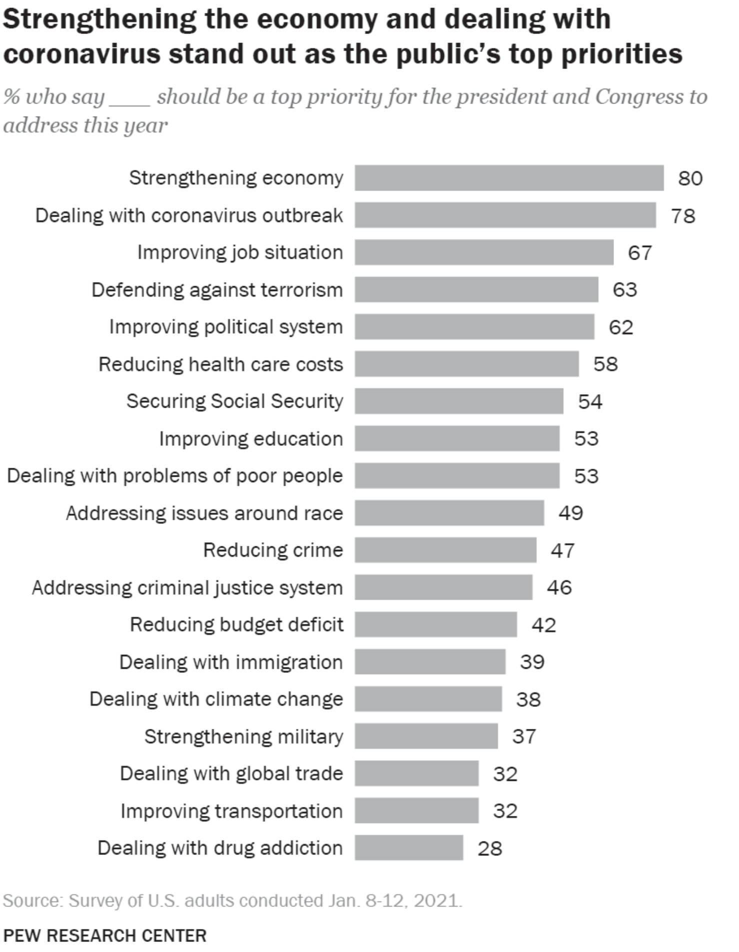


Figure 3.3. A survey conducted by the Pew Research Center in January 2021 listed public policy priorities for the Joe Biden Administration and the United States Congress. Climate change ranks 15th out of 19 options. The priority of interests for the American public in 2021 are, in order, the economy, dealing with coronavirus outbreak, jobs, and terrorism.[7]

The fact that only 5% of Europe's inhabitants are "extremely concerned" about the consequences of climate change, even though Extinction Rebellion and Greta Thunberg are currently undisputed media stars, proves that climate realism has defeated climate alarmism and offers hope that common sense, even if politically incorrect, will ultimately triumph.

Moreover, the political and administrative (bureaucratic) leadership of the European Union, which took over the model of the American Democrats' Green New Deal and proposed its own European Green Deal,[8] should reflect on the results of this study. Because no matter how skilled the new environmental policies are in finding solutions to decarbonize community economies, all have little value if voters do not vote for them. The citizens of Europe have the need and the desire to see that their opinions are known and respected by the political, economic, and social actors on the Brussels political power scene.

On a global scale, climate change concerns also rank very low (actually, in last place) among more than 9.7 million people who answered the United Nations Global Survey for a Better World in 2015. The rationale of the survey was to establish the Sustainable Development Goals "to protect this earth and make it a safe, equal, and nurturing home for all who live on it."[9] At the time of its publication, this survey was the broadest in its scope, covering more than 9.7 million respondents from 194 countries. In it, respondents prioritized 16 important issues they considered the most important for their future, as seen in Figure 3.4.

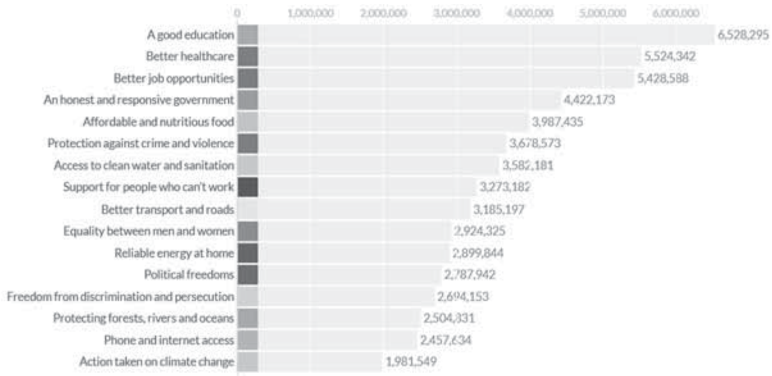


Figure 3.4. Global top priorities based on the votes of more than 9.7 million people surveyed by the UN in 2015.[9]

Based on the numbers presented in the figure above, it is clear that the top concerns of those more than 9.7 million voters from all over the globe were education, health, jobs, the eradication of government corruption, and access to affordable and nutritious food. “Action taken on climate change” came in 16th place out of 16.

Conclusions

The studies presented here raise a serious alarm signal on a fundamental problem. In a democracy, *common sense* translates into the sound and prudent judgment of voters. Therefore, policy proposals (climate, environmental, economic, etc.) must be based on a solid evidence and implemented through general agreement within society. Following this line of thinking, the authors of the first study concluded that “there is little point in designing sophisticated economic policies,” like the Green New Deal, to combat climate change if voters do not see climate change as a matter of deep concern to them and their families. And today, European voters have no such worries.

Imposing climate solutions by force, through laws, taxes, and daily media assaults on the climate apocalypse, is dangerously like the old practices, from Romania and other former communist countries, of “victorious” socialism, which promised to take human society “to new heights of prosperity and progress.” But that promise hinged on citizens being “closely united around the party and its brilliant leader.”

Climate realism has nothing to do with climate socialism.

CHAPTER 4

ABOUT THE INCONSISTENCY OF "CRITICAL POINTS" IN THE EVOLUTION OF COMPLEX NATURAL SYSTEMS

You will die of old age. I will die of climate change.

The young barefoot woman carrying the sign that read this alarmist statement must have found out something so dire and dangerous that she had no time to put on shoes before coming to alert us.[1] And like her, there are many, many other girls, and extremely few boys. What scared her so much?

I make a hypothesis: The major fault lies with climate alarmism, which is full of apocalyptic prophecies about the end of the world in the next few decades, which creates panic and anxiety by relying on the fear of a (too) rapid death due to global warming.

Climate alarmism mechanisms are multiple, sometimes complex, and potentially dangerous, and they can cause depression, suicide, gerontophobia, and other extreme psychological manifestations. Children grow up terrified, and six out of every ten American teenagers are frightened by climate change. The production of alarmism has now reached such a high level that half the world's population truly believes that climate change will end humanity.[2]

And how can you not believe this when, for example, just last year, a sensationalist article claimed that future increases in ocean levels due to climate change could flood the homes of 187 million people?[3] But that study also found it unlikely that anyone would do anything to adapt to the dramatic sea-level rise in the next 80 years. The terrifying number of 187 million climate victims was just an exaggeration, like many others of the same type, and was a number 600 times too high. But the terrifying effect on the population must not be ignored.

In 2019, a similar story made waves in media around the world. Large parts of inhabited land will be underwater by 2050, and the cities bordering the shoreline will be wiped off the face of the earth. *The New York Times*, a champion publication of alarmist records, and other media began to reference a study published in the journal *Nature,* which estimates that rising ocean levels will affect 150 million people in eight Asian countries: Vietnam, China, India, Thailand, Bangladesh, Indonesia, the Philippines, and Japan.[4]

Such apocalyptic breaking news went viral immediately. "Climate change is shrinking the planet, in the most frightening way," tweeted Bill McKibben, founder of the international climate propaganda organization 350.org. Climatologist and climate activist Peter Kalmus from NASA's Jet Propulsion Lab said he was once worried about being labeled "alarmist," but the news has made him embrace the term.[5] This alarmist balloon broke miserably when the media neglected to mention a small piece of information found in the article: coastal adaptation measures were not considered in the composition of the catastrophic flood model.

Readers of my latest book, *Climate Change − A (Sometimes) Politically Incorrect Guide*, had the opportunity to get to know a group of these alarmist mechanisms at work, based on the individual components' dismantling.[6]

Here I continue investigating and bringing to light another mechanism that ensures the functioning of climate alarmism: the concept of tipping points, with the extreme variant being the points of no return.

Tipping point is a term popularized by Malcolm Gladwell in his 2000 book[7] and is the point at which significant nonlinear relationships are recorded between the evolutionary attributes of a complex natural system (i.e., ecological, hydrological, climatic) and the factors (natural or human) that produce changes in the system. If the "critical point" exceeds a certain threshold, the changes to a new state of the system will become rapid. They may also become irreversible or could manifest hysteresis, a return to the initial condition on a path different from the initial changes path. For example, take the accelerated and simultaneous melting of ice caps in Greenland and Antarctica.[8]

Point of no return is a term taken from aviation, meaning the point of the flight path at which the aircraft does not have enough fuel to return to the starting point. Figuratively, it indicates the critical point or stage of an action or decision-making process that will result in irreversible effects that cannot be avoided or prevented. An example of this could be signing a sale-purchase contract.

In the climate system, according to the statement provided by the United Nations Secretary-General, António Guterres, on December 1, 2019, if the provisions of the Paris Climate Agreement are not met, the danger of global warming could accelerate, overcoming the irreversible point of the climate system. The agreement says that the world must stabilize the increase of the global average temperature to + 2°C (ideally, + 1.5°C) from the preindustrial period, or it will face consequences, including the extinction of the human species.[9] In other words, Guterres warns us that "the point of no return is no longer over the horizon … It is in sight and hurtling toward us."

The theoretical or empirical existence of "critical points" have manifested over the decades and centuries and are known and studied in many complex natural systems, such as the biosphere, cryosphere, thermohaline ocean circulation, atmospheric circulation, and marine ecosystems.

In the climate system, it is worth noting that critical points can be caused by fluctuations in the climate itself or natural external factors, such as slow variations in Milanković cycles. For example, during the last glacial intervals, the temperatures in Greenland fluctuated rapidly between extremely cold intervals called stages, and relatively mild intervals called interstages. The amplitude of temperature variations that occurred was between 8°C and 16°C. These are known as **Dansgaard-Oeschger oscillations**, and they are named in honor of Willi Dansgaard and Hans Oeschger, the researchers who first identified them in the ice cores of Greenland. Their studies suggest that oscillations occur at intervals between 1,000 and 9,000 years.

In 2013, an international group of researchers analyzed the existence of planetary "critical points" in the biosphere in competition with the "critical points" of other complex natural systems.[10]

Of particular importance is the analysis of biosphere changes in the earth's climate and CO_2 concentration. The authors of the study found that "local and regional ecosystems vary considerably" in terms of their response to climate change. Therefore, regime changes vary throughout the terrestrial biosphere. In addition to the fertilizing effect of high CO_2 concentrations, most climate variables, including temperature and precipitation, influence ecosystem responses and produce heterogeneous changes across the earth's biosphere. "Intercontinental connectivity, mediated by atmospheric trace gases" is probably weak because of changes in atmospheric CO_2, caused by biotic fluctuations (i.e., vegetation changes).

In conclusion, the researchers say, the "heterogeneity and independence of ecosystem responses," coupled with "spatially variable changes" in specific climate factors, indicate that the biosphere response will be gradual without a global "critical point" at any particular level of climate change.[10]

To the question raised in their article's title, "Does the Terrestrial Biosphere have Planetary Tipping Points?" the authors' answer was "We do NOT believe."

> [For these] planetary "tipping points" to exist, [human] forces would [have] to act uniformly across the planet, all ecosystems would [have] to respond in the same way [to these forces], and the response would have to be transmitted rapidly to many ecosystems and continents. Even the force of [anthropogenic] climate change does not meet these requirements.[10]

For example, while the climate heats and dries some regions, it cools and humidifies others. Even if terrestrial ecosystems were heated evenly, it "would not produce a global [and coherent change] in ecology because local ecosystems respond differently, sometimes in diametrically opposite ways."[11]

The inconsistency of the concept of tipping points, with their points of no return was already exposed in 2013. This received a new confirmation in August 2020 when eight European researchers published a meta-analysis in *Nature Ecology & Evolution* entitled "Thresholds for Ecological Responses to Global Change do not Result from Empirical Data."[12]

Taking a cue from the question raised in 2013: "Does the terrestrial biosphere have planetary tipping points?" new researchers formulated a study plan in an attempt to find an answer to a similar question: Is the concept of tipping points useful for the development of environmental policies?

To understand ecosystem responses to global anthropogenic change, the authors insist that a framework is needed for the thresholds of influences, beyond which response sizes and their variations increase unequally. However, the authors note, "we [systematically] lack quantitative evidence as to whether empirical data allow such thresholds [to be defined]."

Using detailed statistical analyses of published results from measurements of more than 4,600 impacts of global change on terrestrial ecosystems, researchers found very little evidence to confirm the existence of critical points, when threshold crossings were rarely detected. The researchers' analysis has strengthened their belief that global changes in ecosystems must abandon the general expectations of system properties thresholds as a way of managing nature under the influence of global change. The lead author, Professor Helmut Hillebrand, of the University of Oldenburg, said that the results of the study have significant implications: "If scientists cannot measure how close a certain ecosystem is to a threshold inducing a tipping point, how useful can then a regulation or policy be relying on such a threshold?"[13]

If further evidence is needed to illustrate the evolutionary dynamics of the biosphere concerning climate change, I recommend an article published on September 4, 2020, in the journal *Geology*, by an international group of scientists.[14]

The authors studied temperature variations during the evolution of diverse and complex biosystems in the tropical subzone of Southeast Africa over the last 790,000 years. Using cores extracted from the bottom of the Indian Ocean, palynological analyses were performed. This is the analysis of pollen from fossil plants developed in several different biomes: tropical and subtropical humid forests, dry (sub)tropical forests, (sub)tropical meadows, savannas, shrubs, flooded meadows and savannas, mountain meadows and shrubs, Mediterranean forests, and deserts and desert bushes. The dynamics of the analyzed plant populations were mainly controlled by the amount of available water, which in turn was conditioned by cyclical variations in temperature. Based on the evidence studied, the researchers estimated that the climate system experienced alternating episodes of glaciation and interglaciation, and temperature variations had “an amplitude of ~4°C between glacial minima and interglacial maxima.”

The conclusion of the study in *Geology* is unequivocal:

> The data . . . enabled us to make an assessment of the impact of temperature change on pollen diversity, with results showing there is no link between glacial-age temperatures/CO_2 and a loss of diversity in this record.[14]

Conclusions

The major problem with critical points is that they are not quantifiable. But could a qualitative critical point be identified? Could it be when mutual action mechanisms begin, such as permafrost melting and global warming? Or should we abandon the whole idea? For such systems, where there are probably critical points, the problem is that we cannot know or measure in advance the thresholds that define them. Therefore, critical points are useless for environmental governance.

The inconsistency of critical points in the evolution of complex natural systems immediately leads to an important conclusion: “So, there is little chance of anthropogenic climate change leading to a global tipping point in the biosphere. When it comes to other changes, including land use, habitat fragmentation, and extinction, the case for a global tipping point is even weaker.”[11]

So, what? Scientific articles published in prestigious journals, such as the two briefly presented above, do not go viral or become breaking news in *The New York Times* and other mass media. Why? Because they are not politically correct enough, catastrophic enough, apocalyptic enough, nor are they the forerunners for climate Armageddon.[6]

I don't know if the young barefoot woman holding the accusing placard mentioned at the beginning of this chapter will die of old age or because of climate change.

What I do know, however, is that the alarmist media, with its extensive use of semantic expressions with high emotional loads (i.e., "critical points," "points of no return," loss of biodiversity, extinction of the human species, and others *ejusdem farinae*), probably terrified her.

It can also be speculated that both she and the famous Swedish student-turned-climate activist learned from the *real* scientists the *genuine* truth about climate change subject to anthropogenic influences. The 18 authors of the three articles discussed above are probably not found in the obligatory bibliography that produced the famous Gretathunbergian exhortation:

> I don't want you to listen to me, I want you to listen to the scientists!

CHAPTER 5

HOW CATASTROPHIC IS CLIMATE CHANGE?

In June, the Associated Press (AP) published an alarming article, entitled "UN Predicts Disaster if Global Warming Not Checked."[1] The AP journalist interviewed Noel Brown, the director of the United Nations Environment Program (UNEP) in New York. The senior United Nations (UN) official said that "entire nations could be wiped off the face of the earth by rising sea levels if the global warming trend is not reversed by the year 2000. Coastal flooding and crop failures would create an exodus of 'eco-refugees,' threatening political chaos."

Then Mr. Brown added: "Governments have a 10-year window of opportunity to solve the greenhouse effect before it goes beyond human control. As the warming melts polar icecaps, ocean levels will rise by up to three feet, enough to cover the Maldives and other flat island nations."

Mr. Brown went on to point out that even the most conservative scientists "already tell us there's nothing we can do now to stop a . . . change" of about three degrees.

"Anything beyond that, and we have to start thinking about the significant rise of the sea levels . . . we can expect more ferocious storms, hurricanes, wind shear, dust erosion."

Do you think that the Associated Press article reflected the UN's position in June 2020? No, the article was published in *June 1989*, and the cataclysmic events predicted by the senior UN official concerned the year *2000*, not 2030.

You have just read concrete proof of climate alarmism. The mode of operation of this new type of activism was suggested in October 1989 by Stephen Schneider, a well-known climatologist, winner of the Nobel Peace Prize in 2006, member of the Intergovernmental Panel on Climate Change (IPCC), and professor of environmental biology and global change at Stanford University. In an interview with *Discover* magazine, Schneider called for ignoring the scientific method and rational arguments and replacing them with the appeal to emotions:

> to reduce the risk of potentially disastrous climatic change . . . we need [scientists should consider stretching the truth] to get some broad-based support, to capture the public's imagination. That, of course, entails getting loads of media coverage. So, **we have to offer up scary scenarios, make simplified, dramatic statements, and make little mention of any doubts we might have**[2] [emphasis added].

Climate alarm has turned into today's apocalyptic environmentalism amid the late last century's social and political crises. In 1970, when the fear of overpopulation was at its height (see *The Population Bomb)*,[3] the first Earth Day was celebrated amid the turmoil created by the Vietnam War.[4] In 1983, when tensions created by the Cold War escalated dangerously, more than 300,000 people protested in Hyde Park, London, against nuclear weapons.

After the Soviet Union's demise and the end of the Cold War, the people of the West found themselves without an external enemy against whom to focus their negative energies. The implosion of communism flattered pride on the one hand but also created a goal disturbing, on the other hand: "As the only winner in the conflict, was to focus on you all the criticisms that might have to move on others."[5] This situation led to an unprecedented situation that was hard to imagine.

Give us the enemy back! (Pascal Bruckner)

Climate change has thus become the new apocalyptic threat to humankind's future. It is the new enemy against which all possible weapons and ammunition must be fought. The result of the unrestrained exaggeration and propaganda of the last three decades has led to the transformation of climate change into a highly publicized catastrophe. A Green Party politician from Great Britain bluntly said how the metamorphosis took place:

> "Climate change" is a vague and innocuous term and it is dangerous for us to use it. Let's not be fooled by terms like "climate change." Talking now about preventing a "climate catastrophe" does not mean alarmism. It simply means saying things by name.[6]

The exacerbation and inflammation of emotions that are not hindered by robust data or rational arguments appeal to human visceral emotion, and ancestral fears have become the current props of climate activists. What could be more explicit than the four horsemen of the Apocalypse marching in front of the participants in the Conference of the Parties (COP)15 Climate

Conference in December 2009 in Copenhagen?[17] The *Climategate* scandal preceded the works of the conference.[7]

In the run-up to the current Covid-19 pandemic, to prepare for the signing of the Paris Climate Agreement, the World Health Organization published a famous document that opens with an apocalyptic warning: "Climate change is the biggest threat to global health in the 21st century."[8] And just as the coronavirus tentacles were beginning to spread, illuminati and glitterati gathered in Davos in January 2020. They said that climate change was responsible for all the biggest long-term risks around the world.[9]

Amplified without shame by the rating-ridden media, these catastrophic alarms did not go unnoticed by many people, both young and old, who came to believe that climate Armageddon is somewhere close. An international survey of 30,000 people in 28 countries, conducted in September 2019 indicated, among other things, that almost half (48%) of people believe that climate change will lead to the extinction of the human race.[10]

Recent populist climate movements, such as Extinction Rebellion and FridaysForFuture, and the emergence of activist Greta Thunberg ("I don't want you to be hopeful. I want you to panic")[11] and the politician Alexandria Ocasio-Cortez ("The world is going to end in twelve years if we do not address climate change")[12] have fueled an anxiety of the imminent end of the world. This has become the basis of a new kind of Judeo-Christian religion: *apocalyptic environmentalism*.[13] In this religion, God is replaced by nature, and human problems are no longer the result of our sins in relation to God, but instead those committed in connection to nature. In the old Judeo-Christian tradition, priests interpreted the divine will or laws, including establishing the distinctions between good and evil.[13] In this new religion of apocalyptic ecology, the role of priests is played by scientists, more precisely by the 97% of experts who agree with anthropogenic global warming.[14] "I don't want you to listen to me, I want you to listen to scientists," Greta Thunberg and others like her repeat.[15]

And yet . . .

How catastrophic is climate change?

A concrete answer to this fundamental question cannot be given through slogans, propaganda, public demonstrations, and other similar manifestations. It must come from a thorough analysis of existing data.

The best source I found to formulate the answer is called the Emergency Events Database (EM-DAT).[16] This source comes from the International Disaster Database in the Center for Research on the Epidemiology of Disasters, which is maintained by the School of Public Health at the

Université Catholique de Louvain in Brussels. EM-DAT collects data on deaths caused by natural and anthropogenic disasters from 1900 to the present.

The list of natural disasters includes the following climatic causes: droughts, fires (forest and wild bushes), and eruptions of glacial lakes. Additionally, I included in my analysis other causes related to climate change:

- meteorological (hurricanes, cyclones, typhoons, tornadoes)
- extreme temperatures (cold and heat waves)
- hydrological (floods, avalanches, landslides)

The annual distribution of deaths caused by the causes mentioned above is indicated in Figure 5.1.

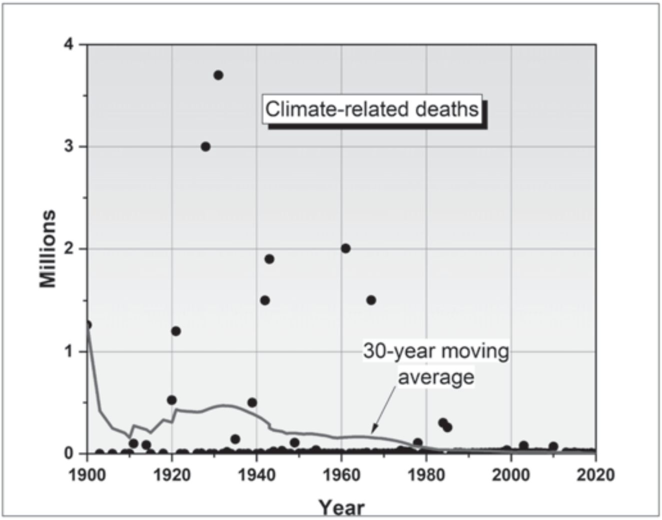


Figure 5.1. Deaths caused by climate disasters between 1900 and 15 July 2020. Graph made by the author using data from EM-DAT[16]

It is important to emphasize that in the period covered by Figure 5.1, CO_2 emission concentrations increased from 0.030% to 0.042%.[18] Also, the world's population has increased by almost 500%, from 1.6 billion in 1900 to 7.8 billion in 2020. In contrast, the number of deaths caused by the above-mentioned climatic events has decreased significantly, as Figure 5.1 suggests.

Using the same database, British researchers Hannah Ritchie and Max Roser (2019) analyzed global deaths from all-natural causes per decade, which is shown in Figure 5.2:

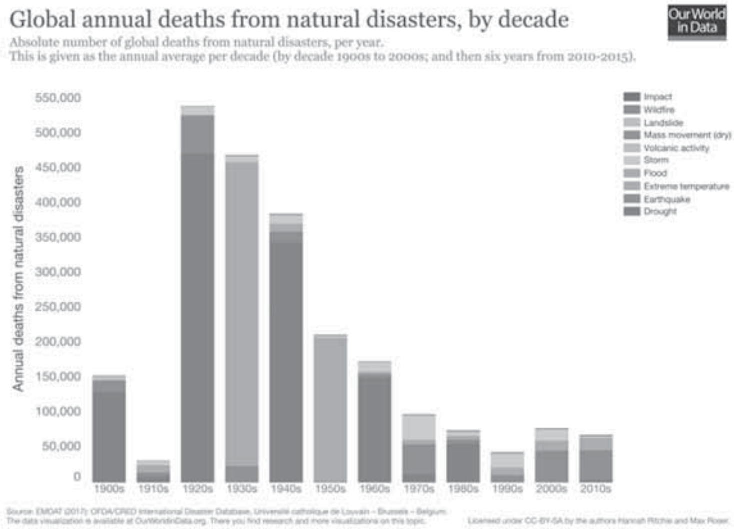


Figure 5.2. Annual global deaths caused by natural causes, per decade (1900–2015).[19]

The conclusions of the two researchers reveal several interesting aspects:

- Historically, droughts and floods were the most catastrophic natural disasters in the first decades of the nineteenth century. Deaths from the two causes have fallen sharply today. Today, the deadliest events tend to be earthquakes, but they are not affected by climate change.
- Deaths caused by natural causes have declined significantly in the last century, from millions in some years to an average of 60,000 in the decade 2006–2015.
- Globally, natural disasters were responsible on average for 0.1% of all deaths recorded in the decade 2006–2015. The percentage ranged from 0.01% to 0.4%.
- Disasters affect the poor the most: many deaths tend to be centered on low- to middle-income countries without the necessary infrastructure to protect and respond to events.

Table 5.1 shows the overall deaths and their rates for two distinct periods: 1900–1989 (90 years) and 1990–2010 (20 years), as well as the extreme weather events responsible, all using data from the same EM-DAT database.

Global Deaths and Death Rates for Various Types of Events, 1900–1989 and 1990–2010

	Deaths per year		Death rates per year (per million people)	
	1900–1989	1990–2010	1900–1989	1990–2010
Droughts	130,044	203	58.19	0.04
Floods	75,169	7,515	31.87	1.24
Storms	11,018	18,326	4.00	3.06
Mass Movement—Wet	441	704	0.15	0.12
Extreme Temperatures	124	7,503	0.03	1.15
Wildfires	22	78	0.01	0.01
TOTAL	216,819	34,330	94.24	5.61

Source: I. M. Goklany, "Deaths and Death Rates from Extreme Weather Events: 1900-2008," *Journal of American Physicians and Surgeons*, vol. 14 (4), pp. 102-09. Available at http://www.jpands.org/vol14no4/goklany.pdf; EM-DAT: The OFDA/CRED International Disaster Database, 2011, Université Catholique de Louvain, Brussels, Belgium. Available at http://www.em-dat.net. Accessed Mar 26, 2011 C. McEvedy and R. Jones, Atlas of World Population History (New York, N.Y.: Penguin, 1978) and WRI [World Resources Institute], 2011, EarthTrends Database. Available at www.wri.org, Accessed Mar 23, 2011.

Table 5.1. Overall number of deaths and death rates for different types of natural disasters, 1900–1989 and 1990–2010.[20]

For most of the twentieth century, the most catastrophic extreme weather events were droughts, floods, and storms. In the 111 years represented in Table 5.1, droughts and floods accounted for 58% and 34%, respectively, of all deaths worldwide, while storms were responsible for 7%. Thus, these three categories together accounted for 99% of all deaths caused by extreme weather events.[20]

An alternative source for assessing the various causes of human mortality is the World Health Organization (WHO).

In 2000, the WHO identified climate change as the cause of 154,000 deaths out of a total of 55,693,000, as seen in Table 5.2. The WHO has attributed global warming as the cause of "77,000 of about 250,000 deaths from protein malnutrition, 47,000 from about two million deaths from diarrheal diseases and 27,000 from more than one million deaths from malaria."[23] According to the EM-DAT database, 2,000 deaths were the result of the floods in 2002. Although there are some doubts about the accuracy of the WHO's data collection procedures, global warming accounted for only 0.3% of all global deaths in 2000, according to their results. On a scale of 26 risk factors, climate change ranks 21. With such statistics, how one can seriously talk about the catastrophic consequences of climate change when so many other issues are deadlier?

	Leading risk factors for DALY loss	DALYs	Leading risk factors for total mortality	Total mortality
1	Underweight	137 801	Blood pressure	7141
2	Unsafe sex	91 869	Tobacco	4907
3	Blood pressure	64 270	Cholesterol	4415
4	Tobacco	59 081	Underweight	3748
5	Alcohol	58 323	Unsafe sex	2886
6	Unsafe water, sanitation, and hygiene	54 158	Low fruit and vegetable intake	2726
7	Cholesterol	40 437	Overweight	2591
8	Indoor smoke from solid fuels	38 539	Physical inactivity	1922
9	Iron deficiency	35 057	Alcohol	1804
10	Overweight	33 415	Unsafe water, sanitation, and hygiene	1730
11	Zinc deficiency	28 034	Indoor smoke from solid fuels	1619
12	Low fruit and vegetable intake	26 662	Iron deficiency	841
13	Vitamin A deficiency	26 638	Urban air pollution	799
14	Physical inactivity	19 092	Zinc deficiency	789
15	Risk factors for injury	13 125	Vitamin A deficiency	778
16	Lead exposure	12 926	Unsafe health-care injections	501
17	Illicit drugs	11 218	Risk factors for injury	310
18	Unsafe health-care injections	10 461	Airborne particulates	243
19	Lack of contraception	8814	Lead exposure	234
20	Childhood sexual abuse	8235	Illicit drugs	204
21	Urban air pollution	7865	**Climate change**	154
22	**Climate change**	5517	Lack of contraception	149
23	Noise	4151	Carcinogens	146
24	Airborne particulates	3038	Childhood sexual abuse	79
25	Carcinogens	1421	Ergonomic stressors	0
26	Ergonomic stressors	818	Noise	0

***Table:* Ranking of 26 global public health risk factors based on the global burden of disease (measured as disability-adjusted life years [DALYs]) and on global mortality for 2000[2]**

Table 5.2. WHO classification of the top 26 risk factors based on the overall importance of the disease (measured by years of life with disabilities, DALY) and mortality for the year 2000.[21]

In 2016, the WHO also published a list of the top twenty causes of planetary death that year, which is shown in Table 5.3.[22] Around 56.9 million fatalities were recorded, of which more than a quarter, 15.2 million, were caused by heart disease and stroke. These two diseases were the leading planetary “killers” between 2000 and 2016. As expected, climate change did not make the top 20, just like in 2000, and probably accounted for less than 1% of deaths. But still, the world will disappear because of global warming, right?

2016			
Rank	**Cause**	**Deaths (000s)**	**% of total deaths**
0	**All Causes**	**56,874**	**100.0**
1	Ischaemic heart disease	9,433	16.6
2	Stroke	5,781	10.2
3	Chronic obstructive pulmonary disease	3,041	5.4
4	Lower respiratory infections	2,957	5.2
5	Alzheimer disease and other dementias	1,992	3.5
6	Trachea, bronchus, lung cancers	1,708	3.0
7	Diabetes mellitus	1,599	2.8
8	Road injury	1,402	2.5
9	Diarrheal diseases	1,383	2.4
10	Tuberculosis	1,293	2.3
11	Cirrhosis of the liver	1,254	2.2
12	Kidney diseases	1,180	2.1
13	Preterm birth complications	1,013	1.8
14	HIV/AIDS	1,012	1.8
15	Hypertensive heart disease	898	1.6
16	Liver cancer	830	1.5
17	Colon and rectum cancers	794	1.4
18	Self-harm	793	1.4
19	Stomach cancer	760	1.3
20	Birth asphyxia and birth trauma	679	1.2

Table 5.3. WHO classification of the first 20 deadly diseases in 2016. Unlike in 2000, climate change is no longer a significant cause.[22]

In 2020, the list of the ten deadliest natural disasters worldwide from 1980 to 2019, as determined by the death tolls, contained six earthquakes (more than 600 million victims), two cyclones (279 million deaths), and two heat waves (76 million deaths).[24] By far, earthquakes were the #1 “killer” on the planet.

Some “morbid” comparisons

Suppose we are still threatened in several decades with extinction as a species due to a +2°C global increase in temperature compared to the preindustrial era. In that case, I suggest we look at other comorbidities that are seen as catastrophic and then concrete figures about the catastrophic nature of climate change.

The latest data on mortality caused by climatic, meteorological, hydrological, and extreme temperatures is as follows (data extracted from the database used for Figure 5.2):

2017: 8,683 deaths
2018: 5,804 deaths
2019: 11,467 deaths

If any of these numbers seem catastrophic to you, or possibly leading to the "extinction of the human species" or the climate apocalypse, I invite you to compare them with other morbidities.

Each year, there have been recorded:

- 270,000 pedestrian deaths.
- 1.35 million deaths caused by traffic accidents.
- 2.3 million deaths from accidents at work.
- 4.2 million deaths due to polluted ambient air.[23]

ANNUAL TOTAL: 8.12 million deaths from nonclimatic causes.

It turns out that in the last three years, climate change has caused only 0.1% of all deaths from other morbidities. For any rational person, 0.1% is too small of a percentage to be called catastrophic.

Conclusions

Climate change is real, it has been going on for at least three billion years, and it will continue uninterrupted as long as the climate system's five synergistic components (lithosphere, atmosphere, hydrosphere, biosphere, and cryosphere) have the energy to function. The current global warming episode, an integral part of the natural cycle between past and future glaciation, also contains an anthropogenic component. Controlling this component (in the sense of limiting it) is a challenge to which we must respond calmly and ingeniously. Unfortunately, climate alarmism, recently distorted in apocalyptic ecology, makes it difficult to solve this challenge and instead diverts specialists' attention from finding smart solutions. It is exaggeration without any evidence, as shown above.

Even if the decarbonization of world economies, with the stated goal of reducing greenhouse gas emissions, was needed, the solution is not to protest at the Extinction Rebellion meetings ("Love. Rage. Rebellion") or at Greta Thunberg's marches ("skip school Friday for climate!") but is to increase investments in renewable energy research and development. Only then can the (unsubsidized) price of renewable energy be reduced to a price below that of fossil fuels. Only then can other inherent negative characteristics of renewable energies (intermittent character, low energy density) could be eliminated. When these technological achievements exist, they will make every citizen on the planet immediately give up coal, oil, and gas as electricity sources.

Until then, however, let us act like Odysseus and his sailors passing the island of apocalyptic mermaids that is beautiful but deadly. Either we close our ears so that we no longer hear their deceptive and murderous song, or we tie ourselves to the mast of reason and common sense and ignore them with pride.

Chapter 6

Is There a Population Limit that the Earth can Support for a Decent Living?

When I started writing this chapter on April 26, 2020, the world's population was approximately 7,780,429,000 inhabitants.[1] When I resumed writing on May 23, 2020, the number had risen to 7,786,470,000. Since the beginning of the year, 55,137,000 people have been born, and 23,148,000 have died, resulting in an increase of about 32 million people globally in about five months. That is a monthly average of about 6 million new people on earth. By the time you read these lines, the numbers will have already changed, most likely marking a new increase in the world's population.

According to the most recent forecast made in 2019 by the United Nations, the chances are that in the next 80 years, the planet will host 15.6 billion people, which is twice the current population, as seen in Figure 6.1.

Naturally, the question arises again: is there a limit to the population that the earth can support without humankind returning to a savage stage? I wrote "arises again" about the question because it is not new. It has been asked for over four thousand years and has received various answers. One by one, the Epics of Gilgamesh (ca. 2100 BC) and Atrahasis (ca. 1800 BC), Plato (in *Critias* and *The Republic*, ca. 360 BC), Niccolo Machiavelli (1517), Giovanni Botero (1588), and Johann Joachim Becher (1668)[3] described the existential anxieties produced by population growth. They mentioned famines, diseases, floods, wars, deforestation, soil degradation, all scourges that would question people's existence.

And because they all had to have a single name, they were called Malthusianism, after the author of *Essay on the Principle of Population* (Rev. Robert Malthus, 1798). When analyzing people's efforts to control their existence's natural limits, Malthus saw only ruin and death. He argued that food resources grow linearly while the population grows exponentially. Therefore, humanity will crash into an ecological wall created by the limitation of agricultural land, and humanity will be crushed.

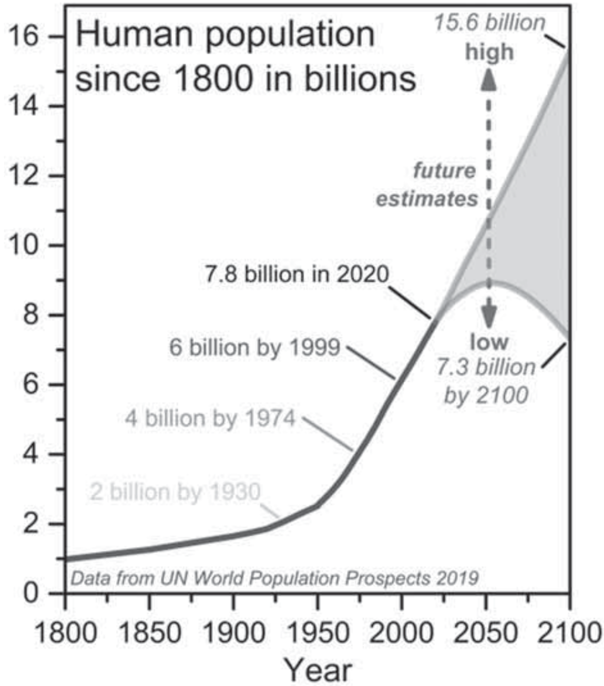


Figure 6.1. Population evolution (in billions) from 1800 to 2019. Two scenarios, one "low" and one "high," estimate the number of people in 2100.[2]

Critical reactions to the Malthusian apocalypse were not long in coming. In 1820, William Godwin rejected the hypothesis made in Malthus's essay, arguing that "humanity had unlimited powers to remedy bad things and improve their living conditions, and Malthus' figures on food production and population growth are wrong."[4]

Decades later the fathers of communist doctrine, Karl Marx and Friedrich Engels, also became vituperative Malthusianism critics. After apostrophizing the Anglican pastor, denouncing him as *a master of plagiarism*, a *sycophant*, and a *writing priest*[5], Marx criticized Malthus for trying to explain "overpopulation" through the use of the external laws of nature.[6]

Engels rejected the Malthusian hypothesis in 1844, stating that science can also grow in a geometric progression under "the most ordinary conditions and that the productive power available to mankind is immeasurable, and soil productivity can be increased ad infinitum through the application of capital, labor, and science"[7].

In the nineteenth century, human society faced a paradigm shift that tested Malthus' hypothesis, breaking the world out of the so-called Malthusian trap.[8] The Industrial Revolution's maturation meant a period when the steamship, the railway, and the telegraph stimulated agricultural inventions and economic openings in new territories. In the United States a new form of energy, oil, became available on an industrial scale after the successful debut of the first mechanical drill in Titusville, Pennsylvania in 1859. And in Europe, internal combustion engines were invented. Like coal, oil and natural gas usage has imposed hydrocarbons as their primary energy source, which has catapulted humankind into unprecedented levels of progress and economic development.[9] Oil and natural gas have contributed, among other fundamental achievements (i.e., medicine, plastics), to the mechanization and fertilization of agriculture, enabling the spectacular growth of food resources and the demolition of the Malthusian apocalypse.[10]

Despite the World Wars and communism, the twentieth century did not see the population suffer from the ecological wall of limited agricultural land. On the contrary: the population doubled from one to two billion in 130 years, from two to four billion in only 43 years, and increased by 2 billion in only 25 years, as shown in Figure 6.1. The exponential trend of population growth, predicted by Malthus, is happening today in the "high" scenario, as in Figure 6.1, and this will be extended until the next century.

From many important points of view, today's world lives much better than it did a hundred years ago. Extreme poverty was drastically reduced from 90% to about 10% in 2013.[11] Literacy has risen from 15% to over 85% in 2015.[12] Longevity has more than doubled from under 30 to 70 (on a global scale), to 80 years in developed countries.[13] Infant mortality of children under five years of age decreased from 20 million in 1950 to 5.4 million in 2017.[14] Child labor use has also been significantly reduced.[15] Extreme conflicts, with millions of casualties, disappeared after World War II, and we now live in one of the most peaceful periods in history.[16]

In 1996, it was estimated that half of the United States' population, 136 million people, benefited from improvements in science and technology in economic development, public health, nutrition, and pharmacy. Without those improvements, a quarter of Americans, 68 million people, would have died before they reached the age of reproduction. As a result of those early deaths, another 68 million would never have been born. In the twentieth century, more lives were saved in the United States than were lost worldwide in the same century's wars. Such progress in reducing mortality has continued and expanded to the present day.

Economic prosperity, measured by gross domestic product (GDP) per capita, has also seen significant, albeit uneven, growth over the last century.[17] Considering only the last 30 years, there have been massive poverty reductions due to the almost doubling of GDP per capita.[18] In 1950, nearly two-thirds of the world population were living in extreme poverty. In 2015, less than 10% of people are in this situation.[19] These economic achievements have helped transform people's lives. For example, in 2000, 3.76 billion people had access to safe drinking water,[20] and in 2015, that number reached 5.23 billion people (i.e., a 40% increase).[21]

After all these findings, there is no point in reheating Malthusian "soup," cooled since 1798. And yet, the paradox of progress exists:

> We live better and longer than ever in the past. But the better things get, the more threats people perceive where they do not exist and the more dissatisfied and unhappy they become. The recent pandemic has added an extraordinary fear of death, for example.

The last two generations have known various manifestations of neo-Malthusian pessimism, born out of the fear of resource depletion and fueled by the pessimism of ecological limitations associated with humanity's economic development.

Prophets vs. Wizards

I have described elsewhere, using the antithesis ***prophets*** vs. ***wizards***, the birth of modern neo-Malthusianism and eco-pessimism, referring to William Vogt and his 1948 book *Road to Survival*.[5] Vogt's main solution to solve all ecological problems was to control the population that consumes too much: "Eat less! Stop eating meat, milk, and cheese! Don't multiply!" Moreover, Vogt embraced eugenics in response to the overpopulation of the planet, urging governments to give money to people with mental disorders and people living in poverty so they could become sterilized. Thus, he imagined, there would be a "favorable selective influence" on the human species.

The following highly publicized eco-apocalyptic prophecies were issued by Paul R. Ehrlich in *The Population Bomb—The Population Control or Race To Oblivion* (1968) and in the Club of Rome, which sponsored *The Limits to Growth* (1972) by Dennis Meadows, Donella Meadows, Jørgen Randers, and William W. Behrens III.

Vogt's idea of population reduction through control methods was enthusiastically embraced by Paul Ehrlich: "The causal chain of degradation [of the natural environment] is easy to trace back to its original source. Too many cars, too many factories, too many detergents, too many pesticides …, too little water, too much carbon dioxide—they all have one source: **too many people**."

According to this neo-Malthusian, eco-pessimistic paradigm, humans are no different from other animal species and are dependent on a fragile and complex network woven from interconnections with other beings. More people and more material wealth can only have one consequence: the catastrophic depletion of resources and the irreparable degradation of the environment.

It is not surprising that the eco-prophets mentioned above proposed and supported the population's active control through forced sterilizations, birth taxes, refusals to improve the lives of the poor, and more. The *Limits to Growth* has triggered a planetary hysteria that the population bomb will explode, and the end of the world will come! Driven by the wave of widespread fear, organizations such as the International Planned Parenthood Federation, the Population Council, the United Nations Population Fund, and the Association for Voluntary Sterilization have initiated programs and advertising campaigns to reduce fertility in Third World countries.

The results were frightening. Millions of women have been sterilized, often forcibly, illegally or in unsafe conditions, in places like Bangladesh, Mexico, Bolivia, Peru, Indonesia, and especially in India. There, in 1975 alone, sterilization was applied to over 8 million women and men. The population control programs stipulated by the prophet Vogt have also been carried out by force in Egypt, Tunisia, Pakistan, South Korea, and Taiwan.[22]

Inspired by *Limits to Growth*, the Chinese have concluded that the only way to avoid population catastrophe is a law in which a couple is entitled to only one child. Adopted in 1980, the law has produced tens of millions, perhaps 100 million, of forced abortions, often in precarious conditions that have led to infections, infertility, and even death. Millions of more women have been forced to use IUDs or to be sterilized. After nearly forty years, China still feels the demographic disaster of the one-child policy.

Malthus and his contemporary disciples have overlooked that human beings, unlike animals, have not only mouths for food but also arms for work and brains to think of new solutions. Moreover, people's ability to act and interact, alone or as members of coherent groups, allows for the application of unique intellectual abilities that use innovation to solve complex problems (economic, ecological, etc.).

Unlike eco-prophets, *wizards* believe that science and technology, properly applied, are how humankind can solve difficult situations. For those who embrace the future with optimism, well-being is not the biggest problem but is the solution to problems. Only when we become richer, smarter, and more educated will we be able to invent more, solve eco-dilemmas, and win eco-future matches.

Eco-prophets see the world as a finite whole in which the environment around them constrains people. For them, the stability and preservation of that environment guarantees our future, which is the goal. Eco-prophets also believe that the natural world embodies a higher order that should not be disturbed by ordinary human actions.

Wizards see unlimited and inexhaustible possibilities of activity and look at people as competent managers of the planet. For them, growth and development represent the luck and blessing of our species. That's why the planet is like a tool kit that everyone can use for free.

A serious critique of the Malthusian hypothesis was penned by Ester Boserup in 1965 when she published *The Conditions of Agricultural Growth: The Economics of Agrarian Change Under Population Pressure.* Boserup challenged Malthus' hypothesis that the relatively slower rate of food production acted as an upper limit for potentially faster population increase.[23] Much of Boserup's theory of agricultural intensification is based on the remarkable idea that necessity is the mother of invention, an idea that even after half a century remains conclusive for the development and argumentation of the dimensions of sustainability. But, as a corollary, I would add:

Innovations are essentially different from inventions because they represent the transformation of invented objects into things with practical and accessible uses for people. If inventions belong to a single genius, innovations are always a collective phenomenon, based on creative collaboration, and freely agreed upon. That's why more people means more ideas and solutions.[24]

Paraphrasing Matt Ridley, innovations are the children of freedom and the parents of prosperity.

The descendants of Malthus

Neo-Malthusians have lost the match with "linearly growing food resources," as well as the one with limited mineral resources. The historical bet (set up in 1980) between the eco-pessimist Paul Ehrlich and the cornucopian Julian Simon is significant.[25]

According to Ehrlich, author of the book *Eco-Catastrophe!* published in 1969, ecological degradation will annihilate all important animal life in the oceans by 1980. Hundreds of thousands of people will suffocate due to air pollution, and life expectancy in the United States will decrease to 42 years old. “Western society,” Prof. Ehrlich also proclaimed, “is on the verge of finalizing the violation and killing of the planet for economic gain.”

Prof. Julian Simon won the bet because he applied the logic of insufficiency to a free society. The consumption of more goods by more people makes resources limited. And if something becomes rare, it is also more expensive. But the existence of free markets favors feedback through the price system. This situation creates short-term problems, but problems can also be opportunities. The free-market system ensures that if a resource becomes limited its price will rise, and this will create an incentive for economic actors to use the resource more efficiently in the future. This will also incentivize scientists, engineers, and entrepreneurs to find replacements (e.g., the replacement of copper wires by fiber optics and plastic) or to discover more resources (e.g., George P. Mitchell’s discovery of oil and gas shale reservoirs through hydraulic fracturing). As long as people operate in a free society, they will invent a solution because human ingenuity is the ultimate resource.

Bill McKibben, a well-known environmentalist and founder of 350.org, has acknowledged since 1998 that each new generation of Malthusians has made new predictions that the end is near and that everything has turned out to be wrong.[26] Today, neo-Malthusian prophets no longer mourn the inadequacy of food or raw material resources but instead despair over the fact that humanity no longer has enough places to store the byproducts of its increased economic activities, which has produced pollution.

For neo-Malthusians, the most polluted place on the planet is the global atmosphere, which is said to no longer be capable of absorbing increasing carbon dioxide emissions, and therefore maintaining favorable conditions for human existence. This change in tactics, from the fear that humanity will not survive because there will not be enough food to the fear that humanity will perish because of the “pollution” of carbon dioxide in the atmosphere, is obvious. The new tactic intends to demonize carbon dioxide (aka the “pollutant”). But what kind of pollutant can carbon dioxide be, when I am made of it, you are made of it, and all plants and animals are made of it?

And because the composition of the atmosphere, which is a public resource without well-defined property rights,[27] cannot be applied to the functioning price system in the case of free markets, neo-Malthusians use the same well-known slogan: either we lower the current standard of living, or we control population growth. Both measures aim at reducing carbon dioxide emissions, or “pollution” (i.e., through the decarbonization of national economies) sooner (2030) or later (2050).[28]

Optimistic wizards see things differently

Humankind is not doomed to immediate extinction or a return to the “comfort” of the primitive commune. Humankind can improve its living conditions and reduce its pressures on other species and the environment by using skills developed over time that no other animal species possesses.

Starting from the idea that necessity is the mother of all invention, people have always sought solutions to their problems and have invented ways to combine existing things into new products and technologies.

For example, immediately after the start of oil extraction in Pennsylvania in 1859, American refineries produced only lighting gas, thus saving many whales. The byproducts of refining were dumped into rivers or burned as useless “waste.” But over the next two decades, “waste” was reduced from about half the mass of original crude oil to less than a quarter of it through the invention of many useful new product, such as oils, fats, paraffin, Vaseline, candles, insecticides, and solvents. Although refineries also produced gasoline, its use was limited to the manufacture of paints and varnishes, most of which were considered “waste.” However, after the invention of internal combustion engines, gasoline and diesel production became the hydrocarbon industry’s most lucrative activity. The heavy fractions left after refining the light ones found immediate use as asphalt for roads and tar for roofs. And after the development of combustion technologies, fuel oil became heating fuel and fuel for ships.

And American oil inventions didn’t stop there. In just 40 years since drilling the first oil well in Pennsylvania, the giant Standard Oil has greatly diversified the range of products created from the refinery’s former “waste” stuff. John D. Rockefeller’s company had sold about 200 new petroleum products, many of them more valuable than the original gasoline: naphtha for local anesthetics, industrial solvents, household fuels, and fuels for internal combustion engines, paraffin for candles, pharmaceuticals, oils, lubricants, etc.[29]

Today, thousands of different products are obtained from the extraction and processing of hydrocarbons. Some examples (fuels, fertilizers, pesticides, plastics, tires, etc.) can be found in one of my 2019 papers.[10]

The extraordinary capacity of the human mind to continually innovate is a strong argument for accepting population growth. Statistically speaking, the chance of finding a curious and inventive individual among another 5,000,000 people is higher than among 500. To believe that a numerically small population could enjoy more of goods is specious because a reduction in labor will simultaneously reduce the means of production. After all, as the French economist Jean-Baptiste Say wrote in a letter to Malthus, it is not clear that in sparsely populated countries "people's needs are more easily met . . . On the contrary, the abundance of production, not the reduction of consumers, provides sufficient supplies for our all-needs."[30]

Using an argument from Godwin's critique of Malthus, a human being is the "only animal capable of perseverance and premeditated diligence . . . the only creature susceptible to science and invention and who has the power to transmit his thoughts and knowledge accumulated in those permanent recordings called books." To continue this idea, it can be said that progress is the normal state in the case of humankind and, therefore, the means of subsistence grow faster than the population. All other things being equal, a larger population means greater efficiency in the means of production.[31] Or, following the remarks made by the economist Henry George (1886):

> The richest countries are not those where nature is most prolific, but those where work is most efficient—not Mexico, but Massachusetts; not Brazil, but England . . . It was not the increase in food resources that led to an increase in population in North America, but the increase in population produced the increase in food resources. More people mean more food.[32]

What more do eco-pessimists tell us?

While Malthus's initial concern was about food scarcity and starvation, the second wave of neo-Malthusianism from the 1970s was fear "about limits to growth and developing scarcities in a range of necessities."[33] Both movements proved to be false predictions, and it was expected that people would learn a lesson from those failures. But, in recent years, the specter of Malthus is haunting eco-pessimists, but it is draped in the cloak of global warming. I selected just a few representative examples:

Sir Robert Watson, the second head of the Intergovernmental Panel on Climate Change (IPCC), currently head of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), said in 2018:

> The more people we have on the Earth and the richer they are, the more they can demand resources … [more food, more water, more energy]. There's no question that the threats on Earth today are far more than, say, 50 years ago, and in 50 years time, there will even be more threats.[34]

Rajendra K. Pachauri was the third IPCC chief. He shared the Nobel Peace Prize with Al Gore in 2007. His statement is from the same year:

> We have been so drunk with this desire to produce and consume more and more whatever the cost to the environment that we're on a totally unsustainable path . . . I am not going to rest easy until I have articulated in every possible forum the need to bring about major structural changes in economic growth and development. That's the real issue. Climate change is just a part of it.[35]

Andrew Weaver was the leader of the Green Party in British Columbia between 2015 and 2020. He has published the books *Keeping Our Cool: Canada in a Warming World* (2008) and *Generation Us: The Challenge of Global Warming* (2011). He writes, "Technology alone cannot solve global warming … infinite growth cannot take place in a finite system. Collapse is inevitable."[36]

Statements such as the above are numerous. Although Malthus' initial hypothesis of 1798 fell completely into disuse, as the world's population continued to grow exponentially without being crushed by the ecological wall of limited agricultural land, neo-Malthusians and eco-prophets did not give up their dreams of saving the planet through population control to reduce the environmental footprint. What is again lost in sight are the countries with small ecological footprints and resources within safe biophysical limits. Nepal, Haiti, Malawi, Myanmar, and Nicaragua are just as many examples of economically, socially, and ecologically failed states.

The new apocalypse has changed its content. Humanity is now threatened by climate change, more precisely by global warming caused by the burning of fossil fuels, and the only and mandatory solution is to decarbonize the economies and switch immediately to renewable or renewable energy.

Again, what is overlooked is the fact that there are no 100% renewable energies.[36] Fossil fuels have made unprecedented progress possible through large-scale urbanization, advanced education, improved living standards, high-performance medicine, and abundant food. All of these and more have contributed to our resilience in times of crisis and natural disasters.

Conclusions

In an essay published earlier this year, philosopher Maarten Boudry points out that "false humiliation will not save the planet." We can, of course, give up fossil fuels, but the planet we will have saved will give us a completely different life than the present one. Boudry pointed out that

> The right way to look at anthropogenic climate change is as an unexpected side-effect of something that, by and large, proved an immense blessing to humanity. Sure, if we had left all those fossilized remains of ancient animals and plants under the ground, we would not now be stuck with rising global temperatures. But then our lives would also have remained solitary, poor, nasty, brutish, and short, as they had been for the better part of world history until around 1800.[37]

The solution to the current climate crisis is not to control the population for a hypothetical reduction of ecological footprints. Or, as has recently happened, to look tenderly at a Swedish child giving political lessons to world leaders and environmentalists.[38]

The future of the planet and those who will inhabit it depends on the stimulation of extraordinary human ingenuity, which has proven over the centuries to have immense creative powers, such as combining and creating new things, technologies, and flourishing interactions. That's why seven billion people can represent seven billion solutions.

Economic growth stimulated and supported by free-functioning markets and individual, creative innovations is the "vaccine" to be administered to neo-Malthusianism and eco-pessimism.

Chapter 7

Planet of the Humans— An Unexpected and Virulent Critique of "Green" Energies

On the eve of Earth Day's 50th anniversary, the famous documentary filmmaker Michael Moore launched *Planet of the Humans.*[1] The new film was made by screenwriter and director Jeff Gibbs, Moore's collaborator on the renowned *Bowling for Columbine* and *Fahrenheit 9/11*. The film went viral after just one week, with over four million views and 33,000 comments on YouTube.

What happened? The new documentary broke with the traditions of previous films by Michael Moore, which were mostly strong criticisms of the capitalist system and the republican political establishment in the United States. *Planet of the Humans* was not at all the long-awaited climactic exhortation on Earth Day, but a bombshell destroying the myth of renewable energies.

It was surprising that Jeff Gibbs took this position because he is known as an environmentalist, like Michael Moore, and confessed from the beginning that he was one who "hugged the trees." We ask ourselves then, why are we still dependent on fossil fuels? Environmentalists were waiting for a new diatribe to emerge from the film against what they consider to be the biggest obstacle in achieving their "green" dreams, or a world where coal, oil, and natural gas will no longer burn.

But Gibbs' answer to this question is a shocking surprise: "Green energies will not save us! It is an illusion that we must dispel: the idea that renewable energies will be able to keep industrial civilization in working order as it is today and that these technologies are totally 'green,' when in fact they are still destructive to terrestrial ecosystems."

Wow! To be honest, I did not expect Michael Moore, whose leftist positions are clearly stated in his previous documentaries and who supported Bernie Sanders in the presidential campaign of 2020 to transform our energy system to 100% renewable energy, to produce and praise *Planet* *of the Humans*, a “blasphemy” that some environmentalists immediately attacked.[2]

The film’s virulent criticisms concern solar, wind and biomass combustion, as well as eco-fuels (ethanol, biodiesel, hydrogen). The evidence presented by Jeff Gibbs indicates that all so-called green energies and technologies cannot exist without the contribution of fossil fuels. From the mining phase that transports various metals and nonmetals to the continuation of constructing buildings, wind turbines, solar installations, and more, large amounts of cement, steel, glass, and aluminum are consumed. And more materials are needed for the replacement of those installations. Therefore, the energies mentioned above are “green” only on the outside, with their core being “black” like the oil and coal that make them work.

These criticisms are not new. I have presented the big ecological soap bubbles that inflate various nongovernmental organizations (NGOs) and people in several articles. For example, in 2016 and 2019, I criticized the myth of electric vehicles as an ideal solution to combat anthropogenic global warming. Those cars generate significant environmental outsourcing (i.e., greenhouse gas emissions from the use of nonrenewable electricity, which results in pollution from the production and disposal of batteries).[3]

In the film, at minute twelve, there is undoubted proof of the situation presented above. At the Chevrolet Volt (an electric hybrid) launch in Lansing, Michigan, the movie director asks the giant General Motors spokesperson if she knows where the electricity used to charge the electric car’s battery comes from. The lady hesitantly responds that it would involve “some coal.” A moment later, a former city official confirms what many people know: The city’s network is 95% powered by a coal-fired power plant.

A recent study by the International Energy Agency (IEA) shows that an electric car with a range of 400 kilometers will have to travel 60,000 kilometers just to “pay” for CO_2 emissions from the production process.[4] This means that a new electric car, driven on average 12,000 kilometers a year, will “pay” its carbon debt only after five years. The IEA hopes that the world can reach 130 million electric cars in ten years, which is an astonishing task, given that it took decades to reach just over 5 million. Even if we could do this, emissions would be reduced by only 0.4% of the global level. In the words of IEA Director Fatih Birol, “If you think you can save the climate with electric cars, you are completely wrong.”

However, governments are struggling to subsidize electric cars. The IEA estimates that each electric vehicle costs $24,000 in grants, research, development, and additional infrastructure investment. Not surprisingly, the

Dutch Court of Auditors recently ruled that the Netherlands wasted taxpayers' money on subsidies, calling them an "expensive joke."

The critique of the ecological impacts generated by wind and solar farms is not very new or original. A 2019 paper drew attention to the impossibility of ensuring the current energy consumption of the United States of around 4 billion MWh with the help of wind farms alone:

> Instead of the 58,000 turbines we have now, the United States would need some 14 million turbines, each one 400 feet tall, each one capable of generating 1.8 megawatts at full capacity, when the wind is blowing at the proper speed.
>
> Assuming an inadequate 15 acres apiece, those monster turbines would require some 225 million acres! That's well over twice the land area of California—without including transmission lines! Their bird-butchering blades would wipe out raptors, other birds, and bats across vast stretches of America.
>
> Manufacturing those wind turbines would require something in the order of 4 billion tons of steel, copper, and alloys for the towers and turbines; 8 billion tons of steel and concrete for the foundations; 4 million tons of rare earth metals for motors, magnets, and other components; 1 billion tons of petroleum-based composites for the nacelles and turbine blades; and massive quantities of rock and gravel for millions of miles of access roads to the turbines. Connecting our wind farms and cities with high-voltage transmission lines would require still more raw materials—and more millions of acres.
>
> All these raw materials must be mined, processed, smelted, manufactured into finished products, and shipped all over the world. They would require removing hundreds of billions of tons of earth and rock overburden—and crushing tens of billions of tons of ore—at hundreds of new mines and quarries.[5]

Gibbs and Moore's film highlights the links between various environmental, antifossil, and antifracture NGOs (e.g., Sierra Club, 350.org, the Union of Concerned Scientists, Nature Conservancy), billionaires who with one hand donate to environmental movements and with the other make money on global warming (Michael Bloomberg, Richard Branson, Elon Musk, Vinod Khosla, Jeremy Grantham, etc.), and groups of banks and corporations with strong financial motivations.

The most disappointing character in the film—it seems to me—was the former Vice President Al Gore. After negotiating the Kyoto Protocol's US approval in 1997, which was a monumental failure on climate ecology, Gore was crowned a Nobel Peace Prize winner for his film and book *An Inconvenient Truth* (2006). During various public shows, performed after his Nobel crowning, he trumpeted the climate apocalypse in multiple tones.

Meanwhile, the "climate change" business brought him hundreds of millions of dollars in cash benefits, even though, as the film clarifies, there were apparent conflicts of interest between the two types of business.

Another example of climate activists' hypocrisy is the promotion of renewable energy produced by biomass through the burning of trees instead of fossil fuels. Contrary to the claims of eco-activists, such energy is not carbon-neutral, nor renewable, nor sustainable. It is just bad taste propaganda, which, unfortunately, some people fall prey to.

But perhaps the film's most disgusting effect was the reaction by a group of activists, led by none other than Josh Fox, the director and producer of the infamous propaganda film *Gasland*. He bravely demanded, and for a short time even obtained, a ban on the distribution of the film *Planet of the Humans*. Outraged by these Stalinist practices, Michael Moore decided to offer a free 30-day viewing of the film on YouTube.

However, because the Moore–Gibbs tandem is essentially ecological, the film contains neo-Malthusian positions. After meticulously and perseveringly dismantling the myth of renewable energies, lamenting that environmentalists have fallen prey to *green* illusions, betting everything on biomass, wind turbines, solar panels, and electric vehicles, Gibbs finally tells us: "We humans must accept that infinite growth on a finite planet is suicide. We must accept that our human presence is already beyond sustainability and all that it entails."

More specifically, the implications are that people are the problem, not energy production. And the fewer people there are on the planet, the better for them and the planet, right? This logic is the same as Thomas Malthus in 1798 or Paul Ehrlich in 1968 (*The Population Bomb*, a book published by Sierra Club).[6]

Although the elephant in the room is fossil fuels, Jeff Gibbs does not allude to the indisputable fact that humans' tremendous progress in the last 100 years (i.e., we live longer, healthier, wealthier, and are more literate) is primarily due to fossil fuel that produces electricity, agricultural machinery, fertilizers, medicines, plastics, etc. To neglect to say at least one sentence about the fundamental role of hydrocarbons in the human species' flowering in the last century seems suspicious to me. Nuclear energy, real renewable energy that humanity needs to reduce its carbon footprint, is not even discussed in the film.

Conclusions

The new documentary film by Jeff Gibbs and Michael Moore, *Planet of the Humans*, asks a series of uncomfortable questions for eco-activists and demonstrates that so-called green energies have a significant “black” component due to their use of various amounts of coal, oil, and natural gas at different stages of production.

The film opens our eyes to the “green” emperor’s real clothes and breaks the curtain that masks the whole wardrobe. The myopia of those who only see the world through carbon lenses becomes more evident after viewing.

Affordable and reliable energy is the basis of modern economies. About 2.5 billion people around the world live in some form of energy poverty. Access to safe energy impacts all other major humanitarian issues, including hunger, shelter, clean water, education, healthcare, human migration, women’s empowerment, and more. Those who do not have access to energy suffer from energy poverty. Unfortunately, renewable energies cannot eliminate this poverty, regardless of the number of batteries available.

The energy transition from carbon to noncarbon fuels generates dissension and looks unproductive. It is “fueling” (pun intended!) a confrontation between the environment and the economy and between the political left and right.

Simply said, coal and oil are not a problem. The energy they provide has improved almost every aspect of the modern world.[7] Emissions from their combustion (i.e., CO_2, SOx, NOx, mercury, dust, and ash) are problems. Therefore, we need to focus on emissions. One does not need to throw the baby out with the bath water. By analogy, we cannot eliminate food, another form of vital energy, just because its growth consumes large amounts of water, requires fertilizers, impoverishes soils, and affects rivers and aquifers. What do we do in this case? We try to reduce these impacts as much as possible. Similar actions must be taken in the case of fossil fuels. Because, as the film discussed here demonstrates, no form of energy production is 100% renewable.

Looking at the energy transition through only a carbon lens is not only political myopia but is also guaranteed bankruptcy.

CHAPTER 8

GROUPTHINK OR GROUPS OF THINKERS? ABOUT THE PRINCIPLE "FIFTY MILLION FRENCHMEN CAN'T BE WRONG"

Several years ago, while visiting my hometown of Iași, Romania, I was surprised by the originality of an enormous billboard posted on a major crossroads. It was an advertisement for a furniture store. On a beautiful golden-white leather sofa, a gorgeous ebony young woman was sitting, almost naked. What shocked me was not the fact that my hometown used an unusual female image, but that the English (not Romanian) text displayed at the feet of the majestic black woman read, "We are all different. Fortunately." Although the image was intended to increase a particular store's furniture sales, it seemed to carry a significant message about human diversity.

After returning from Iași, that advertising slogan continued to swirl in my mind. How can it be explained, I wondered, that in a world where diversity is celebrated, there is, unfortunately, such an intense polarization of the intellects, reaching as far as *Groupthink*? What is the role of consensus in forming and maintaining Groupthink? And why, instead of Groupthink, don't we have groups of thinkers?

Although there are many possible answers to the above questions, I describe the role and importance of consensus, fueled by its large numbers, as an instrument of social pressure imposed by thinking as a particular group.

The term Groupthink refers to a group with a consensual approach, which often causes problems that have various consequences. Because members who share Groupthink aim to reach consensus, therefore making inappropriate, wrong, irrational, and ineffective collective decisions, the result is a visible deterioration in "mental efficiency, reality testing, and moral judgment" of the entire group.[1]

In a Groupthink, members act with absolute confidence in their opinion from the beginning. "They talk only to each other, convince each other using specious arguments," force others to agree with them, "refuse to consider clear evidence that contradicts their views," and ignore the proposals and advice of others outside the group. The more they talk to each other, the more convinced they become of their idea of justice.[2] As a result, group members' ability to make final decisions is severely impaired, and the effects of these decisions often have a low success rate.

According to Irving Janis, "Groupthink occurs when subtle constraints prevent a group member from fully exercising" their critical power and prevent someone from "openly expressing doubts" when the majority of group members appear to have reached a consensus.[3] For these reasons, "Groupthink [is a model of] thinking that people engage in when they are deeply involved in the group [cohesion, where] members' [efforts to achieve] unanimity" outweigh their need to realistically assess "alternative courses of action."

Janis also considers Groupthink as a psychological impulse to obtain consensus at any cost, suppressing dissent and the evaluation of alternatives in the decision-making process. This is an observation about how the privileged position of consensus makes up Groupthink. This observation also produces an opening of perspectives that I seek to explore in this chapter.[4]

Groupthink is responsible for exalting consensus and activating the conspiracies that try, and unfortunately often, suppress the diversity of views necessary for understanding mental health. By their nature, thought groups orient and move in the direction of consensus. Their cohesion and homogeneity are ensured, among other things, by the polarization generated by so-called persuasive arguments that identify the direction or "pole" of the Groupthink discussions. Intrinsic to group thinking, policing is a phenomenon that exists in many human societies, with varying degrees of intensity, and has been exacerbated in recent years by the proliferation of social networks.[5]

Hundreds of social psychology studies have shown how to polarize group thinking.[6] The more people share a propensity for a particular problem and discuss it intensely in their thinking group, the more they reorient themselves to extreme positions. The comments made by others in the group will try to convince the most reluctant to adopt the new positions. After discussions, the group members become more self-confident and more inclined to extreme positions. For example, risky groups will accept even greater risks and cautious groups will become even more cautious. And groups alarmed by climate change will become extremely alarmed (i.e., the people behind Extinction Rebellion, the Green New Deal, and the Greta Thunberg Fan Club).

The principle "fifty million Frenchmen can't be wrong"

There is probably no greater pressure in contemporary society than social pressure. The explosion of the blogosphere, the all-powerful and ever-present communication and social networks, and the number of "influencers," has created the conditions for the dictatorship of social pressure. The belief that *fifty million Frenchmen can't be wrong*[7] is deeply rooted in the psyche and acts as a principle of social conduct because large numbers of people (i.e., 97%) produce magical fascination that is denied to small numbers (i.e., 3%). If enough people do or say something, it means that there must be something significant in their actions. The majority can't be wrong! The consensus is always right!

The much-claimed supremacy of the rule of the democratic majority creates a paradoxical situation in which social opinions define the truth (i.e., *fifty million Frenchmen can't be wrong*). Knowledge then becomes a democratic process, and the truth is established by vote. However, I (still) believe that the truth is born of an idea that corresponds to facts and data, not public opinion.

Moreover, this notion of majority justice disregards, and sometimes despises, the dissatisfaction of those segments of society that disagree with the majority, such as the minorities in opinion over politics, elections, society, the climate, and more.

The idea that *fifty million Frenchmen can't be wrong* induces a desire for conformity due to fear of being different. This is the opposite of the advertisement I saw in Iași and has become the object of public ridicule. Many people also follow a principle of conformity, based on the Japanese proverb, "the nail that sticks out gets hammered down."[8] That is why we often do not see any nail willing to face the blows of the hammer.

There is sometimes the wisdom of the crowds[9]. But trying to challenge the verdicts of the majority is dangerous. Since 1754, Voltaire warned that "it is dangerous to be right in matters on which the established authorities are wrong."

Despite the principle of fifty million Frenchmen can't be wrong, most of them are often wrong. And what is your reaction when you notice that each of your thinking groups expresses a judgment or opinion that you know is not true? One possible answer could be to not care about what others did or said. Judge everything with your own eyes. Just over half a century of social psychology research has demonstrated that truth does not provide reliable protection against the majority consensus.[10]

The classical study of this phenomenon was conducted in 1951 by the famous researcher Solomon Asch, a former professor at Brooklyn College and the founder of social psychology.[11]

His experiment, suggestively entitled, *“A Minority of One Against a Unanimous Majority,”* began by presenting two drawings to groups of seven to nine participants. On the first group, a line was drawn that served as a standard. The second drawing contained three lines for comparisons. One of the three lines was equal in length to the standard line. Participants were then presented with several sets of the two drawings. Their task was simple in that they had to choose the line that was equal to the standard one. There was nothing complicated, ambiguous, or difficult. Only one comparison line was equal in length to the standard line, and the other two were visibly longer or shorter. Left alone, people had no problem making the correct judgment.

However, in the second part of the experiment, Asch also used groups of seven to nine people, and one person was an innocent participant. The others were extras paid by the organizer and they formed the quasi-unanimous and incorrect majority of the group. Asch then tested the following hypothesis: The naive participant will follow the group majority and give a wrong answer.

How did Groupthink work in that experiment?

Suppose that, looking at the first series of two drawings, the naive participant sees that the correct answer is line B. But the person next to him says loudly that line A is the correct answer. Our innocent man rubs his eyes, looks once more, and thinks, *it’s line A, what the heck!* Maybe the gentleman next to me has vision problems. But then the second participant responds the same way by saying that line A is the same as the standard line. Then everyone else points to line A as the correct answer. The experimenter then asks the naive participant again for the answer.

The results published in 1956 by Asch showed that almost 37% of innocent participants changed their initial opinions and adopted the incorrect majority’s answers.

His initial study was reproduced almost 100 times in many countries, such as Japan, Canada, and the Netherlands. Each time, various types of people, facing the majority’s dictatorship, gave up their judgments and accepted the group’s incorrect answer.

Participants in Asch’s experiments and in others that followed were interviewed about the causes that led them to deny their observations and adopt the majority's incorrect answers. Two main motivations have been identified as principles of social conduct:

1. The principle "fifty million Frenchmen can't be wrong" or the tyranny of big numbers

Apparently, people conform to the pressure of most of a Groupthink with large numbers because they want to fit into that group … and because they think the group is better informed than they are.[12]

If 97% of climate experts say that people are solely responsible for current global warming, they must be right, and I am wrong. If necessary, "global warming" can be replaced by other consensual topics (e.g., fracking, plate tectonics, hydrocarbon genesis, and species extinction) where the majority of experts are right, and dissidents are considered skeptics or politically correct troublemakers. People act as nails that stick out and which must be immediately hammered down with the baton of the science police to align with the others.[13]

2. The principle *the nail that sticks out gets hammered down* or when the social comparison implies the need for compliance to avoid ridicule or punishment

The premise here is that each of us wants to be seen favorably by the other Groupthink members. We seek to identify what others value, and then we decide where we stand in comparison to the rest of the group. If we find a difference in opinion, then we orient ourselves to cancel it and even overcome it, which is a sure path to extremism.

The principle of "the nail that sticks out too much" works wherever there is strict control of the majority over potential dissidents. From large corporations to start-up companies, and from religious cults to neighborhood committees, this occurs in many group situations. Any newcomer must respect the authority of the team and should not vocalize any type of disagreement with the majority.[14] Instead of encouraging a diversity of opinions, as suggested by the advertisement noticed in Iași, we are witnessing more or less subtle attempts to silence the opposition.[15] The power of the majority "hammer" controls the behavior of the dissident minority "nails." You are not welcome in our group. *Lasciate ogni speranza, voi ch'entrate* … (Dante, *L'Inferno*)

The direct pressure on dissidents and their deviant ideas is a well-known occurrence. "He who is not with us is against us," it is said. Any dissident in society will continue to face increasing pressure from other group members who want to deter them from that line of unique thinking. The risk of having opinions *à rebours* was clearly expressed by Voltaire in the above quote. The power of "others" is not negligible[16] and should not be underestimated, especially if George Carlin is right: "Never underestimate the power of stupid people in large groups."

Are there any risks if you ignore this principle? Yes, and you must be prepared for public reproach and flogging at the stake of infamy.

The pressure on Groupthink members to think uniformly for the sake of maintaining consensus seems to be a harsh and insidious attack on the human personality. It is a good and accurate example of Solomon Asch's so-called conformity experiments in the 1950s, clearly documenting how individuals give in to or resist the pressure of a majority group, as well as the effects these group pressures have on individual opinions and beliefs.[17]

Conclusions

Senator William Fulbright left us with this admirable piece of advice: "We must learn to welcome and not to fear the voices of dissent."[18] And, quoting a spiritual remark by Mark Twain, I would add, "Whenever you find yourself on the side of the majority, it is time to reform (or pause and reflect)." Free thinking begins in dissent.

As a non-politically engaged scientist, I feel free and at the same time obliged to testify about any intellectual slippage that I have encountered in the vast, as of yet unrestricted, field of exchange of ideas. And I expect my eventual readers to adopt a position by thinking out of the box when they encounter new ideas, positions, and opinions, which at first sight might seem politically incorrect.

Challenging the majority opinion requires courage. Being a dissident requires conviction. Too often, we assume that the truth consists of numbers rather than rational evaluations of information. Groupthink pushes its parishioners to blindly follow the majority, and this can be seen in endless commercials, gregarious consumer behaviors, hectic Ponzi schemes and financial bubbles, cheerful marches and rallies by climate activists, and more.

Disagreeing with the majority is often an engine of innovation, conviction, and error correction. Most Groupthink's dictatorship can be successfully challenged. We only need one skeptical, dissident voice to free us from the yoke of the majority. Even if that voice belongs to someone who is a victim of bigotry and intellectual intolerance, it is the guiding light of the human race, a light that shears the darkness of ignorance.

Because knowledge always begins with skepticism and ends with self-confidence.

That is why we need groups of thinkers, not Groupthink.

CHAPTER 9

SCIENCE POLICE AND DEFIANCE OF CONSENSUS

Police typically catch criminals, give fines for traffic violations, maintain public order and peace, and more. It is one of the oldest forms of social authority.

The Thought Police ("Thinkpol") described by George Orwell in the novel *Nineteen Eighty-Four* discover and punish crimes of thought, or personal and political thoughts not approved by the Party. Thinkpol is made up of people with totalitarian views on certain topics. They regularly watch over and monitor any deviation from official thinking in an attempt to control people's opinions and beliefs outside the Party.

The science police,[1] a mild form of thought policing, patrol universities, the media, and the internet, often through aggressive sheriffs who pursue those who try to disrupt any form of agreement on sharply polarizing issues such as climate change, the decline of biodiversity, and hydraulic fracturing.

What happens when the science police discover "criminals" who defy the existing consensus on, for example, climate? They are ignored, ostracized, denigrated, unpublished, excommunicated from conversations and debates about climate change, pointed out and put on the pole of infamy, and given polarizing and slanderous labels (e.g., denier, antagonist, denialist, paid for by the fossil fuel industry).[2] I hope that the following few examples will be edifying.

Science police in the journal *Nature*

For decades, environmentalists have called for a so-called biodiversity crisis because global rates of species extinction are rising and are affecting local and regional habitats. This belief has been strengthened by experimental studies which have shown that an ecosystem's functioning is diminished when plant diversity decreases. Only one step was needed to go from this idea to the formulation of the consensus that due to urbanization and agriculture, along with other aspects of contemporary human society, natural habitats are strongly fragmented and, consequently, this has led to the reduction of ecological diversity and to the deterioration of ecosystem health. In other words, humanity must be pilloried for crimes against biodiversity. And the sixth extinction is happening right now![3]

But the reality is paradoxical. Biodiversity, in general, is not declining at all spatial scales. Global declines are usually not visible at the regional level and only occur in special cases at the local level.[4] Human activities do not always negatively impact biodiversity. For example, since humans landed in New Zealand, most likely in the thirteenth century, "the number of plant species in the country doubled, from about 2,000 to over 4,000." The island country, which did not have mammals, except for a few species of bats and marine animals, houses today over 25 species of mammals (e.g., rabbits, deer, dogs, rats, hedgehogs, ferrets, opossums, and wallabies). Regardless, New Zealand, along with other parts of the planet, is presented as a place where the "biodiversity crisis" has fully manifested, with species going extinct at a worrying rate.[4]

In 2013, Mark Vellend, a professor of ecology at the Université de Sherbrooke, Quebec, and his colleagues in Belgium, the United Kingdom, the United States, and Switzerland, sent an article to *Nature* in which they challenged the consensus of the biodiversity crisis. By compiling and analyzing a database of more than 16,000 plant plots from habitats worldwide, the researchers obtained robust data that led them to reject the current consensus of the biodiversity crisis. Specifically, they have not identified any general trends in the last century indicating the decline of local plant species diversity.

Upon receipt of the manuscript, the science police from the journal *Nature* immediately took action. One of the reviewers reacted with astonishment:

> I appreciate the unexpected evidence, which is contrary to the consensual assumption . . . But because of the great political implications of the manuscript and how it could be interpreted in the media, we are forced to raise the bar for acceptance.

The reviewer continued to express his astonishment that there are "criminals" who dare to defy the consensus:

> Unfortunately, although the authors are careful to state that they are discussing local biodiversity changes and explain why this is relevant to the scientific community, clearly the media, which reports on these results, will step on this and report that biological diversity is not in decline if the manuscript were published in Nature. I do not think that this conclusion

> would be justified, and I think it is important that we do not open the way for this conclusion to reach the public.[1]

Nature rejected the article. Fortunately, it was published in the same year in PNAS.[5]

There are other examples of the opacity used by reviewers and by *Nature*. One of the greatest scientific discoveries of the twentieth century was made by geophysicist Glen Penfield. He identified the impact crater site produced by the meteorite that, sixty-six million years ago, caused the last mass extinction of species on earth.

Confident of the findings and in the evidence found, Glen Penfield and his collaborator, Alan Hildebrand, sent an article to *Nature* magazine in 1990. The manuscript was rejected. One of the references, a prominent NASA expert, wrote in his comment that "the only original thing in that work is the impossible-to-pronounce name Chicxulub." No comments.

Science police on Wikipedia

Almost all of my students tell me that they start with Wikipedia[6] when finding information for their climate change research projects. Unfortunately, many media organizations, nongovernmental organizations (NGOs), and journalists do the same. I must discuss in detail with them how ignorance proliferates and how the science police act at the famous "university" (Wikipedia) founded by Jimmy Wales and Larry Sanger in 2001.

The main example I use is that of William M. Connolley, who had the opportunity to admit or not to admit editing information about climate change. Connolley appointed himself in 2003 as editor (i.e., web administrator, or "sheriff of the science police") at Wikipedia and, with the help of a group of supporters, controlled all entries with keywords such as *climate*, *climate change*, and *climatology*. Connolley's group, the climate science police, regularly monitored the changes proposed by various users and quickly returned them to the original text whenever someone tried to enter any information that contradicted the orthodoxy of anthropogenic global warming.

Lawrence Solomon, a well-known Canadian environmentalist, wrote in 2010:

> Connolley took control of all things climate in the most used information source the world has ever known – Wikipedia. Starting in February 2003, just when opposition to the claims of the band members were beginning to gel, Connolley set to work on the Wikipedia site. He rewrote Wikipedia's articles on global warming, on the greenhouse effect, on the instrumental

> temperature record, on the urban heat island, on climate models, on global cooling. On Feb. 14, he began to erase the Little Ice Age; on Aug.11, the Medieval Warm Period. In October, he turned his attention to the hockey stick graph. He rewrote articles on the politics of global warming and on the scientists who were skeptical of the band.
> All told, Connolley created or rewrote 5,428 unique Wikipedia articles. His control over Wikipedia was greater still, however, through the role he obtained at Wikipedia as a website administrator, which allowed him to act with virtual impunity. When Connolley didn't like the subject of a certain article, he removed it — more than 500 articles of various descriptions disappeared at his hand. When he disapproved of the arguments that others were making, he often had them barred — over 2,000 Wikipedia contributors who ran afoul of him found themselves blocked from making further contributions. Acolytes whose writing conformed to Connolley's global warming views, in contrast, were rewarded with Wikipedia's blessings. In these ways, Connolley turned Wikipedia into the missionary wing of the global warming movement.[7]

Finally, under pressure from this public scandal, Wikipedia removed "Sheriff" Connolley from the position of editor but not permanently. He was later reinstated.

In January 2013, the German magazine *Die Kalte Sonne* wrote, under the headline "Connolley—The Climate Counterfeiter: The man who rewrote our worldview":

> Incredible but true: the Wikipedia head judge on climate issues was a member of the British Greens and openly sympathized with the views of the controversial IPCC. So, he wasn't a referee at all, but the 12th man on the IPCC team.[8]

In 2010, Kim Dabelstein Petersen, another prominent editor of Wikipedia on climate issues, was banned. Petersen's mission was to detect any dissent from climate orthodoxy or even someone correcting obvious defamation against a skeptic and to remove them immediately.

Using Wikipedia as a credible source of information is questionable. Do it at your own risk.

Science police in universities

The climate propaganda blog called Skeptical Science (SkS)[9] was created in 2007 by Australian John Cook. Later, in 2013, Cook and co-workers published an article in the climate consensus series, stating that

"97% of experts agree with anthropogenic global warming."[10] The article was severely criticized by several scientists in 2018.[6]

The blog—SkS—hosts, among other things, a list of scientists it has labeled "climate misinformers." The list contains 17 academics, including David Legates from the University of Delaware, the professor who produced the most destructive critique of Cook et al.'s 2013 article. Unfortunately, the "Cook's list" is a blacklist that the science police use to harass and ultimately eliminate those labeled as "climate misinformers" from academia. I always believed that labels are useful for jars, not people.

Two examples:

1. Roger Pielke Jr. is a professor at the University of Colorado, Boulder, with 25 years of experience in interdisciplinary climate studies.[11] Since defending his doctoral dissertation in 1994, Professor Pielke Jr. has argued that climate change poses risks that require significant action in response. But he also said that our response efforts so far have been unfortunate and inadequate. His views, which he was not afraid to make public, led some people to try to exclude or remove him from discussions, sometimes with considerable success. Pielke Jr.'s research on climate and severe weather has been cited more than 20,000 times (*h*-index = 59). However, an official from the National Science Foundation (NSF), the main government source of research funding in the US, clearly warned him:

> Don't bother sending a grant proposal to NSF, because we will not be able to find a reference that will give you a positive score.[1]

Based on his research, Professor Pielke Jr. has shown that although the climate is warming, it does not necessarily increase the frequency or severity of extreme weather disasters. He also expressed this position before the US Congress in December 2013 when he contradicted President Obama's scientific advisor on the links between climate change and extreme weather events, a topic dear to environmentalists and warmers.

Because of his anticonsensus views, Professor Pielke Jr. became radioactive even to those who had sympathized with him. Controversial pressure and assaults on his reputation as a scientist have forced him to give up climate research. Recently, Pielke Jr. was transferred from the Ecological Studies Program to the Department of Sports (!) at the same university, where he teaches the course Introduction to Sports Governance. Having tenure, he could not be expelled from the University of Colorado, Boulder.

The science police have achieved their goal.

In December 2016, Pielke Jr. published a devastating article in the Wall Street Journal, "My Unhappy Life as a Climate Heretic," whose subtitle needs no further comment:

> My research was attacked by thought police in journalism, activist groups funded by billionaires and even the White House.[12]

On March 29, 2017, he testified again before the United States Congress about the situations in which science clashes with politics, about his climate research, and about the efforts of the science police to shut his mouth permanently.[13]

2. Professor Judith Curry is a climatologist, former head of the School of Earth and Atmospheric Sciences at Georgia Technology, and a member of the National Aeronautics and Space Administration (NASA) Advisory Council Earth Science Subcommittee. She was also a member of the National Oceanic and Atmospheric Administration (NOAA) Climate Working Group, a member of the National Academies Space Studies Board, and a member of the National Academies Climate Research Group.[14]

Like Roger Pielke Jr., her former colleague at the University of Colorado, Boulder, Professor Curry is a renowned expert in various fields of extreme climatology and meteorology (hurricanes, ocean and atmospheric thermodynamics, albedo variations, Arctic and Antarctic glacial variability, etc.) Her research has been cited over 20,000 times (*h*-index = 67).

Although she was an official IPCC referent and an initial supporter of anthropogenic warming,[15] Judith Curry gradually changed her position, especially after studying climate skeptics and the arguments and data of Roger Pielke Jr. and Steve McIntyre. Since 2009, after the great *Climategate scandal*, Curry began to criticize the climate consensus, which is that people are the primary cause of global warming, and instead started emphasizing the harmful role of alarmism, the uncertainties of climate models, the lack of concrete causal links between climate change and weather extremes, and more.

Between 2004 and 2019, Professor Curry testified six times before the United States Congress. Each time, she expressed the idea that the dangers associated with global warming are exaggerated and difficult to predict. In her testimony, Curry criticized, among other things, President Obama's climate plan and the United Nation's proposed climate action plan. During her testimony on February 6, 2019, Curry stated the following:

> Man-made climate change is not an existential threat in the 21st century… The perception of a near-term apocalypse has narrowed the policy options.[16]

The science police could not, of course, tolerate such a betrayal. Judith Curry's name was immediately blacklisted, like on *Skeptical Science*. What happened next? In an interview in February 2020, Professor Curry said:

> In 2012 I was informed by my Dean that the administration wanted me to step down as Chair. While there were several reasons for this, one obvious reason was extreme displeasure by several activist climate scientists who had a very direct pipeline to the Dean.

Judith Curry resigned and began looking for administrative positions at other universities.

> At the time, I was getting numerous inquiries from academic headhunters encouraging me to apply for major administration positions, ranging from Dean to Vice Chancellor for Research. I applied for several of these and actually interviewed for two of them. I did not make it to the final short list.[17]

Curry believes the major obstacle to her re-employment was antiskeptic prejudice, promoted by "Cook's List" and other similar blogs. With no chance of being hired, on January 1, 2017, Judith Curry applied to retire, although she was not old enough. The reasons given are available here.[18] The science police have reached their goal again.

One of the world's best climatologists has been "taken out" because she no longer accepts the consensus of the 97% of experts who believe in anthropogenic global warming. And again, unfortunately, the science police, tireless and always vigilant, will not stop to mercilessly hunt down all those who defy consensuses.

CHAPTER 10

THE PRISONER'S DILEMMA AND GLOBAL WARMING

The current pandemic will end sooner or later, after which media bombardments about the fires in Australia or California, Greta's avatars, rising temperatures in parallel with carbon dioxide concentrations, the climate apocalypse, and others will resume. Anticipating the upcoming media campaign, I allow myself to draw attention to a remarkable event that has gone virtually unnoticed by the same media.

In December 2019, the 25th Conference of the Parties (COP25) was held in Madrid, an integral part of the United Nations Convention on Climate Change (UNFCCC). After two weeks and two days of discussion, the failure of the conference was unequivocally stated:

> "Once again, no progress has been made to bring countries more in line with the 1.5 degrees target of the Paris Agreement," said Bas Eickhout, a Dutch member of the European Parliament who has been part of the EU's delegation at the negotiations. "Very strict rules are an absolute necessity and old, untrustworthy CO_2 credits have to be scrapped. That has not happened in Madrid, the summit ended without a deal."[1]

Why was COP25 a remarkable event? Because it followed COP24, which followed COP23 and so on until COP1, which took place in 1995. All these conferences set themselves to achieve a planetary agreement on stopping anthropogenic global warming by eliminating the burning of what they consider the primary source of increased carbon dioxide emissions. After 25 years of negotiations, *parturiunt montes, nascetur ridiculus mus*: one agreement is already dead, the Kyoto Protocol, and another is dying, the Paris Agreement.

When a sports team loses 25 consecutive games, what else can be said? You need a new coach or a new game tactic. After 25 years of climate conference failures, an analysis of the disaster causes, even limited to one book chapter, could shed light on a better understanding of what has happened and is still happening. Because just setting targets for 25 years did nothing to halt global warming. It is time to hit them.

Professor William D. Nordhaus at Yale University won the Nobel Prize in 2018 for "integrating climate change into a long-term macroeconomic analysis." He is the only Nobel Prize-winning economist. He recently suggested that some game theory concepts could elucidate the complex nature of different types of international agreements.[2]

The first category is represented by relatively simple agreements that offer significant benefits and important incentives to willing participants. For example, in 1951, the English language was adopted as a universal means of communication in civil aviation to prevent air collisions or ground accidents.

With an average level of complexity and difficulty, the second category of international agreements is well exemplified by trade treaties based on reciprocity, with variable bilateral tariff advantages.

Finally, the third category of international agreements facing the most challenging problems concerns global public goods. Unlike private goods, whose owners consume and use them exclusively, global public goods offer benefits that cross borders, generations, and population groups.

But the question immediately arises: who supplies those global public goods? Once they exist, it means they're there for the benefit of all. But then there will also be consumers who will seek to enjoy the benefit of global goods without contributing to their production. In the absence of a collective action mechanism, they risk being undersupplied. Similarly, without collective action, the opposite of public goods (e.g., pollution, noise, street crime, risky bank lending) will become oversupplied.

An example: April 12, 2020, marks the 65th anniversary of humanity receiving the free formula for the polio vaccine, produced by Dr. Jonas Salk's team at the University of Pittsburgh. By then, millions of children and adults worldwide, including President F. D. Roosevelt, had been mutilated for life by the unforgiving disease. Dr. Salk never patented his discovery, and his vaccine became a global public good with no input from outside the United States ("Patent? There is no patent. Could you patent the sun?").

Today, Dr. Salk's followers, including his son, Peter, are working without respite in the University of Pittsburgh's labs to discover the formula for the Covid-19 vaccine. It will undoubtedly be a global public good. However, one question occurs: will those discoverers have the moral height of Dr. Salk to declare that "There is no patent. Could you patent the sun?"

What is being observed for now is a perfect example of global public "evil." The pronounced decrease in travel and communications costs of all kinds has accentuated the rapid spread of the Covid-19 virus, a gloomy wake-up call that painfully reminds us that some global forces do not respect borders or peoples. In such borderline situations, unfortunately, non-cooperative policies such as beggar-thy-neighbor also appear. Romania's decision in 2020 to suspend the export of many agricultural products falls within this type of behavior. It suggests that some states behave like the ostrich that sticks its head in the sand by prioritizing its national interests. Those countries give up cooperation plans, which offer both global and individual benefits for participants.[3]

Many of the current complicated international problems (e.g., terrorism, migration, armed conflict, nuclear proliferation, military agreements, and cyberwarfare) are just examples of *the prisoner's dilemma*.

Proposed in 1950, the prisoner's dilemma is the central paradox of game theory that shapes cooperation and social conflicts. The paradox stems from the fact that individual, rational decisions can lead to nonoptimal collective results in a strategic situation, where participants have incentives to gain advantages at the expense of others. Study after study has shown that in the end, all parties lose.[4]

International climate agreements, proposed and unsuccessfully implemented in the last 25 years, fall into the third category and are also a good illustration of the prisoner's dilemma. The death of the Kyoto Protocol in 2012 and the agony of the current Paris Agreement, signed with great political and media fanfare in 2015, were produced by several causes. These include the lack of functional structures to stimulate and reward the participants, the scale, difficulties, exorbitant costs of implementation, questioning practices about the calculation of the carbon budget of nations, the lack of clear penalties for those who do not comply with contractual obligations, the absence of legal binding for the signatory parties, and more.

I will continue to present only three major causes, which, in my opinion, have contributed significantly to the failure of global climate efforts.

"Travelers without a ticket"

One of the inherent vices of international cooperation in the third category subject to the prisoner's dilemma is the existence of "travelers without a ticket," or free riders.

It is a sad, unequivocally demonstrated reality that some states are driven by the desire to preserve their national interests and prefer to "travel without a ticket." They expect to receive public goods without contributing to the costs of producing them. In international climate agreements, some countries expect others to reduce their emissions without significantly spending by themselves.

Invoking national interests, interest prioritization makes sense as long as the impacts produced do not go beyond national borders. For example, a government can protect its citizens in international trade agreements by applying preferential tariffs, as was done in the United States' recent cases (2018–2021) in relation to China, Mexico, and Canada. But when the United States continually reduces its carbon dioxide emissions by replacing coal with shale gas, while China, India, and Brazil increase their emissions and build new coal-fired power plants at home and beyond, the situation is no longer okay.[5] Nationalist, non-cooperative policies, centered solely on the national good and relying on other countries' spending on reducing emissions, are counterproductive.

The failure of international climate agreements is caused mostly by free riders. And both President George W. Bush—who rejected the Kyoto Protocol, primed by the Clinton–Al Gore tandem—and President Donald J. Trump—who decided to withdraw the United States from the Paris Climate Agreement, arranged by the Obama Administration—have invoked the existence of climate free riders, or countries that benefit unilaterally from reducing American emissions.

A second eloquent but nonclimatic example of the adverse effects of the free rider syndrome can be seen through the contractual obligations of the North Atlantic Treaty Organization (NATO) member countries, obligations that were assumed by the signing of the Treaty at the time of accession.

NATO members have agreed to defend together, one for all and all for one, and to bear this defense's costs jointly. But in reality, the burden of spending is strictly asymmetric. The United States contributed 71.7% of NATO's 2018 budget, more than Germany, France, Italy, Spain, the United Kingdom, and Canada combined.[6] In the same year, several NATO members spent minuscule amounts of their gross domestic product on defense. Luxembourg spent 0.46%, Belgium spent 0.90%, Spain spent 0.92%, and Slovenia spent 0.98%.

Countries that fail to fully fulfill their obligations as participants of an international agreement on the use of public goods benefit from a free ride at the expense of other countries' massive expenditures. We should not, therefore, be surprised by President Trump's reactions in 2017 on the future of NATO:

> Twenty-three of the 28 member nations are still not paying what they should be paying for their defense …This is not fair to the people and taxpayers of the United States, and many of these nations owe massive amounts of money from past years.[7]

Conclusions

Returning to today's climate policies, countries have no good national reasons to participate in an international agreement with clearly expressed obligations and penalties for their non-fulfillment. And if they participate, there is a tendency to report fictitious figures about their emissions or to simply not take on ambitious targets. This seems a cynical solution to the dilemma of climate prisoners.

CHAPTER 11

CLIMATE CHANGE AND ITS ROLE IN THE EMERGENCE AND DEVELOPMENT OF HUMAN CIVILIZATION: IMPLICATIONS FOR A PROBABLE FUTURE

Let's imagine that a time machine would be available to transport us over 12,000 years in human society's prehistory. The planet was then in the final phase, called the Younger Dryas, of the last glaciation that had begun approximately 115,000 years ago. It was much colder than today, and huge ice caps covered large parts of Eurasia, North America, and many southern mountainous areas. There were many droughts because water evaporation from the cooling oceans was low, and the rains were few and insufficient in quantity. A large amount of water became ice, which led to a decrease of about 120 meters in ocean level. Many of today's islands were actually connected to the continents.

In Africa, prolonged droughts led to Lake Victoria's complete drying up and a rise in the Kalahari Desert. In South America, the equatorial forest of the Amazon shrunk to a few isolated clumps of grassy trees. The skies were covered with clouds of dust, aroused by quasi-permanent glacial winds. In Antarctica, the dust deposited on the ice caps is found today in extracted ice cores and provides clear evidence of icy weather conditions. About 10% of the land surface was covered with loess, a rock made of fine sand and dust carried by icy winds.

Low ocean temperatures amplified the dissolution of carbon dioxide so that by the end of the Pleistocene, during the so-called Ice Age (2,580,000–11,700 BC), the concentration of carbon dioxide in the atmosphere was only 190 ppm (0.019%), unlike at the beginning of the Holocene (the current geological epoch[1]), when carbon dioxide had reached a concentration of 250 ppm (0.025%)[2]. Such a situation reduced plant productivity because photosynthesis is limited to low atmospheric carbon dioxide. Experiments have shown that at concentrations of 190 ppm, plants such as wheat and rice produce only about a third of the number of grains they produce today, even if they have plenty of water and nutrients.[3]

Lack of rainfall, the presence of strong glacial winds, and relatively low concentrations of carbon dioxide have led to significant reductions in plant-covered areas and increases in desert areas. The survival of groups of people in the latter part of the Pleistocene was a constant challenge. A predominantly vegetarian diet in a glacial world with few plants was not the optimal solution for primitive humans, who are energy-eating mammals with developed brains and small intestines. It was then when we started hunting herbivorous animals (e.g., bison, antelope, deer, and horses) for an additional calorie intake. In some places, a human specialization emerged in the extraction and consumption of some roots.

The domestication of plants and animals, which could have provided some food security, proved difficult for another reason: extreme climate variability. Data obtained from isotopic, palynological, sedimentological, and micropaleontological measurements taken on ice cores extracted from Antarctica and Greenland or sedimentary cores from the ocean floor suggest that the temperature was much more variable during the last glaciation than today, both in the polar and tropical regions. Specifically, changes in global temperatures from one decade to another have been estimated to be four times faster than at present.[4] Temperature fluctuations have also occurred on millennial and submillennial scales. For example, the last millennial episode of global cooling was Younger Dryas, which lasted from 12,600 to 11,600 BC and was marked by ten hot–cold cycles.

Compared to the last part of the Ice Age, the period that the planet has known in the last 10,000 to 11,000 years is one of climate stability, with very few variations of a relatively small magnitude. Figure 11.1 illustrates this comparison using extensive data over the last 50,000 years from two locations: the Santa Barbara Basin in California and Greenland.

The rapid and periodic deterioration of the climate through the advance and retreat of glaciers, causing long periods of drought or frost, has forced primitive people to continuously migrate in search of more favorable areas for daily food.

Because agricultural-based subsistence systems are vulnerable to large-scale climate fluctuations and extreme weather, and because cultural evolution (aka changes over time in attitudes, skills, habits, beliefs, and emotions that people gain through learning and imitation) of these systems occurs relatively slowly. **Agriculture was impossible in the Pleistocene**.[4]

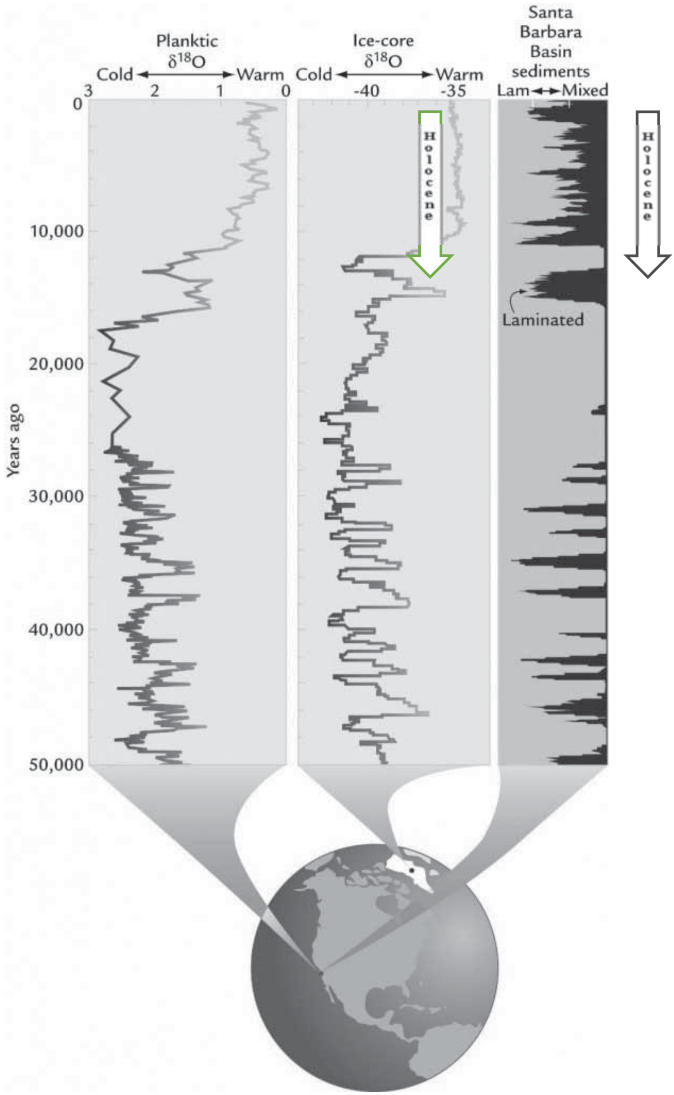


Figure 11.1. Millennial temperature fluctuations in the Santa Barbara Basin, California (left) and Greenland glaciers (middle). The data are obtained from the analysis of oxygen isotopes in planktonic sediments and glacial cores. The pattern of the two graphs is similar. It is easy to notice that the last 12,000 interglacial years or so of the Holocene mark the existence of a warm and stable climate compared to the previous glacial period, or the Pleistocene.[10]

Starting about 11,600 years ago, the **Holocene, the interglacial age,** began. The climate became much more stable, and temperatures began to rise, most likely due to some combined influence of Milanković cycles (the precession of the equinoxes, the variation of the eccentricity of the orbit of revolution, and the variation of the angle of inclination of the earth's axis of rotation). During the next several hundred years (200–800 years)[5], as the oceans warmed, so did the concentrations of atmospheric carbon dioxide emissions that were previously dissolved in water, as well as precipitation due to more intense evaporation.

The glacial-interglacial transition (i.e., the Pleistocene-Holocene boundary) produced a major and rapid change in the environment and triggered the intensification of subsistence systems. This was a phenomenon called the agricultural revolution. Practically, the reduction of climate variability, the increase of carbon dioxide concentration in the atmosphere, and the intensification of precipitation changed terrestrial ecosystems from ones where agriculture was impossible to ones where agriculture could be practiced in many different places (i.e., the Middle East, China, Africa, South America, North America, Central America and New Guinea). **The Holocene means the era in which agriculture was born and propagated**, which is the birth certificate of human civilization. Nomads became sedentary, began to domesticate plants and animals, became proto-farmers, and population density increased, with some disruptions caused by new diseases or famines. The invention of agriculture soon led to new cultural innovations, such as tribes, kings, gods, and wars, which were also fundamental bricks in the construction and development of prehistoric and more recent human societies. Agriculture is the innovation that enshrined the birth of human civilization.

Like the Industrial Revolution, the agricultural revolution was one of energy. Its goal was to produce more food as a concentrated form of energy and to direct it to decrease, or reverse, entropy by creating more human bodies at the expense of other species.[6] As the climate changed, becoming warmer, wetter, more stable, with higher amounts of carbon dioxide, people turned to diets containing more productive and domesticated plants and animals, making ecosystems more efficient for feeding people. Scientists also argued that almost all trajectories of intensification of Holocene subsistence systems are progressive and agriculture has eventually become the dominant strategy in all but marginal ecosystems. In this regard, agriculture was obligatory and inevitable, which is why it emerged as a simultaneous innovation in so many different places.[2]

Prehistoric populations, which discovered or adopted better subsistence strategies based on agriculture, tended to grow rapidly, exerting competitive pressure on smaller populations and using fewer effective strategies. Thus, during the Holocene, this kind of group competition favored the implementation and spread of agriculture over wider areas.

Once triggered, the new agricultural revolution was not exempt from the climatic variations present in the Holocene. For example, the impact of the Little Ice Age (ca. 1300–1850) on European agriculture was significant. There was a long-term agricultural crisis with continental expansion. At the beginning of the modern era, for fragile societies, two consecutive years without harvests—especially grain—meant famine. The frozen rivers no longer allowed the mills' operation or transport to the cities, cutting off their food supply sources. Cereal crops did not return to their old values until after 180 years. Many tens, perhaps hundreds of millions of lives, were lost due to devastating famine, incredibly long and frequent wars, devastating pandemics (the Black Death alone from 1347–1351 caused between 70 and 200 million deaths), prolonged droughts, severe cold, catastrophic floods, and other causes. It is no coincidence that exactly in the middle of the seventeenth century, Thomas Hobbes lamented in his masterpiece *Leviathan* the life of man living in the Little Ice Age as "poor, nasty, brutal and short."[7]

The Little Ice Age was a climatic variation on a millennial scale of the Holocene, but experts say it was incomparably much "milder" than events of similar duration during the last glaciation.

Conclusions

Low average plant productivity and high, climate-induced variations in plant productivity were "the external constraints that [significantly reduced] both the efficiency and reliability of plant subsistence in the last glacial cycle, ultimately [hindering] the development of agriculture."[8]

The invention and spread of agriculture with the onset of global warming in the Holocene decisively marked modern human civilization's emergence and development. The fact is that in the last 10,000 to 11,000 years, the climate has been relatively stable, with a concentration of carbon dioxide conducive to plant development, and sufficient rainfall. This has led to the change of land from an ecosystem in which agriculture was impossible everywhere to one in which we can practice in many different places. Of course, the mere presence of favorable natural conditions would not have been enough for the spectacular advances and monumental achievements humanity has made on the road to civilization, a road marked by countless inventions and innovations, intense work, passion, ambition, and more.

What awaits us in the future?

There are only two climates on planet earth: *glacial* and *interglacial*. We now live in the Holocene, which is an interglacial age. The return of climate change in a regime characteristic of the Pleistocene, the last glaciation, is very likely if the three Milanković cycles' mechanisms continue to function as in the Pleistocene. Supporting agriculture capable of feeding seven to fifteen billion mouths in the next 80 years[9] will be a colossal challenge for farmers unaccustomed to working in conditions of large-scale and high-frequency climate change. Decreased carbon dioxide concentrations and reduced rainfall suggest, at best, a significant collapse in global agricultural production.

The current anthropogenic global warming, caused by greenhouse gas emissions, could be a temporary solution to delay the new ice age. However, this hope is the only speculation because, at present, we do not know with sufficient confidence what feedback reactions control the functioning of climate mechanisms. Existing data suggest that the current rise in carbon dioxide levels threatens to raise temperatures to values that, in previous interglacial epochs, triggered a significant feedback effect, which then produced a relatively rapid return to glacial conditions.

The risks of such a return to the Ice Age are impossible to estimate. A scenario of the continuation of current agricultural production in conditions of a colder, drier climate, with lower carbon dioxide concentrations, can only be apocalyptic. Therefore, the comparison between the climatic instability of the Pleistocene and the dependence of agriculture on the stability of the Holocene is a lesson that we must think about.

CHAPTER 12

WHEN THE WEATHER BECOMES CLIMATE

Meteorologists tell us how to dress in the next three to five days. Climatologists tell us what wardrobe to choose in the next 30 to 50 years. The former have at hand concrete measurements of variations in temperatures, precipitation, winds, snow cover, and more. The others have futuristic models at their disposal.

Meteorologists, those who tell us several times a day about the weather or probable weather, do not always provide accurate information, especially when they announce a sunny day that then turns out to rain.

We can't say anything bad about climatologists because some work with the past, others with the future.

Those working with past climates use computational models, which strive, with more or less success, to reproduce the observed paleoclimatic data (e.g., temperatures, greenhouse gas concentrations, sea-level changes). It's not a secret that computer simulations suffer from an endemic "disease," or a mismatch between empirical data observed in the field and the data obtained in a computing lab. The symptoms of this "disease" can be detected either in geological data, simulated data, or in both cases.

For example, researchers described a "considerable discordance" between simulated data from 35 of the 36 climate models used and actual surface temperature data recorded in the Middle Holocene China.[1]

The existence of mismatches between real climate data and computer simulations has been recognized by scientific forums, such as the World Meteorological Organization, 2009:

> There is often a discrepancy between the spatial (and temporal) representativeness of climate observations and the output data of the climate model, in which the latter does not fully represent the range (or scale) of variability observed in the former. This mismatch is due to the fact that observations are generally collected at certain sites (point values), while the values of the grid points of climate models are often assumed to be means of the area.[2]

The fact that a "famous" climate modeling in 1998 produced an equally famous artifact, the "hockey stick," which the Intergovernmental Panel on Climate Change (IPCC) incorporated in its 2001 report, created many jokes and doubts about the seriousness and the degree of confidence of climate models.

On 29 March 2017, during a testimony before the US House Committee on Science, Space and Technology, Professor John R. Christy, University of Alabama in Huntsville, presented another compelling example of the discrepancies between climate patterns and observed values of tropical temperature variations in the middle troposphere since 1975. There are 102 IPCC CMIP5 climate models and three different sets of measurements (balloons, satellites, and reanalyses) describing the tropical mid-tropospheric temperature variations between 1976 and 2016. Since 1996, there has been a significant difference between the models containing anthropogenic greenhouse gases and the three different empirical data sets. The testimony concluded that the introduction of greenhouse gas effects in climate models produced discrepancies with the observed data.[3]

The second category of climatologists are those who produce models of the climate future.

A primary problem about predicting any future events is related to the fact that we cannot know the future, because if we knew it, there would be no future.

Another problem is represented by the "disease" of climate models requiring continuous treatment. New changes, corrections, and adjustments of equations, boundary conditions, initial conditions, introductions or eliminations of climatic parameters, and more are always needed to achieve an acceptable simulation of paleoclimatic phenomena (e.g., random variations in temperatures, greenhouse gas concentrations, average ocean level, glacier-covered surfaces, and volcanic eruptions).

Elevated as high rank decision makers of environmental policies, climate models are now seen as real predictors that climate change *might* suffer. It is both hegemony and tyranny that lead to a disproportionate inflammation of the power of social and political discourse based on the shaping of possible future climate change.

The justification for this statement was found in 2018 in an official document of the IPCC—the leading forum invested by the UN with the elaboration of climate policies that must be embraced and applied by the peoples of the world:

> The climate system is a coupled non-linear chaotic system, and therefore the long-term prediction of future climate states is not possible.[4]

Despite the above official straight recognition that climate models are unable to predict future climate conditions, billions of dollars have been spent on simulations, almost all of which have been shown to greatly exaggerate what actually happened in the geological past of the planet. These funds could have been spent smarter and more productively on climate change itself than on computer models that are simply unable to predict the future global climate due to the intrinsic factors mentioned in the above IPCC statement. And yet, applications from those interested in obtaining new grants and new government funding to continue climate simulations never stop.

And although climatologists' models are "suffering," they are still used as a political weapon by various militant organizations, NGOs, the IPCC, and the United Nations, and any minor dissent is immediately questioned without a right of reply: *how dare you?*

The weather–climate dichotomy has turned the first term, weather, into a weapon increasingly used in public discussions about changes in the second term, climate.

In the summer, when heat waves, heavy rains, and forest fires occur more intensely, some climatologists and environmentalists will look for any possible connection to global warming, hoping that today's weather will help people understand tomorrow's dangers of climate change.

However, in winter, when cold waves, snowstorms, and frost deaths occur more intensely, some (perhaps the same) climatologists and environmentalists "forget" to talk about climate change and the dangers of tomorrow's cold. These people and most of the media have changed their communication strategies[3] and in winter, they no longer speak about global warming, but about the "polar vortex," the "cyclone bomb," the "trans-Siberian express," and so on.[4]

We are witnesses or participants in a weather-climatological war. As the trenches between the supporters and opponents of climate action widen and strengthen, both camps are using various weather manifestations as weapons needed to win the war. These transient phenomena have, by definition, uncontrollable variability and magnitude.

Casus belli is the flexible definition of the term "climate," which has generated the current trenches between "weather" and "climate."

The most common definition of climate is average weather. But it is the average of what? Is it temperature, precipitation, or wind speed? And what kind of average—arithmetic, geometric, loess, harmonic, or other types? Do these environments satisfy the various differential equations in the models? Is there a function that correlates the various environments with each other? Can differently calculated environments be used to define climate?

All these questions, and others, must be answered satisfactorily to fix the contradictory ideas that divide public opinion. It would also be in the interest of both belligerent camps to win the debate. In fact, during the last two decades, international climate communities have sought to find ways to particularize the goals set in 1992 by the United Nations Framework Convention on Climate Change (UNFCCC). The goal was “the prevention of dangerous anthropogenic interference with the climate system” and could be obtained through specific, quantitative targets that were easy to understand by both public opinion and politicians.

Although different quantitative targets have been proposed, such as greenhouse gas concentration, ocean heat content, or sea-level rise, the global average temperature has been chosen as the favorite indicator for quantifying climate change’s target level.[5]

The choice to use temperature variations as a proxy for climate variations probably comes from the fact that it is much more “palpable” if it is translated into observations that each person, even without access to oceans or glaciers, can do daily. Trying to convince someone that global warming means raising the average ocean level by 1–2 mm/year[6] does not have the same emotional impact as breaking news announcing to humanity that year X was the warmest of the last century. However, the global average temperature’s designation as a quantitative indicator of climate change, especially anthropogenic climate change, is marked by significant metrological uncertainties and paradoxes. Later in this book (Chapter 21) I will present the Simpson paradox in the context of global temperature measurements, described initially in an article I penned in 2018.[7]

Separated from the two definitions at the beginning of the chapter, a kind of axiom circulates in the public space, leaving room for many interpretations and ambiguities. Weather is what you get, the climate is what you expect. For example, how long do we have to wait for the transition to occur? Should the waiting period include only constant external conditions? If external conditions vary, as in reality, how does the waiting period change?

In scientific literature, the definition of climate rarely exceeds a statistical framework focused on the atmosphere. Climate is the statistical manifestation of the evolution of weather in relation to temperature variations at the earth’s surface. Although the terrestrial climate system is composed of five elements with synergistic action—the atmosphere, hydrosphere, lithosphere, biosphere, and cryosphere—only the first, to which the weather belongs, is usually popularized, discussed, and included in climate policies.

Such a vague and incomplete definition of what climate really is does not offer the best prospects for comparing and contrasting climate change, both natural and anthropogenic, and globally and locally (i.e., microclimates). The inaccuracy of the definition and the uncertainty around "when does the weather become climate?" translates into problems in multilateral negotiations, reducing the relevance of climate talks and the effects of its changes on local communities. The lack of a robust definition can affect even the highest organizational arrangements for climate policy.[8]

Sometimes, strange and confusing definitions of climate appear even in collective works, containing multiple contributions from university professors and researchers. For example, in 2016, Tom Bristow at the University of Melbourne and Thomas H. Ford at Monash University edited the volume *A Cultural History of Climate Change*, published by Routledge Environmental Humanities. In the *Foreword* signed by Dipesh Chakrabarty, a Lawrence A. Kimpton Distinguished Service Professor in History, South Asian Languages and Civilization at the University of Chicago, it can be read that:

> Climate change, considered as such, is a geophysical phenomenon [sic!] and, as an object of study, belongs squarely to the province of physical sciences. But "*dangerous* climate change" is not something that can be defined by scientists alone, for our understanding of what constitutes danger, and to whom and how and when, entails some crucial value-judgments.[9]

Leaving aside the untruth that climate change is not just a geophysical phenomenon, the introduction of a *dangerous* determinant creates the feeling that we are dealing with two distinct categories of climate change, one purely "geophysical" and interesting only to scientists and another "dangerous," although there is no precise definition of dangerousness, that is the prerogative of those outside the scientific field. This is because only scientists can issue "crucial value judgments." No more comments.

Climate does not mean the same thing to everyone

If it can be said in almost any language that the weather is "good," "bad," "changeable," etc. without creating misunderstandings, then the characterization of the climate and its changes must follow the saying *non idem est and duo dicunt idem.* In other words, what some people consider a beneficial climate change could be considered harmful by others.

The idea of climate is, in fact, a classification of convenience, which allows for, under the umbrella of the vaguely defined term, a heterogeneous mixture of colloquial, scientific, philosophical, and political contexts.[10]

In an earlier research, I described four "tribes"—egalitarians, fatalists, hierarchists, and individualists—that each contain different cultural perceptions and social attitudes related to climate change and the risks posed to society.[11] And in "Climate change and the polarization of public opinion. About the effect of good news vs. bad news,"[12] I presented six distinct categories of the American public, from "alarmed" about climate change to "careless."

In another article, following Hulme (2009),[2] I argued that today's climate change has more significant potential as a mobilizing idea than a physical phenomenon. And ideas can be used, but there cannot be considered problems waiting for solutions. Therefore, climate change can no longer be addressed only as an ecological problem while waiting for technical solutions. Climate change is not like lead in gasoline or asbestos in construction, which are undesirable physical substances that can be eliminated or banned. Nor is it a simple societal problem in search of a political solution. Inevitably, the weather–climate relationship has metamorphosed, adding four essential mythological dimensions: Edenic, Babylonian, Apocalyptic, and Themistian.[13]

It turns out that the climate is a subjective concept. The attempt to legitimize it by objective "injections," such as global average temperatures, greenhouse gas concentrations, or variations in the average level of heat in the oceans, only assists in highlighting the already existing contrasts between different societal, political, historical, and personal levels regarding the idea of climate and its relation to the weather.

Another example of the problematic weather to climate translation is the derivatives introduced by the IPCC to raise awareness and public opinion about the impending climate apocalypse.

Since the mid-1990s, warming by 2°C above preindustrial levels has been accepted as the threshold beyond which dangerous climate change could begin. But in 2015, on the signing of the Paris Climate Agreement, a new temperature emerged, 1.5°C, as an alternative target, and subsequent propaganda campaigns quickly reformulated the slogans. Today, 1.5°C heating is considered a "safe" limit for climate change control. Those who trained in the army know that mobile, migratory targets are the most difficult to aim at and shoot down.

Another derivative is based on an almost linear relationship between global temperature highs and cumulative carbon dioxide emissions, which could be used as a climate proxy. So, we have a new target: the concept of the carbon budget. The initial derivative became a second-order derivative, and the carbon budget also underwent a translation. Extending from a flux problem, where the number of emissions in a given year/period is focused upon, it has become a stock issue, where the allowable quantity of emissions in a given year/period is important. Next, the last derivation is that the allowable carbon budget also changed in relation to the temperature increase of 1.5°C. And from here, it was not far until the launch of the deadline: The IPCC SR15 report warned us that the time left until the fateful 1.5°C warming threshold is crossed is 12 to 34 years, starting in 2018!

What followed was pandemonium. American Democratic Socialists launched the Green New Deal,[14] a Swedish student began boycotting school and holding "ignorant" and "inactive" climate politicians accountable[15], Extinction Rebellion launched actions of "civil disobedience," and new political movements began to demand declarations of climate emergency in national and international parliaments, cities, universities, and schools. And this was just because "science said we only have twelve years left!"

When the weather (aka temperature) becomes (wrongly) climate …

How can the achievement of the target of only 1.5°C global warming compared to the preindustrial level be appreciated? It is simple to average terrestrial land and water temperatures, conveniently ignoring the Simpson paradox (see Chapter 21 for more details about this paradox).

The accuracy and precision of temperature measurements are controlled by several factors, however, including thermometer type, sensor quality, thermal radiation, internal heating, heat transfer between sensor and adjacent surfaces, recording procedures, and others. If the factors or instrumental effects they generate can be quantified and the errors introduced eliminated by appropriate corrections, there are still factors whose influences are more difficult to estimate and correct. An example of this can be seen in the weather station's location and the urban heat island effect. I will present only the temperature measurement stations.

In a study published by the prestigious *Journal of Geophysical Research*, researchers analyzed 1007 of the 1227 United States weather stations managed by the National Oceanic and Atmospheric Administration (NOAA), to determine errors that occur due to the locations of the respective stations when recording maximum/minimum temperatures.[16]

The quality of locations where NOAA weather stations are installed to measure and record maximum and minimum temperatures were classified using the Climate Reference Network (CRN) system:

CRN 1 designates a flat, clear surface with sensors located at least 100 m from artificial heating sources and ground cover with vegetation <10 cm high.

CRN 2 is similar to CRN 1, with surrounding vegetation <25 cm and artificial heating sources at 30 m.

CRN 3 is the same as CRN 2, except artificial heating sources are at 10 m.

CRN 4 differs due to artificial heating sources <10 m.

CRN 5 has a sensor located near/above an artificial heating source, as seen in Figure 12.1.

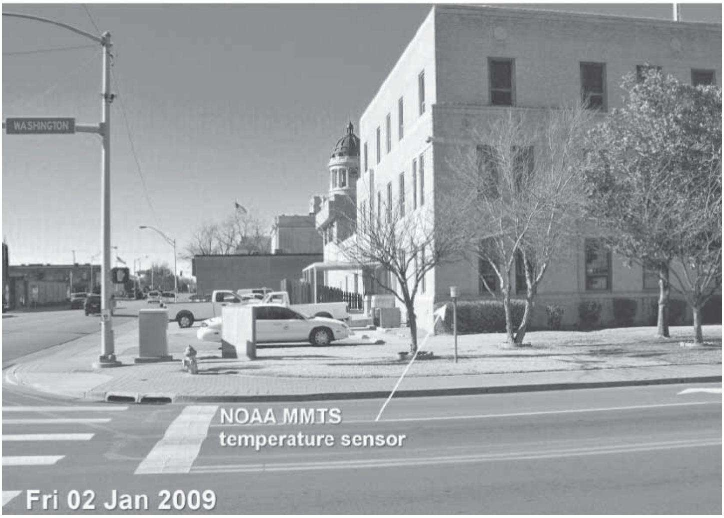


Figure 12.1. The maximum–minimum temperature sensor (MMTS) was installed by NOAA in Ardmore, Oklahoma on a street corner in full view of multiple heatsinks and within a few feet of the traffic intersection at City Hall.[17] This is a typical example of minimum quality (CRN 5) of temperature measurements. The phenomenon of the urban thermal island is predominant in such a location.[18]

A survey of USHCN surface stations revealed the classification of site quality depicted in Figure 12.2.

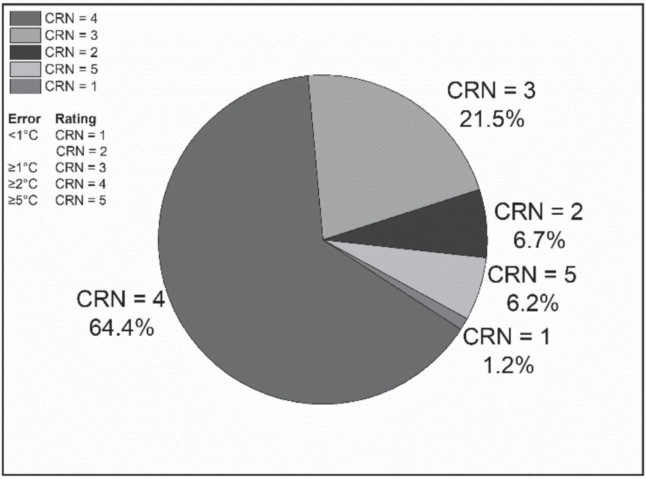


Figure 12.2. Distribution of the quality of weather station locations used by NOAA to measure and record maximum and minimum temperatures. Of the 1007 stations examined, 92.1% produce erroneous temperatures ≥1°C to 5°C higher than the North American Regional Reanalysis (NARR) temperatures. (Based on data from Fall et al., 2011.[16])

The data presented point to an alarming situation for the accuracy and precision of temperatures officially recorded by the United States agencies. Of the 1,007 stations analyzed, only 7.9% introduce errors of <1°C. The rest of the stations, an impressive 92.1%, report erroneous temperatures higher than ≥1°C to 5°C. The alarming situation discovered by the authors of the article forced NOAA to try to apply a correction called homogenization. This is a process by which NOAA officials simply cancel or adjust thermometer records at certain weather stations just because they differ from the adjusted temperatures at nearby weather stations. But, because the 114 "good" stations, with minor errors (<1°C), are dominated by the remaining 1,007 "bad" stations, with errors of ≥1°C–5°C, the temperatures measured by the high-quality stations (CRN1 and 2) are eliminated to maintain the homogenization between the low-quality stations (CRN 3, 4, and 5). As a result, homogenization adjustments will increase the temperatures in the "good" stations to be in line with the trend displayed by the stations with "bad" locations.

In the study discussed above, the authors draw attention to some severe metrological problems:

> This study demonstrates that station exposure influences USHCNv2 temperatures. Temperatures are highest compared to independent analyses at stations with the worst location characteristics. Estimates of temperature trends vary depending on the classification of the site: those with a poor-quality location produce an overestimation of the minimum temperature trends and an underestimation of the maximum temperature trends, producing a substantial difference in the estimates of diurnal temperature trends . . . Tendency differences become progressively higher (and more likely statistically significant) as the quality of the site degrades.[16]

Finally, it can be erroneously concluded that heating above 1.5°C to 2°C has already occurred. Besides fake news, we also have fake temperatures.

If the national network of a country like the United States faces such a problem in recording temperatures, we can easily imagine what is happening in other countries. For example:

- The monthly mean temperature in September 1953 at Păltiniș, Romania was reported as −46.4°C (while in other years, the September average was about 11.5°C).
- For April, June, and July of 1978, Apto Uto (Colombia, ID: 800890) had average monthly temperatures of 81.5°C, 83.4°C, and 83.4°C respectively.
- At Golden Rock Airport, on the island of St. Kitts in the Caribbean, mean monthly temperatures for December in 1981 and 1984 were reported as 0.0°C. But from 1971 to 1990, the average in all the other years was 26.0°C.[19]

Conclusions

Dressing the climate with a single coat, or statistically analyzing weather, is counterproductive due to the inherent ambiguity involved in the temporal transition between the two phenomena and the main limitation to a single component of the terrestrial climate system. Recognizing intrinsic subjectivity in current definitions of climate could alleviate the current harshness of the question in this chapter's title: "When does weather become climate?"[20]

One possible answer would be that it is probably impossible to conclusively decouple the weather–climate tandem at the "grass roots" level. This is because the weather, especially extreme weather, is considered to be a climate experiment by many people.

On another level, however, I suggest that climate and its changes are a "wicked problem" whose definition is difficult to formulate and for which a definitive solution may not exist. In principle, the wicked problems are societal problems that sometimes have a scientific or technical component. Unlike purely technical-scientific issues, which can be precisely defined and can have a solution, societal problems appear in a complex social framework, full of uncertainties, with a diversity of opinions, traditions, interests, and values. In such a framework, we will rarely find a consensus on the problem itself, much less on the possible solution.

A wicked problem is familiar to many stakeholders (i.e., ordinary citizens, communities, organizations, peoples, and more). Any attempt to find a solution to a wicked problem will have multiple unsuspected consequences.

And the status of the solution cannot be judged based on objectives or absolute standards. It should instead be based on the beliefs, interests, and subjective values adopted by those involved in the problem. In other words, "it makes no sense to talk about 'optimal solutions' to these [wicked] problems . . . Worse, there are no definitive answers."[21]

Instead of merely being a technical problem that can be solved, like preventing mercury pollution in rivers or removing plastic from the oceans, climate change is just in the middle of a wicked problem, twisted and intertwined with eternal questions about meaning, purpose, responsibility, and human ethics.[22]

CHAPTER 13

THE FOURTH ENERGY TRANSITION AND THE LABOR PAINS

The history of human civilization is also a history of energy transitions, or a series of disruptive technologies that have indelibly marked distinct stages of economic, social, and cultural development. In principle, humankind has experienced three major energy transitions. Now, the fourth is starting.

The first transition implied fire control that allowed humans to release energy by burning biomass, the amount of which was limited by photosynthesis. With the help of fire, people began to eat better, live more comfortably, and appear more efficient than animals. Mastership of fire was one of our species' most impressive achievements, permanently separating humans from other mammals approximately 800,000 years ago.

The second transition took place 10,000 to 12,000 years ago with the invention of agriculture, which transformed and concentrated solar energy into food in the form of chemical energy. The transition from the itinerant search for food to its sedentary production, coupled with the domestication of animals, freed people for activities other than subsistence and led to the birth of great cultures, organized societies, and historical consciousness. In this second period, which lasted until a few centuries ago, energy was primarily provided by animals in households and larger human populations in the form of muscle power.

The third transition, going from biofuels and animal power to fossil fuels, created today's modern world and the first truly global civilization. The Industrial Revolution, the central emblem of this transition, was the revolution of coal, oil, natural gas, and cars that used these fuels to produce electricity, heat, and kinetic energy.

Today, the world faces its fourth energy transition, or a sudden abandonment in just a few decades, of fossil fuels and their replacement with noncarbon dioxide energy sources. Basically, it is a return to preindustrial times where the sun's energy was relied upon instead of using deposits of coal, oil, and natural gas from many millions of years ago.

The labor pains

The fourth energy transition differs from the first three in several respects.

1. Throughout history, people have usually traded relatively weak energy sources, with low energy density (MJ/kg) or power density (W/m^2), for sources that produced more energy per kilogram or power per square meter. This can be seen in Figure 13.1.

From wood, straw, bushes, broken branches from trees, etc. (power density below 10 W/m^2), to coal (power density between around 500–20,000 W/m^2), and finally to hydrocarbons (power density between around 100–35,000 W/m^2). By comparison, ethanol-type biofuels, forests, wind, and solar power are notorious for their low and very low power densities (around 2–100 W/m^2).

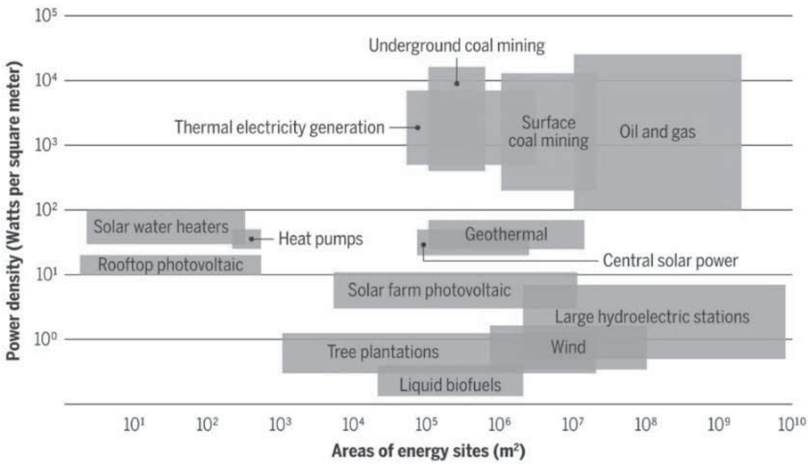


Figure 13.1. In the past, people have used energy sources with a higher power density, which produce more energy per unit of mass and require less land for production. Renewable energies have a lower density than fossil fuels (brown). This means that the current move toward the global adoption of renewable energy will significantly increase the footprint of global energy production through larger production areas of lower power density, while preventing nuclear energy expansion.[1]

At the forefront of all recent environmental movements, the current paradigm proclaims the reversal of this historical trend and the return to low-density, intermittent, non-scalable, and expensive energy sources without subsidies. Why? Because, in the opinion of environmentalists, this would be the main solution to control anthropogenic carbon dioxide emissions.

The major consequence of the proclaimed reversal of energy density will be the obligation to allocate land areas 100 or even 1,000 times larger for renewable energy production than at present.[2]

The vast impacts on agriculture, biodiversity, and environmental quality in the United States if the fourth energy transition occurs by 2050 are fully exemplified in Chapter 8 “Planet of the Humans – an expected and virulent critique of ‘green’ energy.”

2. To better appreciate the difficulties faced by the fourth energy transition, I will use an analogy with the famous remark made by Tolstoy in the opening paragraph of *Anna Karenina*: “Happy families are all alike; every unhappy family is unhappy in its own way.”

The analogy refers to the apparent speed and ease with which energy transitions are implemented in some countries vs. the complicated, prolonged, and delayed transitions facing other countries. Both situations are specific and intrinsically linked to unique social, economic, environmental, and technical circumstances.

In the Netherlands, the gigantic natural gas field Groningen, extending in the north of the country for about 900 km^2, was discovered near Slochteren on July 22, 1959, and the first gas transport took place in December 1963. In a short time, the gas from Groningen revolutionized the country’s energy balance because, after virtually all industries and homes were converted to new energy, important resources remained for export. The Netherlands has become the ideal example of an advanced economy that has rapidly transitioned to using a new energy-rich source.

Another example is Kuwait, where the oil industry’s development began in 1934 when the Kuwait Oil Company received an operating concession, along with APOC (Anglo-Persian Oil Company), which would later become British Petroleum (BP) and Gulf Oil.

At that time Kuwait was a poor British protectorate, with an area less than half that of the Netherlands and a single city with fewer than 100,000 inhabitants, mostly nomads. Traditional exports of pearls, horses, spices, and coffee were in sharp decline. The mining concession was signed on December 23, 1934, and four years later on February 23, 1938, a vast oil field was discovered—Al-Burqān, the second largest in the world after the giant Al-Ghawār in Saudi Arabia.

In 1946 when it began exporting, Kuwait produced about 800,000 tons of oil. After one year, 2.25 million tons were produced and in 1965, with a production of 100 million tons, the country surpassed Saudi Arabia and became the fourth-largest producer in the world at that time, behind the United States, the USSR, and Venezuela.

For Kuwait, the energy transition meant advancing, in a single generation, from a poor country whose imports of wood, kerosene, and charcoal were predominant, to an oil superpower.

But the pace of transition is not the same for large and rich countries. The comparison between the Netherlands and the United Kingdom is a better example.

BP made the first natural gas discoveries in the British North Sea sector in 1965. But despite intense exploration and exploitation of rich and near-surface deposits, Britain was unable to obtain even in 30 years what the Netherlands has achieved in a decade. The share of natural gas, used as a primary source of energy, was 5% in 1970 and only after 30 years had it increased to about 39%.

The main causes of the performance differences between the Netherlands and the United Kingdom are found in the absolute volumes of gas required by the two national systems (220 Mtoe/year in the United Kingdom vs. 60 Mtoe/year in the Netherlands). Also, Britain would have to shut down many coal-fired power plants to replace them with gas-fired ones.

Another illustration of the "labor pains" facing the fourth energy transition is at the heart of Germany's comparisons. In 2000, fossil fuels supplied 84% of the country's energy. This was followed by a historic campaign, including *Energiewende* since 2010, during which 90 GW of renewable energy sources were built, which was enough to replace the electricity produced. The amount spent exceeded $500 billion. But because the Germans see the sun only 11% of the time, the country is still "breastfed" by thermal power plants that burn fossil fuels. In 2017, they still produced 80% of the energy consumed. A fourth energy transition has probably been well thought out and implemented, but the environmental benefits are minimal.

3. The speed of adopting and implementing disruptive technologies in the past is not ideal for the current energy transition to renewable energy. It will be extremely difficult to restructure modern industrial and post-industrial civilization, which is an enormous consumer of energy, and to replace its bicentennial fossil base with one consisting exclusively of non-fossil sources.

For example, the invention and proliferation of internal combustion engines and motor vehicles, which was an essential part of the third energy transition, took place in a relatively short period of several decades beginning in the 1880s. A major cause of it was, in my opinion, the quasi-simultaneous existence of geniuses named Nicolaus August Otto, Gottlieb Daimler, Wilhelm Maybach, Karl Friedrich Benz, Rudolf Diesel, Henry Ford and Louis Chevrolet. A similar list of geniuses of wind and solar energy is unknown to me.

The advent of tractors on American fields and automobiles on the streets led to the rapid decline of horse-drawn transportation, despite fierce opposition from horse owners and feed farmers. The transition from animal-powered to fossil-fuel-powered transport has not benefited from excise duties on animal-propelled carriages or from generous government subsidies.

Another example is the invention of the telephone in 1876 by Alexander Graham Bell, which revolutionized the way people communicate. One by one, phones with switchboards, a rotary disk, buttons, and cell phones appeared. But only one genius, Steve Jobs and one company, Apple, produced—just twelve years ago—a disruptive, paradigmatic change by inventing the touchscreen smartphone.

What has happened in the last twelve years? It is a planetary communication explosion fueled by the fastest penetration of an object in the entire history of humankind. About 4 billion of the planet's 7.5 billion people today own a smartphone because people are social animals and want to gossip, criticize, and take selfies to post on multiple social networks. Do you think that there was a need for a tax on the old types of phones or a government that offered generous subsidies to smartphone companies? No, the transition from Bell's phone to Jobs' phone was dictated and controlled by research and development, and market forces. There was no need for an IPCC of phones or for pro-Apple activists to pathetically interrogate old phone type owners with questions such as, *how dare you?*

If the fourth energy transition wants to end the torments of production and finally give birth to the much-desired non-CO_2-emitting child, then the examples above should be followed. I have written and repeat once again: Those who are so concerned about carbon emissions should propose and support research and development of those renewable technologies that will eventually become able to outperform fossil fuels in price, abundance, availability, and scalability. At this moment, I am convinced that everyone will rush to use them and throw fossil fuels in the trash, without government opportunities or desperate calls. Just as a landline has become a relic in the museum of unused objects in just twelve years due to the voluntarily replacement of it with the smartphone, so will the current gasoline, diesel, and kerosene pumps, whose places on highways, airports, ports, and fields will be taken by new wind or solar power stations.

But until then, I regret to announce to fans of renewable energy that the share of global SUV sales has doubled between 2010 and 2018. At this rate, SUVs could add almost two million barrels per day to global oil demand by 2040, nullifying the fossil fuel savings produced by the nearly 150 million electric cars. Moreover, SUVs have been the second largest contributor to the increase in global carbon dioxide emissions since 2010, after the electricity sector, but ahead of heavy industry, trucks, and aviation.[3]

Why hasn't a "Steve Jobs" of electric transportation yet appeared to enjoy the presence of superchargers capable of providing the same or longer distance traveled with a single fast charge, like filling a gas tank? If this supercharger were available on the market, was reliable, and was produced at a competitive price, do you think there would be a need for apocalyptic threats from the IPCC, the United Nations, or various environmental activists? I think not.

Unfortunately, despite years of hope and intense media and political promotion, wind and the sun produced less than 7% of the world's energy mix in 2018.[4] And this is happening, in my opinion, because the essential technologies needed to produce renewable energy in massive quantities, be they superchargers or super-efficient solar cells, have only seen slow and nondisruptive improvements. Therefore, if the fourth energy transition does not have several "Steve Jobs" with their iPhones, I am afraid that the "labor pains" will last for many decades, beyond 2030 or 2050.

4. To end the labor pains of the transition from fossil fuels to renewable energy, we will have to find concrete and inexpensive solutions to replace current coal, oil, and gas consumption. This means reductions in **billions** of tons of raw materials. For example, humanity currently extracts and uses more than seven billion tons of coal annually. When do we replace them, and with what? It will take time, and the "torments of making" will be replaced by severe economic pain. If in the United States, for example, coal has been partially replaced by shale gases, which have a lower carbon footprint, what will happen in China and India? For now, we only know what the Indians recently said that coal will be the number 1 fuel in India until 2047."[5]

The "economic pains" of the fourth energy transition are incomparable to those suffered by horse owners and feed farmers during the previous transition. The cost-effect analyses estimate that the abandonment of fossil fuels and renewable energy replacement will result in a resounding failure. Here are two examples:

Professor William D. Nordhaus, the only environmental economist honored with the Nobel Prize, estimated in 2017 that the economic losses imposed by limiting global warming to 3°C will account for about 2% of global GDP.[6]

In 2018, more detailed estimates advanced much more substantial losses, at 9.8% of global GDP, due to the same limitation of global warming by 3°C.[7]

If we go on to achieve a goal twice as ambitious or warming of only 1.5°C from preindustrial levels, as required by the Paris Climate Agreement, the world's economic losses will unquestionably be much higher. And the achievements? An analysis of the commitments signed in Paris in 2015 is very pessimistic:

> All climate policies proposed by the US, China, the EU, and the rest of the world, implemented from the early 2000s to 2030 and sustained over the century are likely to reduce global warming by about 0.17°C by 2100.[8]

As in Germany's case, Horace's remark applies here: *Parturiunt montes, nascetur ridiculus mus* . . .

Conclusions

The fourth energy transition is an ideal (some would say it is rather wishful thinking) that mobilizes some segments of the young population to turn the wheel of history. They are forcing humanity to give up dense, cheap, abundant, scalable, and reliable energy sources and to replace them with renewable energies that are much more diluted, more expensive, lacking in abundance, intermittent, and nonscalable.[9]

The "labor pains" caused by the latest energy transition also include serious uncertainties about the decarbonization rate of the world economy and the implementation of new carbon-free power sources. In this context, we are warned that "history is not on the side" of renewables. By looking at traditional sources, such as coal, oil, and natural gas, we realize that it took 50 to 75 years for them to become significant contributors to the energy mix, although the technology needed was mostly available and inexpensive.[2]

The projected rapid growth of renewables seems to be troubling and pessimistic for several reasons.

First, the growth required to meet current energy needs is difficult to conceive. Increasing the share of renewables from a few percent to over 50% is not a simple operation of additional investments. The entire energy infrastructure and the mining and hydrocarbon industry's current structures will have to be massively modified, even if only to try to implement this new transition. At the same time, global energy demand, especially from developing countries, is growing at a rate that current fossil fuels are also struggling to maintain.

Second, we must not forget the enormous and constant headache of renewables. Due to their intermittent nature, they are unable to provide permanent power, so they need fossil fuels on standby. The example of Germany is eloquent, and I have already mentioned it above.

Finally, the fourth energy transition will also be slowed by the size and cost of existing infrastructure. Although the sun and wind provide free energy, there will be economic impacts imposed on nations, corporations, and municipalities through the abandonment of the vast investments associated with the development of the fossil fuel system. For example, modifying or replacing oil and gas wells, refineries, gas and oil pipelines, millions of gas stations, coal mines, etc. will represent a financial effort of at least $20 trillion worldwide.[10]

The economic impacts of the rapid 12 to 30 years transition to the total elimination of fossil fuels, as demanded by environmentalists, has been estimated to be disastrous for peoples' well-being, reducing by a good percentage (2%–9.8%) of world GDP.

The fourth energy transition, tormented for the time being by labor pains, is desirable by ecologists and others. And it is inevitable due to the depletion of conventional fossil fuels, although there are still hopes for the exploitation of vast resources of cryohydrates, or frozen natural gas, found in permafrost and continental shelf.[11] But neither the pace nor the compositional and operational details of the transition from fossil fuels to renewable energy are clear yet.

Chapter 14

When Children Become Experts in Climate Change …

On Friday, September 20, 2019, millions of children worldwide staged strikes and demonstrations to call on their governments to take more decisive actions against anthropogenic climate change.

Over time, we who are no longer children witnessed demonstrations by children who claimed to be experts in Nazism, Soviet communism, Chinese communism, Ceausescu communism, and more. On this day, children demonstrated that they are also experts in climate change.

Under the leadership of Swedish activist Greta Thunberg, today's children say that the world in which they live is "a burning house," and they claim that there is no point in learning in schools because "Now we probably don't even have a future anymore."[1]

What the children in the Greta Thunberg category do not know, as they probably went on strike when the concepts were taught, is that humanity has not only dealt with climate change over many hundreds of years but has proven how to adapt to these cyclical phenomena.

In the 1920s, about half a million people died every year from climate problems, but since then, that number has dropped to 20,000 a year. This was not because disasters have become less frequent. It is only because we have become more prosperous, materially and technologically, so it affects us less. For example, some say that Shanghai will be flooded in a few years due to rising sea levels, but in reality, the Chinese have been fighting this situation for hundreds of years.

What today's children, experts in climate change, do not know very well is that the drastic reduction, even to zero, of carbon emissions in the next 12–30 years is not a viable solution. The physiological needs of people (i.e., food, health, drinking water, hygiene, etc.) and socio-economic needs (i.e., jobs, education, functional infrastructure, eradication of corruption and violence, etc.) require cheap, abundant energy sources that are available and scalable on national areas. And these energy sources, for the time being, are mainly those that burn fossil fuels.

Children, who have become climate experts this year, should be told by responsible parents and adults that after 30 failed climate policies, new strikes and demonstrations are not the solutions they want. Since the Earth Summit in Rio de Janeiro in 1992, our renewable energy consumption has increased by only 1.1%, from 13.1% in 1992 to 14.2% today. And after the much-trumpeted Paris Climate Agreement in 2015, most nations have failed to meet their carbon footprint obligations. So, what did the children demonstrators get on Friday, September 20, 2019?

Are political leaders to blame for the current situation? I would say that the main reason for the current political and climate condition is not, as some argue, due to President Trump, who withdrew the United States from the Paris Climate Agreement. Although, immediately after his inauguration in February 2021, President Biden signed an executive order to reverse Trump's decision. The explanation for the current situation is much simpler. Renewable energy has grown so little because it is still unable to meet all the needs that fossil fuels now provide. Replacing fossil fuels, which are abundant, cheap, and always available, with renewable alternatives would be more expensive and less reliable, slow down the functioning of economies, and reduce their growth. Do you know any politician who will run an election campaign promising economic decline?

According to the World Bank, there is a direct link between poverty and energy, in the sense that the poor will be less likely to use renewable energy, which is more expensive and less available than fossil energy and are likely to remain poor until they have access to classical energies. Also, almost three billion people depend entirely on fossil fuels. Asking them to reduce the use of fossil fuels is the same as asking them to stop doing the things that allow them to escape poverty, which clearly will not work politically and socially.

The Paris Agreement cannot make significant progress, as it did before in Rio and Kyoto. This is because the latest climate pact also requires rich countries to accept future economic deprivations in the hope of inconclusive climate effects. Because the big problem of carbon emissions in the twenty-first century is not rich countries. If, from tomorrow until the end of the century, every wealthy nation on the planet stopped its CO_2 emissions, that is having zero flights, zero meat consumption, zero internal combustion machines, zero heating and cooling with fossil fuels, and zero artificial fertilizers, the difference in global warming would only be 0.4°C until 2100.[2]

A significant reduction in carbon emissions will require large emitters such as China, India, Brazil, and other developing countries to give up fossil fuels and switch to renewable energy. Will such a scenario be possible? So far, I have no reasonable hope.

The solution to the current climate crisis that is more or less real is *innovation*. Those who are so concerned about carbon dioxide emissions should propose and support the development of renewable technologies that outperform fossil fuels in price, abundance, availability, and scalability. At that time, I am convinced that everyone will rush to use them and throw fossil fuels in the history trashcan.

Maybe this should have been the message of children experts on climate change.

Chapter 15

A Significant Decision: We do not Live in the Anthropocene but in the Meghalayan!

In 2016, I argued that we already live between sustainability and collapse in the Anthropocene.[1] It was an attempt to present the point of view that, to signify the importance of the human species as a geological factor and its influence on the biosphere and climate, the adoption of a new subdivision in the International Stratigraphic Charter: Anthropocene (or Age of Man) should be considered.[2]

Proposed in 2000, the concept of the Anthropocene was widely popularized in environmental circles and liberal media as a symbol of humanity's detrimental influence on the planet. Above all, it was a symbol of humanity's effect on the climate, which is that humans have "forced" it to heat up much faster than the "normal" rhythm of the last interglaciation.

Those who argued for and supported this term with eco-appeal were reproached for their concept because it restricts the development of poor countries; it is impractical for those who make political decisions; if the planet had remained in Holocene conditions, it would not have been able to withstand 7.6 billion people today or 10–12 billion in the future; the science behind the concept is very uncertain about the understanding of critical equilibrium thresholds and tipping points); the introduction of sustainability limits, called "new entities" is speculative and unbelievable; scientists involved in the elaboration of the concept have exceeded their limits, getting too close to politics or, worse, positioning themselves even above politics as sole arbiters. Finally, some researchers have argued that there is insufficient geological evidence to define the Anthropocene scientifically, separate from politics and ideology.[3]

In mid-July 2018, my 2016 article's title was contradicted by The International Union of Geological Sciences (IUGS) and The International Commission on Stratigraphy (ICS). World geological officials have stated that we do not live in the Anthropocene, as has been strongly suggested since 2000, but instead in a period called the **Meghalayan**. The new geological age covers the last 4,200 years of earth's history and is one of the three new subdivisions of the Holocene (the last 11,700 after the last glaciation ended). Figure 15.1 shows these subdivisions.

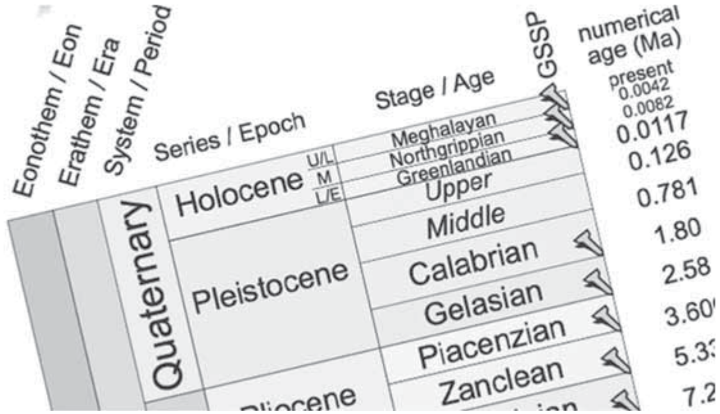


Figure 15.1. New Holocene-era subdivisions (Meghalayan, Northgrippian, and Greenlandian) were officially approved in July 2018.[2]

The Meghalayan (Upper Holocene, 4,200 BP to present) began when agricultural societies around the world, formed after the end of the last glaciation, were severely confronted with a mega-drought and a sudden cooling of the climate, which lasted about 200 years. The impacts caused civilian collapses and massive migrations of people from Egypt, Greece, Mesopotamia, Palestine, and the Indus and Yangtze river valleys. This climate event 4,200 years ago has been documented on all seven continents. The stratotype chosen by IUGS was a speleothem, as seen in Figure 15.2, found in the Krem Mawmluh cave in Meghalaya, India. The new time limit was determined based on the high-precision analysis of the oxygen isotope ratio (O^{18}/O^{16}) in the various layers of the stalagmite. The report reflects precipitation changes, and the more it rains, the lower the concentration of the O^{18} isotope.

The Northgrippian is now the Middle Holocene (8,200–4,200 years BP) and is characterized by a period of sudden cooling of the earth, probably due to large amounts of fresh water coming from the melting glaciers of Canada and then spilling into the North Atlantic, interrupting Gulfstream ocean currents.

The Greenlandian currently refers to the Lower Holocene (11,700–8,200 BP). It was a period of relative warming, marking the end of the last glaciation. The previous two geological ages have used Greenland ice cores as stratotypes.[4]

It is worth noting a unique property about the time in which we live, or the Meghalayan. The beginning of the period coincides with a global cultural event produced by a global climatic event. Professor Martin Head, a geologist at Brock University in Canada and chairman of the International Quaternary Stratigraphy Commission, described the convergence between stratigraphy and humanity's cultural evolution as extraordinary.

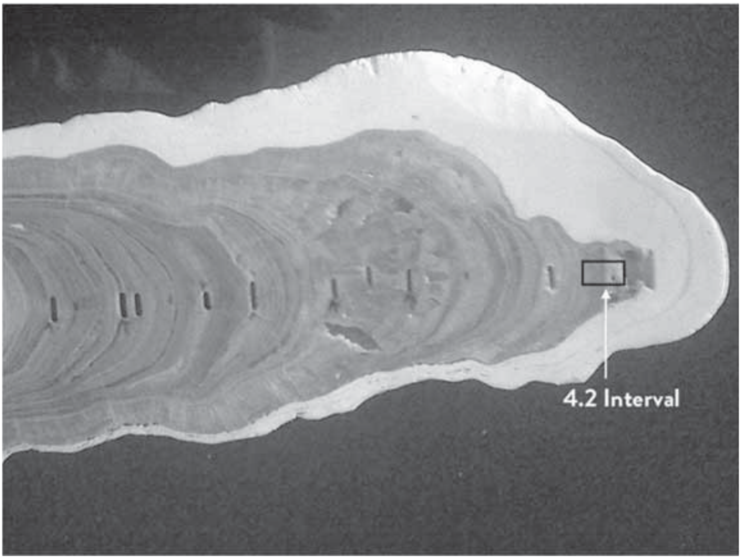


Figure 15.2. A portion of the Indian speleothem that was sectioned and analyzed layer by layer to identify the early Meghalayan age, 4,200 years ago.[5]

What happens to the Anthropocene?

For now, the concept has been pushed onto the back burner. Environmentalists hoped that the term Anthropocene would be formalized in 2018, thus providing a large balloon of oxygen to climate propaganda and eco-activists, but these hopes have been significantly dashed by the adoption of the Meghalayan. Fans of the Anthropocene are frustrated that the Meghalayan was accepted only six years after its initial proposal,[6] while their concept has been waiting for more years to be considered for possible approval. They also feel that the IUGS decision is a trivialization of the

Anthropocene because of the division of the Holocene into smaller pieces. If ever discussed, the Anthropocene will be an even smaller piece of the current Meghalayan.

The main problem that Anthropocene supporters must solve is the nonexistence of a unanimously accepted date of birth.

In my 2016 article, I indicated that *Anthropocene 1.0* would have started around 1800, after the invention of steam engines and internal combustion, or after the beginning of the intense use of fossil fuels.

Anthropocene 2.0 could be placed around 1950, after the end of World War II and the enforcement of the Bretton Woods Agreement; the globalization of trade, communications, and financial networks; a world economy based on capitalist/neoliberal principles; the increase in the supply of public goods and services which led to increased consumption per person, or a "growth imperative."

Attempts to define the age of human influence on the planet in the same way that geologists defined the Meghalayan are problematic, according to Philip Gibbard, ICS Secretary-General.[7] Human impacts on the planet all began on different dates. For example, in China it was 5,000 years ago, while in North America, it was around 1,700 years ago. But geologists aim to choose a single time limit that is the same everywhere on the earth's surface. For this, it is necessary to have a global event in the form of a biological change or a change in the terrestrial physical environment, such as with the geochemistry of rocks and waters. Until then, the Anthropocenists will have to wait.

Conclusions

The Anthropocene as the Age of Man, or a limited period in which the planet is under humans, not humans under the planet is, in my opinion, a suggestive illustration of a phenomenon that may be called the "Myth of the Tower of Babel—the pride of being the masters of nature."[8]

The human race is characterized by a boundless, confident, and independent ego. The aspiration for a God-like status and for self-praise and personal glory exemplifies the Greek idea of hubris, or an immeasurable pride, an overestimation of one's strengths in the face of destiny, and a desire to dominate. The myth that we are the masters of nature and the builders of the Tower of Babel also mobilizes the idea of climate utopias and our ability to imagine geoengineering works that benefit humankind.

For those who are skeptical about the whole idea of the Anthropocene, I have reproduced a paragraph written by Professor Vaclav Smil, which is an eloquent characterization of our current position:

Should we manage to be around for another 10,000 years—a trivial spell for science fiction readers, an eternity for modern, high-energy civilization—we should congratulate ourselves by naming the era shaped by our actions. But in the meantime, let us wait before we determine that our mark on the planet is anything more than a modest microlayer in the geologic record.[9]

Because, like it or not, life on this planet still has an expiration date.

CHAPTER 16

WELCOME TO THE FABULOUS *ANTHROPOCENE ERA*!

Whoever enters the famous Las Vegas Boulevard, also known as The Strip, is welcomed with a greeting: *Welcome to Fabulous Las Vegas, Nevada*.[1]

Whoever enters the new building of the Faculty of Geosciences at Edge Hill University in Lancashire, UK, is welcomed with the greeting: *Welcome to the Fabulous Anthropocene Era*.[2]

Anyone with a cool head would probably ask what connection can there be between Las Vegas, the city of sins, casinos, and legal brothels, and the Faculty of Geosciences at a British university?

One possible answer would be that while Las Vegas was and still is a unique city with many imitators, the Fabulous Anthropocene is a British joke told by a few creative "artists" in front of an innocent and nonexpert audience.[3]

Part of the joke comes from the fact that the term Anthropocene was proposed and popularized by nongeologists as the name of a new geological age: Paul J. Crutzen, chemist, Nobel Prize winner; Eugene F. Stoermer, biologist; Jan Zalasiewicz, teacher of inaugural readings and paleobiologist. If I reversed the roles, it would be as if a group of geological "artists" was lobbying the biologists' camp for the polar bear (*Ursus maritimus*) to be reclassified as a subspecies of the brown bear (*Ursus arctos*) because there was adequate evidence showing that polar bears are actually brown bears with bleached fur!

Another part of the joke comes from what is called, in a classic illusionist trick, the hand's quickness (of the trickster) and the carelessness (of the audience). How to proceed? Take the well-known term *age*, and swiftly change its sense—because the human age is not the same as the geological age. Suppose the vast majority of the public has heard of, or knows the various names of human eras (the Stalin era, the era of great geographical discoveries, the socialist era, etc.). In that case, it is unlikely that the same majority has heard of, or knows the various names of geological eras (e.g., Eoarchean, Paleoproterozoic, and Cenozoic).

Even less is known about the chronological hierarchy of geological time, which is completely different from that of human time or historical time. In descending order of magnitude, the divisions of geological time are *Aeon* → *Era* → *Period* → *Epoch* → *Age*. The year we live in now (2021) is identified on the stratigraphic scale (of geological time):

Aeon Phanerozoic / *Era* Cenozoic / *Period* Quaternary / *Epoch* Holocene / *Age* Meghalayan.

In other words, we live geologically in the Meghalayan, not in the Anthropocene.[4]

The ignorance of geological time divisions generated funny effects, such as the copycat installation erected in front of the British Faculty of Geosciences. I admit that the artist who created the installation, Robyn Woolston, had no idea of the temporal significance of a geological era. But the fact that the professors of geography and geology at Edge Hill University overlooked the ridiculousness expressed by the "fabulous Anthropocene **era**" gives me pause. A geological era refers to a period in the order of tens and hundreds of millions of years. For example, the current era, called the Cenozoic, began 65 million years ago, after the catastrophic extinction of dinosaurs.[5] According to most of its supporters, the Anthropocene began in 1950.[6] The human activities marker was allegedly initiated by the Manhattan Project, whose radioactive waste covered the entire planet. But the isotope with the longest existence in those radioactive falls, iodine 129, has a half-life of 15.7 million years. This means that the Anthropocene will no longer be detectable in the geological strata after the indicated period because its marker will have disintegrated. Applying this finding to the history of the earth, if there had been a nuclear holocaust among, say, Jurassic "warrior" dinosaurs, we would have no evidence today that that conflagration really existed.

I try to understand people outside geology when they try to use various chronological terms, which they attach to human activities. To them, an era sounds more imposing than a period, an epoch or an age (much shorter time intervals). And as long as those labels are used by historians, biologists, anthropologists, philosophers, politicians, activists, and propagandists of all kinds, I don't mind verbal delusions. But when trying, by unorthodox means, to force geologists to change their own time scale, I cannot remain indifferent.

One of the key factors that is strongly emphasized to force the geologists into acceptance of the stratigraphic scale's modification by introducing the Anthropocene age, is the highlighting of the impacts of biological activities, mainly of humans, on geology. These efforts outline the creation of recent deposits containing new minerals and types of rocks, different from those known during the Holocene. These so-called techno-materials are elementary aluminum, concrete, plastics, and synthetic fibers.

But suppose the last century's biological activities are considered so important that they deserve to be immortalized in the stratigraphic scale. In that case, the Siderian period (2.5–2.3 billion years ago) of the Paleoproterozoic era should be renamed the Cyanobacterian period because no organism has had a greater effect on the lithosphere, hydrosphere, or earth's atmosphere than cyanobacteria. Whatever the final impact of human activities, it will undoubtedly fade compared to that of the creatures of the Siderian period.

For those worried about the future of the Anthropocene, I have some bad news. We now live during borrowed time. Our survival as a species, after the short and artificial fever of greenhouse gases, will be subjected to a harsh but objective examination. With a high probability, imposed by the inexorable Milanković cycles, humankind will face the regular climate calendar, and, in no more than 100,000 years, we will live (and try to survive) in a new glaciation.[7] This means that the ocean level, after a temporary increase produced by the current interglacial period and some human activities, will fall by many tens, even hundreds of meters, below current values.

Everything that the rising waters have buried will be subjected to relentless erosion by Arctic winds until almost everything is reduced to dust and glacial sand called loess. In Romania, for example, loess deposits, produced by the last glaciation of about 21,000 years ago, are 20–40 m thick and cover an area of about 40,000 km^2, which is 17% of the current land there. In Asia, the thickness of the loess reaches 400 m. Meanwhile, especially in the northern hemisphere, which contains most of the land, glaciers' advance to low latitudes will uncover massive portions of soil and surface rocks. Agriculture will become an impossible ideal for a population of many (10?) billions.[8]

I know it's hard to imagine, but even harder to accept: eventually, all of human civilization, as we know it, will be reduced to just a few inches of rock deposited on the ocean floor. Every chapter in the earth's 4.5 billion years of history reflects and confirms this inescapable reality. The "Humanity" chapter will be no exception.

And then, why is there so much coinage on the Anthropocene?

At best, I consider the Anthropocene to be a terrible expression of human arrogance, of that hubris that underlies the myth of Babel. It is an aspiration to a God-like status, to self-praise and personal glory, to immeasurable pride, to an appreciation of one's strengths in the face of destiny, and to a desire to dominate.[9]

The Anthropocene's idea as part of the stratigraphic ladder pleasantly tickles our pride and swells our chests of importance because it promises eternal geological life to our creations. This myth of "We are the masters of nature and the builders of the Tower of Babel" also mobilizes the idea of climate utopias, activism, and environmental propaganda. Or it inspires pranks like that of young Swedish activist Greta Thunberg, who, after dropping out of school for a year, set out to cross the Atlantic in a sailing boat as a demonstration that she can fight carbon dioxide emissions with technologies of the time of Christopher Columbus. A somewhat hypocritical gesture because, after the trip to New York with zero carbon emissions, the crew members, plus Greta and her father, returned to Europe by plane. Then, another crew arrived in New York, also by plane, to repatriate the clean boat. In other words, Greta's supposedly ecological, carbon-free journey was also a kind of Anthropocene joke.

If they do not survive millions or tens of millions of years, humans and their actions on the planet are incredibly transient. And the "fabulous Anthropocene era" will remain nothing more than a joke (good or bad, you decide).

Perhaps a name like "Alarmocen" would be more appropriate.

CHAPTER 17

"ASK NOT WHAT WE CAN DO FOR CLIMATE CHANGE, BUT ASK WHAT CLIMATE CHANGE CAN DO FOR US"

Le savant n'est pas l'homme qui fournit les vraies réponses;
c'est celui qui pose les vraies questions.

Claude Lévi-Strauss, 1964
Le Crue et le Cuit

On November 28, 2017, the magazine *The Kingsman: The Voice of Brooklyn College* published an interview I gave regarding my book, *Exploring the Earth System* (co-author, Stephen U. Aja). The second edition of the book, published in August 2017, contains several chapters dedicated to the students who take my course *Climate change—torn between myth and fact.*

Of all the chapters discussing climate change, journalist Ahmed Aly picked up only two: "Taking sides: climate change debate" and "Four essential myths of climate change: Edenic, Apocalyptic, Babelian, and Themistian."[1]

AHMED ALY: As a scientist with an over thirty-year career in oil and gas research, how much of climate change (which I believe, based on my reading, you do not dispute), if any of it, do you think is attributable to human activity?

PROFESSOR CONSTANTIN CRÂNGANU: To start your questions by invoking my 30+ years of research in oil and gas fields looks like an innuendo not deserving an answer. I am wondering, did you notice my other research interests in CO_2 sequestration in geologic reservoirs, geothermal energy, hydrogeology, artificial intelligence, etc.? However, I concede that you are well intended and have no *parti pris* in your questions. I do not dispute climate change because it has always been changing on this planet for billions of years. For you, the climate probably started to change with the dawn of the Industrial Revolution, which is a gross approximation. You probably meant to say anthropogenic global warming (AGW), which was used for some time in the 1980s and 1990s but was then replaced by the new *nom de guerre* of climate change. There are numerous *natural* causes of global warming, as well as of global cooling, such as solar periodic and nonperiodic activity, volcanic activity, gas hydrate decomposition, meteorite impacts, regional and planetary plate tectonics, various oceanic cycles, solar storms and flares, rock weathering, and decomposition, among others. Less numerous and more recent *anthropogenic* causes are burning fossil fuels, cultivating rice paddies, raising cattle, using landfills, and producing cement. From 1850 to the present, the average global temperature has increased by about 0.9°C. How much of these eight-tenths of a degree Celsius is due to humans and how much is due to natural causes is beyond my computing capabilities, but the latest peer-reviewed research indicates that human contribution is substantial, while natural contributions are not negligible. For example, the CO_2 human emissions have remained flat during 2014–2017 period, but in 2016, natural CO_2 emissions, driven by El Niño, increased the CO_2 atmospheric concentration by 3 ppm. Also, I know that we live in an interglaciation period, named the Holocene, where the climate is recovering from the last glaciation. For comparison, I suggest you Google or ask me about the immediate previous interglaciation, a period named Eemian, about 125,000 years ago. That interglaciation represents a proxy for the current one. Data available indicate that average global temperatures were 2°C–4°C warmer than today (not 0.8°C), while the concentration of CO_2 was similar to the preindustrial era (~ 280 ppm). So, the link between temperature increase and CO_2 concentration rise is not clear for the Eemian. Indeed, there were other natural causes at work.

AA: How would you judge the proximity of your emphasis on the "uncertainty . . . inherent in many climate processes" and the "limits . . . to climate change science" to that of the rhetoric of notable climate change "denying" institutes and organizations, such as *Americans for Prosperity* and the *Heartland Institute.* An example is Myron Ebell, who writes that "victory will be achieved when . . . the public recognizes uncertainties in climate science." It is a fight over the expansion of government regarding environmental policy. To me, the ideas appear to be remarkably similar.

CC: It is forced proximity that has nothing to do with your allegations.

AA: Why, or why not, do you believe that the "skeptics" argument should be presented equally as the "proponents" one? (As you do present a greater body of evidence in pp. 269–270 of your textbook for the skeptics). In other words, why, or why not, should anthropogenic climate change skepticism be taught in a core curriculum textbook? Also, based on my reading, it seems that, respectably, you note that politics should be left out of science; that science should be objective. Perhaps it is unavoidable or inevitable, but a significant part of Chapter 21 seems to be subjective in its criticism of "proponents," who you write, "are moving from their realm into uncharted waters of politics." It also covers the false claims of the IPCC "Climategate," and the change in social consensus over climate change. Why did you feel it was necessary to point these things out when there seems to be, in contrast, very little criticism of "skeptics" or as strong as the emphasis on the famous "97% consensus?"

CC: The Romans used to say *Audiatur et altera pars* (let the other side be heard as well), that is, a due process cannot be fair and complete unless both parties had the opportunity to express their opinions. Chapter 21 is titled "Taking sides: climate change debate" and presents many, but not comprehensive, points of view belonging to both "proponents" and "skeptics" of AGW. Extra details can be found in Chapter 15: "Humans as agents of geologic change," which surprisingly did not attract your attention. I also presented two aspects of the current polarization of the climate change debate, namely "The four ways of life" or "The four tribes," and "The six Americas." The IPCC approach for managing climate change risks through mitigation, adaptation, and geoengineering occupies a large portion of the chapter. Also, I draw your attention to "Appendix A: Will New York be a 'baked apple?' Using data sets to explore climate change" (pp. 297–304 of my textbook) in which students can explore the urban heat island effect, a 100% anthropogenic contribution to AGW. So, I believe the "skeptics" got enough counterarguments. Regarding the famous "97% consensus," I assume you are talking about the consensus among "proponents" of AGW. Well, in science, it is not a good idea to invoke a consensus because you then indirectly acknowledge that science is not solid enough. I would never say the consensus of scientists agree that H_2O means water. I would never say the consensus of scientists agrees the earth is round and not flat. Think about the thousands of years when consensus (probably more than 97%!) imposed that the earth was the center of the universe and the sun revolved around the earth. It took just a single brilliant mind, that of Copernicus, to break with that consensus. Science is not based on and does not advance by consensus; that is working well only in politics. Science is based on the repeatability of facts and the testing of hypotheses. According to Karl Popper, the demarcation criterion between science and pseudoscience is falsifiability. In so far as a scientific statement speaks about reality, it must be falsifiable, and in so far as it is not falsifiable, it does not speak about reality. Think about falsifying climate change. Would it be possible? If yes, how?

AA: You felt it necessary to end your book on those chapters and on the idea that the climate crisis must be solved with an “imaginative idea” (that we must subscribe to a “myth”). Sir, how do you believe that academic institutions such as Brooklyn College should be propagating such “myths?”

CC: The position of “The four essential myths of climate change” in the book’s table of contents is purely random due to the editorial process and does not carry any specific meaning. In fact, the book ends with “Appendix A: Will New York be a ‘baked apple?’ Using data sets to explore climate change” (pp. 297–304 of my textbook), in which the “proponents” get the last word. On the other side of your question, I would emphasize that Brooklyn College is a place where academic freedom means presenting and discussing highly polarizing issues from multiple perspectives. Among these, my chapter highlights four ways by which climate determinism, prevalent one hundred years ago, has metamorphosed into climate reductionism, driven today by the tyrannical domination of model predictions of the future. Predictive natural science is overtaking various accounts (i.e., psychological, spiritual, cultural, etc.) of social life and the future climate kaleidoscope. If you don’t believe in those models, which many times could not predict something that happened in the past correctly but pretend to accurately forecast something that will happen in the future, you are suddenly regarded similar to a Holocaust denier or an academic pariah. As a resource of imagination, climate change becomes an idea that can be successfully transposed in many areas (i.e., geographic, social, cultural, virtual) to stimulate artistic creativity, to provoke new ethical thinking about our relationships with the environment, to spur the efforts to protect the population from possible climatic hazards, and many other things. Just because the concept of climate change is so resourceful, I would finally paraphrase a famous quote: Ask not what we can do for climate change but ask what climate change can do for us.[2]

AA: Are you more of a “proponent” or a “skeptic?”

CC: I am a seeker of truth on either side.

CHAPTER 18

A STAIRWAY TO (LOW-CARBON) HEAVEN

I

In 1971, Led Zeppelin launched one of their most famous songs—*Stairway to Heaven.* The lady from the ballad of Jimmy Page and Robert Plant is sure that everything that shines is gold, and, as a result, she decides to buy a stairway to heaven.

Other ladies and gentlemen (nearly 50,000 from 196 countries), gathered in 2015 in Paris at the United Nations COP21 Conference, think that all that is produced by global warming is carbon dioxide and, as a result, they have decided to build a stairway toward a low-carbon sky.

The lady in the song knows that if the shops with stair parts are closed, she can open them with one word. But there's still a problem with that magic word, because, as you know, sometimes words have two meanings.

The ladies and gentlemen gathered in Paris were also hit by the magic word's problem, which could open the doors of government offices that decide where and when to build the stairway to the low-carbon sky. In Paris, the most heated discussions, which led to major disagreements between the participants, were around "shall" and "should." Why? There is a clear difference between the two words in international legal documents. "Shall" has a legally binding meaning, while "should" is more advisory.

Less developed countries have often wished to introduce "shall" in that part of the final document, which refers to richer countries' obligations to pay poorer countries aid for climate change adaptations and shifts to cleaner energy. Initially, the United States and other developed countries preferred the use of "should" in that portion of the negotiated text. But after that, they sought to introduce the word "shall" elsewhere numerous times in the section of the document dedicated to implementing CO_2 emission reductions for all signatory countries.

As an exercise, I counted how many times *shall* and *should* appeared in two proposed versions of the Paris Climate Agreement. On December 9, 2015, there were 182 shall and 47 should. The December 12, 2015 version contained only 143 shall and 40 should.

Regarding its legal force, some elements of the agreement will be voluntary (40 should), while other elements will be compulsory under international law (143 shall). This hybrid structure was specifically designed to provide support for the United States. An agreement that would have required legal obligations for emission reduction would have been legally interpreted as a new treaty, and thus would have been required to be discussed and ratified by the Senate. After the Kyoto Protocol's bitter experience, the participating countries wanted to avoid a similar fate to the Paris treaty.[1]

An article published in *Nature* on 15 December 2015 outlined that the Paris Climate Agreement was dominated until the last moment by the interplay of those two keywords, *shall* and *should*:

> Although countries agreed to engage in this new process, any action that they take to reduce emissions is on a purely voluntary basis. Indeed, **the final change to the agreement in Paris, which took place quietly just minutes before the text was adopted, was to replace a 'shall' with a 'should' in a line stating how developed countries will commit to reducing emissions. This shift towards a voluntary framework based on national commitments was a necessary first step to bring everybody on board—and it worked**.[2] [emphasis added]

As a result, the Paris Climate Agreement uses language that obliges (using *shall*) signatory countries to monitor, verify, and publish reports on their emission levels. But reducing carbon emissions is practically voluntary (using *should*). The document's language does not assign any specific objectives to any country regarding the reduction of emissions. Instead, each government devised a plan detailing how it would reduce its domestic emissions, based on what each state considers possible and the country's internal political and economic situation.

II

After the Paris Agreement on limiting global warming had been signed, with standing ovations and celebrated by politicians and other social categories, it was appropriate to carefully read its provisions to better understand its objectives, modalities of achievement, and costs.

I understand the politicians of 2015 (i.e., President Obama, President Hollande, Prime Minister Cameron, UN Secretary-General Ban Ki-moon) and some prominent environmentalists have applauded the agreement as a historic event, a diplomatic triumph, a historical turning point, a victory of climate justice, and the like. I do not belong to any of the two categories mentioned. I am just a scientist of Cartesian formation (*Dubito, ergo cogito. Cogito, ergo sum)*. So, skeptical by default. This means that I prefer to keep my mind alert and check, as best as I can, everything stated, sometimes with loud fanfare, in the media. I did this after the publication of the official document of the United Nations COP21 conference in Paris.

Why am I skeptical about the Paris Agreement? There are a few reasons:

a. The agreement is not legally binding for the signatory countries

To reach the target of 2°C or 1.5°C as the maximum temperature increase, reducing carbon dioxide emissions is voluntary. Not only is emission reduction voluntary, but each government has devised a plan for domestic emission reductions (INDCs), based on what each state deems possible, given the political situation and internal economy of the country. In other words, the Paris conference resembled those parties where each guest brought what they could to put on the common table. But even so, some came empty-handed. COP21 received only 160 INDCs, although the number of participating countries was 195.

Individual national contributions are varied. For example, the United States and the European Union countries are committed to reducing their emissions. Others have pledged to reduce the “carbon intensity” of their economies, meaning they will reduce CO_2 emissions per unit of GDP. And others promised something else, but not too many.

Scientists have calculated that, when put together, all these national contributions will not be enough to keep global warming below 2°C, let alone the much more ambitious target of 1.5°C.

We are dealing with a weak part of the agreement. Because bringing all the interested parties to the same negotiating table was expansive, the compromise was inevitable. Instead of an agreement with legal obligations for signatories, with economic incentives rewarding good performance and clear penalties for those who disobey the law, the delegates lowered the requirements’ bar to a level that might be described as a trite example of good intentions.[3] The coherence of the decisions was sacrificed for the courtesy of relations. Under these conditions, the agreement is no longer a success-prone plan but rather a collective expression of aspirations, albeit sometimes contradictory.

b. The objectives of the agreement are difficult to achieve, probably impossible

The agreement's text calls on the signatory countries to *voluntarily* reduce their carbon emissions so that the global temperature increase is below 2°C compared to preindustrial values. Also, at the request of nations vulnerable to climate change, such as the Marshall Islands and the Maldives, a clause was introduced for *further efforts to limit the temperature rise to 1.5°C above preindustrial values.* Practically speaking, this last objective is not only difficult to achieve but probably impossible.[4] Already, the global temperature has risen by almost 1°C since 1850, and, due to the inertia of the climate system, another 0.5°C of heating is inevitable, even if the CO_2 emissions become zero starting tomorrow morning. To have a 50–50 chance of limiting heating to 2°C, humankind would have had to drastically reduce carbon dioxide emissions 20 years ago! But if you read the INDCs, you will notice that no country solemnly states that it will dramatically reduce future carbon emissions.

There is no clear indication in the agreement about the largest source of human carbon emissions, which is coal. If the United States, the world's second-largest producer of anthropogenic CO_2, introduced measures to reach pre-1996 emission levels due in part to the replacement of shale gas, China and India (first and third, respectively, in the top world emitters) would still rapidly build new coal-fired power plants, sometimes even three per month. According to some estimates, in the next ten years, over 1,000 new thermal power plants will be built in the world.[5] The Paris Agreement will not stop these new human sources of CO_2.

Don't you think there is a contradiction between what was signed in Paris and what will actually happen on the ground?

c. The money will not be enough

The main idea underlying the agreement is that rich countries, such as the USA, the United Kingdom, Germany, Japan, and others will provide financial aid to developing economies, such as Kenya, Vietnam, Bangladesh, and India, to gradually shift from carbon-intense fuels to renewable energy (i.e., wind and solar). However, it should be understood that western countries' contribution, of $100 billion a year, is also voluntary. And, in analyzing the current state of unconventional energy development, many experts believe that there will be much more than $100 billion a year in costs for developing countries to move to new energy sources.

The International Energy Agency (IEA) estimated in 2014 that the world needs $48 trillion in investment to meet its energy needs to 2035, out of which **$35 trillion** will be needed to keep the energy industry from being a danger to the climate![6] This is the cost that 187 governments will have to bear to clean up their pollution sources and ensure a possible temperature rise below the 2°C threshold, according to Paris's commitments. Will this money be available soon?

d. The agreement does not provide for a cap-and-trade or carbon tax scheme

I know "carbon tax" sounds ominous when it comes to the government, and for a politician who seeks to be re-elected, "tax" is clear anathema. But adopting such a tax would change individuals' financial incentive to produce CO_2. Some important financial and industrial players—the World Bank, Shell, Exxon Mobil and others—argued in favor of a cap-and-trade or a carbon tax mechanism to cut fossil fuel emissions. But instead of trying one of these methods, the signatories of the agreement chose a different approach. The governments will order energy companies and other economic players to reach certain emission reduction quotas.

On the other hand, any individual country is free to disregard the Paris Agreement's provisions and introduce its own carbon tax or cap-and-trade scheme. About forty countries have implemented some form of carbon pricing. China is planning a national cap-and-trade system and has already tested the concept in several pilot regions. California, Oregon, and Washington are the most advanced in introducing carbon pricing systems in the US.

All the funds obtained from the described financial mechanisms could instead be used in research and development funds of alternative energy resources.

e. Professor James Hansen states that the Paris talks are a fraud: mere words without value—no action, only promises

Professor Hansen, former Director of the NASA Goddard Institute for Space Studies at Columbia University, testified before the United States Congress in 1988 on the current global warming and is one of the most important popularizers of the anthropogenic climate impact. But he vehemently criticized the Paris talks:

> It's a fraud really, a fake. It's just bullshit for them to say: 'We'll have a 2°C warming target and then try to do a little better every five years.' It's just worthless words. There is no action, just promises. As long as fossil fuels appear to be the cheapest fuels out there, they will continue to be burned." [7]

I think a professor like James Hansen's views have a specific, if not negligible, weight in a topic like "Global warming and anthropogenic contribution."

Even a famous environmental author and activist, Bill McKibben, wrote in *The New York Times* that the Paris Agreement was designed for 1995, rather than 2015. It is a 20-year phase-out that annihilates the document's intent. If all parties keep their promises, McKibben writes, the planet's temperature will rise by 3.6°C instead of 2°C.[8]

f. History is repeating sometimes

To be skeptical about an international agreement that does not include legal obligations for its signatories, which has set hard-to-reach, probably impossible targets that do not have secure funds for implementation, which does not provide a source for charging carbon emitters, and which is criticized by scientific and environmental personalities, is easy to understand.

I would also add another reason, this time a historical one. Because, whether you want it or not, history sometimes repeats itself (e.g., eugenics and Lysenkoism). To demonstrate, I will use an example, which unfortunately invokes the same Paris.

The year is 1928. Delegates from fifteen countries, including the United States, the United Kingdom, Germany, France, and Italy, met in France's capital to discuss necessary measures to prevent a new world war. In the end, the participants signed the *General Treaty for Renunciation of War as an Instrument of National Policy*, also known as the *Paris Pact*. The signatory states promised not to use the war to resolve "disputes or conflicts of whatever nature or of whatever origin they may be, which may arise among them." Parties not complying with this promise "should be denied of the benefits furnished by [the] treaty." The organizers of the Paris conference and the main authors of the document were Frank B. Kellogg, the United States Secretary of State, and Aristide Briand, the French Minister of Foreign Affairs. The *Kellogg–Briand Pact* is named after them.

The pact's main objective was to remove any war actions carried out to resolve territorial disputes that remained unsolved after the end of the first world conflagration.

Even though the pact had no mechanism for imposing its provisions, it was welcomed in some political circles as *a historic achievement* that will help maintain peace in the world.

Further, history recorded the following facts:

1929: Kellogg received the Nobel Peace Prize.
1928–1933: Sixty-five countries signed the Paris Agreement.
1939: The Second World War began.

Let us hope that future generations will not discuss the Paris Climate Agreement of 2015 in the same way as today's Paris antiwar pact of 1929.

III

When someone is honestly 55% right,
that's very good and there's no use wrangling.
And if someone is 60% right,
it's wonderful, it's great luck, and let him thank God.
But what's to be said about 75% right?
Wise people say this is suspicious.
Well, and what about 100% right?
Whoever say he's 100% right
is a fanatic, a thug, and the worst kind of rascal.

An Old Jew of Galicia

Czesław Miłosz, 1953
The Captive Mind

A new linguistic tug-of-war erupted after President Trump's inauguration in January 2017. What is the *casus belli*?

The Trump Administration continued to deliver on the promises made during the election campaign and was preparing to decide on whether the United States should belong to the group of states that signed the Paris Climate Agreement or not. In 2015, an important role in this decision-making process depended on one phrase/word.[9]

Article 4.11 of the Agreement states that a nation "may at any time adjust its existing nationally determined contribution with a view to enhancing its level of ambition." This time, the keyword was *to adjust*. Because, you know, adjustment can mean "increase, intensification" but it can also mean "decrease, diminishment." The semantic dispute surrounding the word "adjust" divided the Trump Administration into two distinct camps.

For former White House chief strategist Stephen K. Bannon, and former Environmental Protection Agency (EPA) Administrator Scott Pruitt, "adjustment" translates into *growth*, *amplification*, meaning the United States will have to contribute more to its carbon reduction efforts than they initially committed to during the Obama Administration. The two politicians lobbied President Trump to withdraw the United States entirely from the Paris Climate Agreement.

For others, including former Secretary of State Rex W. Tillerson and former CEO of ExxonMobil, former Secretary of Energy Rick Perry (former governor of Texas), and Ivanka Trump (daughter and advisor to President Trump), "adjustment" meant *diminishing* or *reducing* the national contribution. As a result, they suggested that the United States should continue to be a signatory member but renegotiate the United States' share.

Both decisions involve legal issues that the lawyers of the two camps discussed on May 1, 2017. In the case of a complete withdrawal from the agreement, there were indications that environmental activists would sue the Trump Administration, following the already experienced model of the lawsuits instituted against presidential decrees on immigration from certain predominantly Muslim countries. But there was also the view that threats with potential lawsuits are just a ploy to force the President's hand.

On June 1, 2017, President Donald Trump announced his decision—the United States would cease all participation in the 2015 Paris Agreement on climate change mitigation. His main motivation was that "the Paris accord will undermine [the US] economy" and it "puts (the US) at a permanent disadvantage."[10]

Adjustment was adjudicated to mean exit eventually.

But in January 2021, the current Administration annulled the exit and decided to rejoin the Paris Agreement.

CHAPTER 19

MUNK'S ENIGMA – IMPLICATIONS FOR CLIMATE CHANGE

In memoriam

Walter Munk (1917–2019)

Compared to the period immediately preceding the Industrial Revolution, there has been a slight increase in mean global temperature (~ 0.9°C) and the concentration of CO_2 in the atmosphere (~ 0.013%). There have also been variations in the global mean sea level (GMSL), which is another significant indicator of climate change.

A closer look at this climate indicator provides a fascinating story about the search for lost time, which began with a scientist and an enigma.

Geophysics professor Walter Munk (1917–2019) is considered the Einstein of the oceans and the patriarch of American oceanography. In 2002, Munk published an article, "Twenty-century sea level: An enigma," that perplexed the climatology community.[1]

From marine geophysics theory, we know that variations in GMSL relative to the earth's crust are controlled mainly by two factors: changes in the *volume* of the planet's ocean (steric component, dominated by thermal expansion) and changes in the *mass* of the planet's ocean (eustatic component, dominated by melting glaciers and water storage on land).

At the end of the last ice age, about 20,000 years ago, the global ocean level was 125 m below the current level, then it rose rapidly, reaching approximately −2 m around 4000 BC. After the Little Ice Age, sea levels rose by 1.8 mm/year from 1900 (historical rate, a combination of the steric and eustatic components), representing a total increase of 18 cm by the year 2000. Since 1950, there has been an increase of GMSL of 0.6 mm/year due to the thermal expansion associated with global warming, or the rate of influence of greenhouse gases, representing a total of 3 cm. By the year 2000, the average global level of the oceans should have increased by 18 + 3 = 21 cm, which can be seen in Figure 19.1.

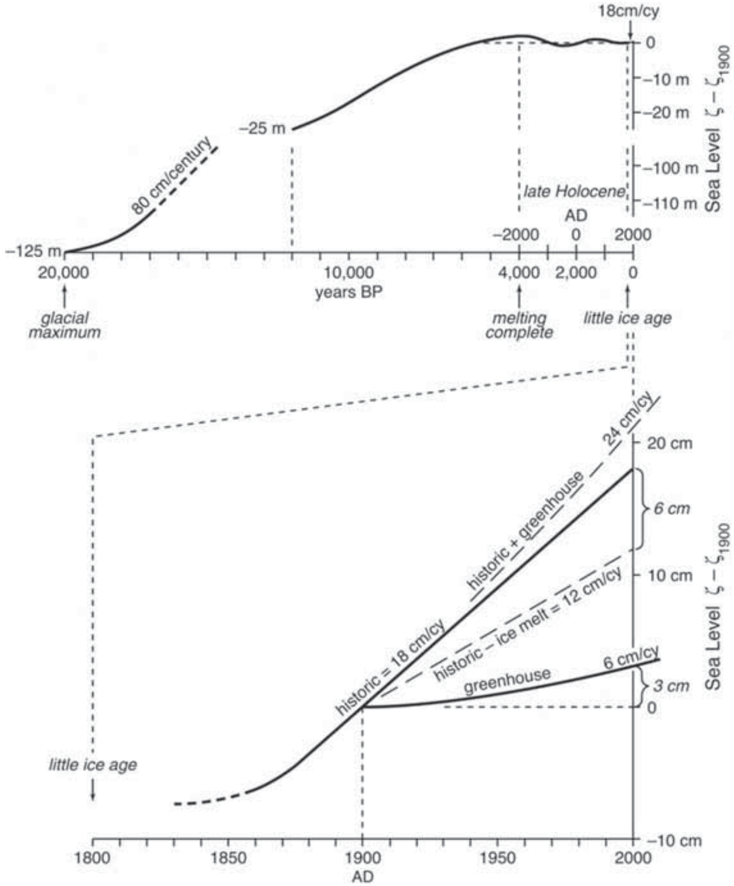


Figure 19.1. The evolution model of the GMSL assumed by Munk is based on published data and models (from Munk, 2002)

The official report of the Intergovernmental Panel on Climate Change (IPCC) of 2001 allocates a eustatic contribution of 0.06 mm/year to the growth of GMSL in the last century.[2] But if we subtract:

21 cm (historical data) − 3 cm (global warming) − 6 cm (melting glaciers)

—there are 12 cm of sea-level rise that cannot be explained, which is more than half of the GMSL increase. Munk calculated that the missing 12 cm would require either an increase in the steric component by 10^{24} J for heat stored in the ocean or the additional melting of 40,000 gigatons of ice in the 20th century (the eustatic component). Both events are impossible to accept based on historical data, which is the first part of the enigma that Walter Munk presented to the academic world in 2002.

How is the global ocean level measured?

For the past 300 years, GMSL measurements have been made with tide gauges, relatively simple devices consisting of an open cylinder in which a float like a ping-pong ball moves up and down, marking tidal flows and ebbs. Today, tide gauge readings are done automatically, using a GPS to transmit and integrate the measured data into a national network.[3]

The largest database of average ocean levels, monthly and annually, measured by tide gauges in the 20th century is maintained by the Permanent Service for Mean Sea Level (PSMSL), which collects data from around 2,000 locations in about 200 countries.[4] However, the quality of the recordings varies, as several factors negatively influence the data. Examples of such factors are the uneven distribution of data collections sites (predominant locations are in the northern hemisphere; there are very few stations at latitudes greater than 60°), locations in areas with subsidence or active glacial isostatic adjustment, locations close to large urban areas (where groundwater is extracted intensely), incomplete measurements, and more.

A compilation of good quality sea level recordings made in the twentieth century with globally distributed tide gauges is illustrated in Figure 19.2.

According to Figure 19.2, in the first part of the last century (1900–1930), the growth rate of GMSL was relatively insignificant, <0.5 mm/year. After that, there was a growth rate of around 1.8 mm/year, a value also used by Munk (2002).

In 2015, a subsequent analysis of the records made by 622 tide gauges included in the PSMSL decreased the growth rate of the GMSL between 1901 and 1990 to 1.2 ± 0.2 mm/year.[6]

In 2018, a similar study found that "the global mean sea level reconstruction shows a trend of 1.5 ± 0.2 mm yr−1 over 1958–2014 (1σ), compared to 1.3 ± 0.1 mm yr−1 for the sum of contributors."[7]

In 2020, another study using tide gauges worldwide estimated that GMSL over a more extended period of 1900–2018, showed an increasing trend of **1.56 ± 0.33 mm yr**−1, not significantly different from the previous period 1958–2014.[8]

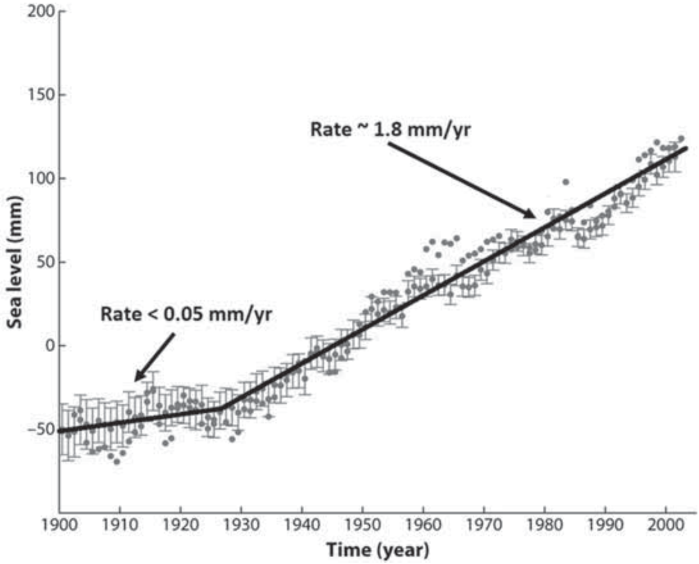


Figure 19.2. GMSL tide measurements between 1900 and 2001. The red dots are data obtained from Church et al. (2004), and the blue ones from Jevrejeva et al. (2006). The growth rates are personal estimates. Modified from Cazenave and Llovel, (2010).[5]

It is worth noting that the latest research confirmed sea-level rise oscillations already presented above in Figure 19.2. It found slow rates of oscillations between the 1900s through the 1930s, followed by high rates during the 1930s and the 1940s, slow rates again in the 1960s and 1970s, followed then by a return to high rates as recorded in recent decades.

Another interesting aspect of sea-level variation in the last century is that "the above-average rate of GMSL rise in the 1940s is largely attributable to above-average contributions from glaciers and the Greenland Ice Sheet." Moreover, researchers estimated that melting glaciers contributed 0.70 mm/year to sea-level rise during 1900–2018, compared to 0.52 mm/year since 1957, suggesting a relative slowdown in the GMSL trend.[8]

Finally, it is also worth noting that neither the multidecadal oscillations in the GMSL trend nor the higher glacier melting contribution before 1957 would positively correlate with the linearly accelerated increase in CO_2 emissions since the 1940s.

What can be said about sea-level changes in antiquity?

A reference paper was published in 2004 by a group of Italian researchers led by an Australian professor of geophysics, Kurt Lambeck.[9] The authors ingeniously used an architectural reality from the Roman period between 100 BC and AD 100.

The wealthy Romans, who had villas in the central Mediterranean (i.e., on the Tyrrhenian seashores), built fish pools called *piscinae*. Roman pools were carved into the rock and communicated with the sea through an ingenious lock. To eat fresh fish daily, Roman architects predicted that the top of the lock would exceed the reflux level by 20 cm. Thus, freshwater could enter the pool daily and, at the same time, limit the escape of fish during the flow. For the drainage of stagnant water, the lock had small drainage holes at the bottom through which the fish could not escape from the pool.

Measuring the positions of the tops of the locks in twelve ancient Roman pools relative to the current tides, the authors concluded that the local level of the Tyrrhenian Sea has increased in the last 2,000 years by 1350 ±70 mm, or 0.675 mm/year. A recalibration of the initial measurements, published in 2018, yielded a lower sea-level increase of **1220 ±60 mm, i.e., 0.61 mm/year**.[10]

Satellite altimetric measurements from 1993 to 2017 (TOPEX/Poseidon, Jason-1, Jason-2, and Jason-3) indicate a **GMSL growth rate of ~ 3.0 ± 0.4 mm/year**, or about 7 cm in 25 years.[11]

However, it must be emphasized that these are different measurements from those made by the tide gauges. Satellites measure changes in sea surface height, or the absolute level of the potential surface that describes the geoid, while tide gauges provide data on the relative variations of the sea surface relative to the crust, meaning they indicate the relative sea level. While the latter directly measures changes in ocean volume (and the combined impact of glacier melting and steric effects), the former does not because a satellite measurement does not consider the crustal deformation produced by various geological phenomena (e.g., glacial isostatic adjustment, subsidence in areas deltaic, or specific actions in active tectonic zones).[12] Often, the literature considers them equivalent, introducing unwanted confusion in estimating the GMSL variations.

Let's recap: three different sets of global ocean level measurements after the last glaciation offer three different growth rates:

- ~ 0.61 mm/year for the last 2,000 years.
- ~ 1.56 mm/year for the last 118 years.
- ~ 3 mm/year for the last 25 years.

Which of the three GMSL values should be considered to solve the first part of Munk's riddle? Hard to answer.

Is time missing? Ancient eclipses, tides, and the effects of the last glaciation

Munk made a second interesting remark in formulating his riddle: Where did all the ice melt after the last glaciation go, and what effects did it produce?

If ice sheets and ice caps melt, this happens close to the poles, and most of the resulting water moves to the equator. This movement is like that of a skater who spreads their arms while turning on the ice. Melting ice 20,000 years ago will slow the earth's rotation. This situation's primary cause is the braking effect produced by the tides that break off the shores, or the so-called tidal dissipation. Additionally, there is another effect: the axis of rotation of the earth oscillates slightly because the melting of ice is not perfectly symmetrical, and the resulting water moves more in some parts of the planet than in others. These two effects, slowing down the planet's rotation and moving the poles of the axis of rotation, are two other components of Munk's puzzle. Let's see what possible answers there are.

Theoretically, one can calculate how much the earth's rotation has changed over the postglacial period, then compare these changes with those we believe induced glacial melting in the same timeframe and see if the two measurements fit together.

Essential data are provided by solar and lunar eclipses recorded with great accuracy by Babylonian, Chinese, Arab, and Greek astronomers.

An extremely meticulous compilation of eclipses from 700 BC to AD 1990 was first published in 1995 by Stephenson and Morrison, and revised in 2003 by Stephenson. It is shown in Figure 19.3.

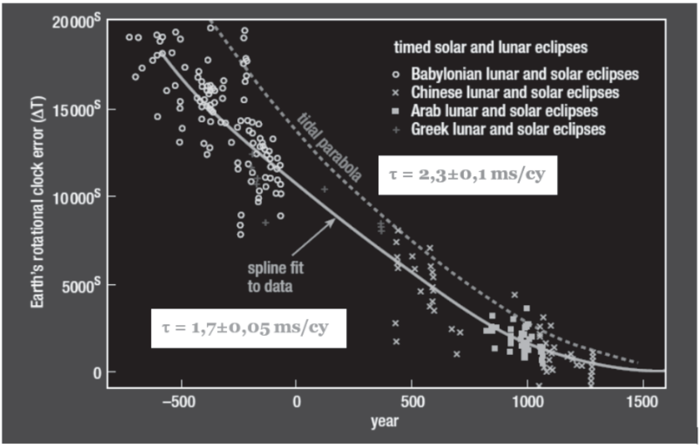


Figure 19.3. The analysis of ancient eclipses derived from the Babylonian, Chinese, Arab and Greek eclipses suggests a slowdown of the earth's rotation sufficient to produce a time error ΔT of ~ 5 hours (18,000 seconds) from 700 BC TO AD 1990. Modified from Stephenson and Morrison (1995).[13]

The error ΔT represents "the difference between the time of occurrence of an eclipse, which is measured in terrestrial time" (theoretically, an invariable time scale) and universal time, which is fixed at the rotation of the earth in AD 1820. In the last 2,500 years, an error of approximately 5 hours (~ 18,000 s) was produced.[14]

The green curve, which approximates all data, indicates an average change in day length with **τ = 1.70 ± 0.05** milliseconds/century (ms/cy). The contribution of tidal braking (blue curve) can be derived independently, provided that the total angular momentum of the earth–moon system is conserved and has been estimated at **τ = 2.3 ± 0.1 ms/cy (dotted blue curve)**. Surprisingly, the tidal effect exceeds the total value of the time error ΔT by

$$1.7 - 2.3 = -0.6 \text{ ms/cy}$$

After the last glaciation, two opposite phenomena changed the moment of inertia of the earth:

1) An isostatic rise (adjustment) of the land at high latitudes, previously covered by glaciers, produced an increase in the rotational speed of the planet by 0.6 ms/cy, and

2) A movement of the melted water masses toward the equator caused a slowdown of the rotation speed (an increase of the length of the day) by 0.1 ms for every 1 cm of eustatic rise of the GMSL.

If the “unexplained” 12 cm were attributed to the melting of glaciers at high latitudes and their movement to the equator, then the average change in day length, in ms/cy, would be:

2.3 (tidal braking) − 0.6 (isostatic lifting) + 1.2 (residual lifting) = 2.9 ms/cy

That is, it would be placed **above the green curve (1.7 ms/cy)** in Figure 19.3, which contradicts the hypothesis of the eustatic rise of GMSL by melting glaciers from the last glaciation.

The search for lost time continues.

A mathematical model can estimate the migration of rotational poles, which is a notion introduced by plate tectonics. When a global eustatic uplift occurs, the rotating poles respond by moving to the source of melting. Over the last century, based on geodetic and astronomical measurements, the rotational North Pole migrated 10.81 ± 0.03 m to the 79.2° ± 0.2°W location in Hudson Bay, confirming an increase in the rotation speed of the earth with 0.6 ms/cy.[15]

Let’s recap again.

In 2002, Munk launched a challenge to the scientific community regarding the rising global average ocean level in the twentieth century, as official IPCC documents had predicted since 2001. His challenge was less interesting for the media, which did not rush to popularize it for well-known reasons of political correctness.

First, Munk showed that the prevailing estimates from the last century for the increase in GMSL by ~ 1.8 mm/year involve two phenomena that did not happen in reality. Either there was an excessive increase in thermal energy stored in ocean water or an additional melting of vast amounts of ice, both of which require global warming of unproven magnitude.

Munk then listed two canonical observations regarding the rotation of the earth: i) the rate of the slowdown of rotation over the last three millennia, as shown by the study of ancient eclipses, is not confirmed by an adequate increase in tidal braking, which would be had to act if ocean levels had risen according to official IPCC data; ii) changes in the orientation of the earth’s rotation vector in the last century are consistent with a model of postglacial isostatic adjustment, which indicates an increase in the speed of the planet's rotation.

The three constituents of the 2002 Munk puzzle have seriously shaken official views on climate change expressed by the IPCC, an organization that, along with Al Gore, received the 2007 Nobel Peace Prize "for their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change."

At the time, the IPCC believed that the oceans' thermal expansion was the ideal candidate to exemplify global warming produced by humans. But scientists have calculated that the steric component of GMSL growth is too small, too late, and too linear.

Evidence from the "search for lost time," or the study of ancient eclipses, excludes a broad eustatic component resulting from the melting of Antarctica and Greenland. However, if excessive melting had taken place at the poles and in temperate climates, a reconciliation with rotational data would have been possible.

An attempt to solve Munk's enigma . . .

This took place in 2015, when several American and Canadian researchers, led by Professor Jerry X. Mitrovica of Harvard University, proposed a preliminary solution to meet Munk's challenges.[16]

The new study's main contribution was to criticize Munk's viscosity model in calculating the perturbations produced in the earth's rotation by postglacial isostatic adjustment. The viscosity model in question had been proposed by Professor William R. Peltier of the University of Toronto in 1998 and 1999.[17]

Mitrovica et al. (2015) proposed another model of viscous behavior of the terrestrial interior, by which the postglacial isostatic adjustment was forced to produce increases in GMSL by **~ 0.7 mm/year**, much smaller than those used by Munk (1.8 mm/year or satellite, ~ 3 mm/year).

Another proposal of Mitrovica et al. (2015) tried to justify their viscosity model by considering the magnetic coupling between the earth's inner metal core and the rocky mantle. The coupling would be facilitated by the outer core, which is in a fluid state and responsible for additional braking of the earth's rotation. This action would be enough, along with tidal dissipation and postglacial effects, to slow the earth's rotation by five hours.

. . . But the enigma persists

Prof. Peltier was Mitrovica's doctoral supervisor. Peltier, whose viscosity model had been used by Munk in formulating his riddle, became the main target of the new modeling proposed by his former doctoral student but rejected the criticism as "absolutely incorrect."

As for the idea of the existence of a core-mantle coupling, which would produce additional braking of the earth's rotation, Peltier stated, "Nice try, but no cigar."

II

Current research trying to solve Munk's enigma and explain those 12 cm missing from the GMSL balance continues.

What is being discussed now in the geophysical world are the results produced by seismic tomography, according to which the internal structure of the planet is no longer concentric, like an onion, but contains coatings whose thickness varies with depth. Adam Dziewonski's visionary works revealed the existence of two vertical structures, large and deep with well-defined edges, one under the Africa-Indian Ocean and another under the Pacific.[18] These discoveries place the dynamics of lithospheric plates in another context, including large volumes of water which could be involved in currently unknown subduction processes, producing significant variations in the average ocean level.

The structures discovered by Dziewonski are currently being investigated by what is called tidal tomography. This parallel technique uses the daily descents and rises of land elevations produced by the tide to improve our understanding of the planet's internal structure. The new tomographic technique's idea is to determine if the two structures discovered by Dziewonski are *floating*, with strong lifting tendencies, or are *anchored* in the rocks of the earth's mantle.

Recently, the first images of the two enigmatic structures were published. Figure 19.4 shows one of these images.

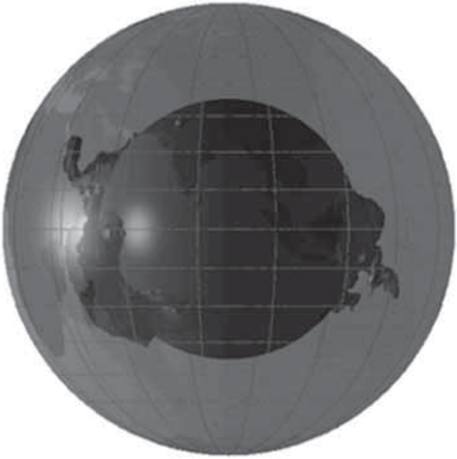


Figure 19.4. Near the base of the earth's mantle, there are two structures the size of some continents, made of hot and compressed rocks. They are called blobs.[21]

Somewhere over 2,000 km below our feet, close to the base of the earth's mantle, two structures made of hot and compressed rocks have been identified. Extending along continents and with thicknesses that exceed Everest's height 100 times, they are officially called large low-shear-velocity provinces (LLSVP) because seismic waves reduce their speed as they pass through them. In geological slang, the respective structures are called "the blobs." If the two structures were to surface, the International Space Station would have to navigate between them.[19]

Geographically, one structure is located under the Pacific Ocean, and the other occupies a position below East Africa and the Indian Ocean, as seen in Figure 19.5. In 2016, two researchers explained that significant details about the two blobs are not yet known.[21] The main uncertainty related to their geological properties is density. Are the blobs denser or less dense than the surrounding rocks? The answer to this question would substantiate the rheological behavior of the two structures.

A higher density would mean that the blobs would sink inside the planet. A lower density would mean that the blobs would rise isostatically to the surface. Both types of movements involve ocean water. Geologists and geophysicists are already speculating that enigmatic structures could feed hotspot-like volcanoes, such as those in Hawaii. Similarly, it has been suggested that blobs have fed super-volcanoes in the past, such as those in

Yellowstone National Park, whose super-eruptions have contributed to earth's largest extinctions.

For now, scientists cannot decide the density due to the lack of specialized measurements. Unlike surface rock outcrops, which can be easily tested and then measured petrophysically in a suitable laboratory, the blobs' density can only be estimated indirectly by proxy measurements of seismic velocities.

To mark the importance of the two blobs' dynamic influence on the variations of the average ocean level, the consequences of the tectonic movements that some geologists and geophysicists associate with the lifting/sinking of the two blobs must be considered.

Ocean water is regularly forced below the earth's surface, along with subdued tectonic plates. Specialists have estimated that about 1 billion tons of seawater are pushed into the mantle each year. Much of this water returns to the surface through volcanic activity, but about 300 million tons of water continue to "travel" in the lower mantle. If this process takes place over the earth's 4.5 billion years of existence, researchers say that all known areas of low seismic velocity, such as "blobs," could have formed this way.[20]

Melting glaciers, sea level, and the water pattern in the bathtub

A separate aspect of Munk's enigma is the so-called tub water model. A lot of people, when they hear that the sea level has risen in the last hundred years, they think, using the analogy with the water in the bathtub, that this increase is uniform over the entire surface of the planet's ocean.

The water model in the bathtub is valid only on small surfaces, where the gravitational forces of attraction are not significantly manifested between the water and the bathtub walls.

But if we work on a planetary scale, then the gravitational interactions between the Antarctic and Greenland glaciers with ocean water must significantly reflect Newton's law of gravitational attraction.

When an ice sheet melts, the sea level does not rise evenly like the bathtub's water level, but very unevenly. The ice floe, through its gigantic mass, draws the seawater to it. Greenland, which is only a tenth of the size of Antarctica, contains 3,000,000 billion tons of ice. What happens when the ice melts? The water goes into the ocean, but at the same time, it suffers a lower gravitational attraction than the land. Paradoxically, when glaciers melt, the sea level near them drops instead of rising!

If Antarctica suddenly melted tomorrow, the shore water level would drop by ~ 100 m! On the other hand, only West Antarctica has enough ice to cause the global sea level to rise by ~ 5 m. Where is the balance between the two actions (sea-level increase and decrease)? I mean, where does the sea level not change at all?

Professor Mitrovica's group at Harvard tried to answer this question and estimated that the change in the direction of sea-level evolution takes place within a radius of about 2,000 km from the cap's edge.

Following the logic described above, Alaska fishermen are not worried about the melting of their glaciers because the ocean level drops do not rise in their fishing areas! Instead, 2,000 km from Alaska will feel the "swelling" of the ocean when Alaska's glaciers melt!

When the land gets rid of the glaciers' weight, it will begin to rise isostatically, pushing the ocean water and creating a new rise in sea level. Areas such as the Scandinavian Peninsula, Patagonia, and northern North America are most active in their isostatic uplift and contribute to the natural rise in sea level.

Conclusions

The most accurate knowledge of ocean level variation is essential for the study of climate change, more essential perhaps than that of temperature variations or CO_2 concentrations. Due to their vast surface and water bodies, the oceans are the largest reservoir for storing heat and carbon dioxide.

I presented the results of three types of GMSL measurements, which differ significantly from each other **(~ 0.61 mm/year, ~ 1.56 mm/year, ~ 3 mm/year**), plus a compromise value produced by modeling **(~ 0.7 mm/year**). The fact that we have inaccurate, even contradictory, knowledge of rising global sea levels after the last glaciation raises a serious question about future scenarios related to the consequences of global warming. For example, it is difficult to know with the information that currently exists whether or not coastal areas will be massively flooded or whether or not we should build protective walls.

Sea level is a crucial parameter of climate change, and, given Munk's enigma, we are in a delicate position. We resort to controversial modeling, such as that of 2015, which respects the measured data and offers solutions.

There are fundamental phenomena about our planet's behavior that we do not know for the time being. Therefore, labeling humanity as the leading cause of current climate change, such as rising ocean levels, is somewhat risky when we do not know all the natural causes that contribute to these changes.

Correct estimation of the various factors contributing to global sea-level change is a complex operation requiring many accurate measurements to identify the causal chain.

In any case, the current idea that anthropogenic global warming is 100% responsible for rising ocean levels over the last hundred years must be seriously scrutinized before it becomes a dogma. Characterizing climate change as natural and/or anthropogenic in terms of sea-level change is a risky endeavor.

CHAPTER 20

THE GLOBAL CRISIS AND NATURE'S MUTINY. WHAT IS GAINED WHEN SOMETHING IS LOST?

Now is the winter of our discontent . . .

Shakespeare, circa 1595
Richard III

The life of man [is] . . . poor, nasty, brutish, and short.

Thomas Hobbes, 1651
Leviathan

Judging only by the chosen mottos, the "global crisis" mentioned in the title does not refer directly to our contemporary society. I borrowed that phrase from the title of a reference book, published in 2014 by British Professor Geoffrey Parker: *Global Crisis: War, Climate Change and Catastrophe in the Seventeenth Century*. "*Nature's mutiny*" is invoked by German journalist Philipp Blom in a book translated into English in February 2019: *Nature's Mutiny: How the Little Ice Age of the Long Seventeenth Century Transformed the West and Shaped the Present*.[1]

What do the two books mentioned above have in common? They describe—with different erudition levels—the period 1300–1850, called the Little Ice Age (LIA) by climatologists and called the general crisis by historians (i.e., Hugh Trevor-Roper, 1959). It was a time replete with numerous and significant events, military, religious, political, social, economic, cultural, and others, that dominated the sixteenth and seventeenth centuries.

The Little Ice Age immediately followed a period of global warming (Medieval Climatic Optimum), which lasted about 300 years (about 1000 to about 1300), when, for example, the Vikings crossed the North Atlantic and established flourishing settlements in Greenland. In England, vineyards were growing, and in western and central Europe the most important cathedrals were built.

Due to multiple natural causes (i.e., decreased solar activity, increased and intensified volcanic eruptions, disturbances in ocean currents, and the influences of Milanković cycles), our planet has suffered a reduction in global average temperatures by 2°C since 1300. As temperatures decreased, ocean currents were affected, seawater salinity was altered, ocean condensation types changed, polar caps and continental glaciers began to grow rapidly and advance to low latitudes, and medieval warming climatic systems (between the eleventh and fourteenth centuries) were deregulated. The Little Ice Age was a global event that had more apparent manifestations in the northern hemisphere, where about 99% of the population lived.

The drop in global temperature by 2°C has generated a long succession of brutal and extreme events, such as violent storms, endless periods of cold rains, summers with devastating droughts, and on top of that, fierce cold and persistent frosts. Crop growth periods were reduced by an average of three weeks, which meant either a delayed ripening or a total lack of ripening. At the European level, a long-term food crisis had set in over large areas. The frequent lack of crops from grains rotting in the field or being destroyed by hail and multiple periods of drought has dramatically decreased available food resources. Food shortages have led to prolonged famine, which has been associated with epidemics and, ultimately, an incredible number of victims in the tens or hundreds of millions.

In the sixteenth century, when the Little Ice Age began to manifest itself most brutally, Europe did not rely on intercountry trade and industry but only on local subsistence agriculture, which produced mainly grains such as wheat, barley, rye, and oats, to which wine, beer, and olives (in the Mediterranean regions) were added. Fresh fruits and vegetables were only available in season. Sea fish were consumed only in coastal areas. The meat was too expensive for most Europeans as regular food, and hunting was a fiercely defended privilege of the aristocracy.

Documents describe the population's collapse during the cold climate of the seventeenth century due to famine during the Ming dynasty in China and the brutal winters in North America, with many victims among English, French, and Spanish settlers. Crops were also insufficient in India. The Ottoman Empire suffered some of the most devastating winters historians have ever recorded. Similar situations are reported in Japan, Malaysia, and the Aztec Empire.

For a long time, European philosophical thinking was dominated by Hegel's ideas that climate influences only the culture of a people and that the spirit of a culture resembles the landscape of that country and the climate in which it develops. Therefore, he believed that only the German landscape, with its temperate forests and temperatures, was suitable for the "true scene of world history" because that was the only way to create true spiritual depth. Hegel also insisted that the American and African Indians could not build a great culture because there, the cold and heat are too strong to allow the mind to construct a world for itself.

It is the merit of the famous *L'École des Annales*, which changed the climate-society paradigm in the late 1920s to one where climate is a determining factor for ALL civilizations.

Fundamental studies authored by Fernand Braudel, describing societies and their trade connections in the Mediterranean basin, and those by Emmanuel Le Roy Ladurie, depicting the lives of medieval peasants in Languedoc (southwestern France), clearly showed that Hegelian speculation about the effects of climate on culture must be replaced by a more appropriate method, in which concrete historical data allows in-depth analyses, finely calibrated to local events and circumstances.

Professor Parker laments the "myopia" of historians, who did not realize that in the seventeenth century that

> An intense episode of global cooling coincided with an unparalleled spate of revolutions and state break-downs around the world (including Ming China, the Polish-Lithuanian Commonwealth, and the Spanish Monarchy), while other states came close to revolution (notably, the Russian and Ottoman empires in 1648; and the Mughal empire, Sweden, Denmark, and the Dutch Republic in the 1650s).
>
> Also, Europe saw only three years of uninterrupted peace throughout the seventeenth century, while the Ottoman Empire enjoyed only ten. The Chinese and Mughal empires fought almost continuously. Throughout the northern hemisphere, war has become the norm for resolving domestic and international problems.[1]

In 1569, Venice's lagoon remained frozen until March, and in the winter of 1572–1573, Lake Constance (Bodensee), between Germany and Switzerland, was covered with thick ice until late spring.

In the middle of the winter of 1622, it was possible to reach Asia from Europe on foot by crossing the fully frozen Bosphorus Strait. In the harsh winter of 1658, the Swedish army marched from Jutland to Copenhagen, crossing the icy sea.

Between 1309 and 1814, the River Thames in London froze at least twenty-three times. In five of these situations, the river ice was thick enough to withstand "frost" fairs over several days. For example, in 1683, inhabitants were able to travel by carriage on the Thames and enjoyed skating shows, booths with shopping stalls, taverns, and even brothels.[2]

Ice barriers, spread over many kilometers, surrounded Iceland. The island's ports were blocked and connections with the surrounding world were severed. Cereal crops failed; people had to change their diet. Together with the eruption of the Laki volcano in 1783, the Little Ice Age halved the population of Iceland.

The colonies of Greenland, which had flourished for 300 years in the Medieval Climatic Optimum, succumbed to famine because cereals and animals could no longer survive the harsh winters. Greenland was practically isolated from the rest of the world by the surrounding glaciers between 1410 and 1720.

King Henry IV of France (1589–1610) woke up with a frozen beard. The birds froze in the air and fell to the ground, dead. Women and men died of hypothermia. Wood, the primary source of heat, grew much more slowly because of the cold. The wine froze in barrels, and thick snow sheets covered parts of Spain.

Europe was a frozen world.

However, endless and brutal winters stimulated the emergence of a new category of artists, especially Flemish and Dutch. These were the painters of winter landscape, a theme almost unknown until then in European art.[3] The terrible winter of 1595, masterfully painted by Pieter Bruegel the Elder, was probably the source of inspiration for Shakespeare, who began his great drama *Richard III,* written in the same year, with the famous sentence I chose as a motto:

Now is the winter of our discontent . . .

What was lost during the Little Ice Age?

Many tens, perhaps hundreds of millions of lives, have been lost due to incredibly long and devastating famine (i.e., 30 years, 100 years), frequent wars, devastating pandemics (the Black Death alone from 1347–1351 produced between 70 million and 200 million deaths), prolonged droughts, severe colds, catastrophic floods, and other causes. It is no coincidence that precisely in the middle of the seventeenth century, Thomas Hobbes lamented in his *Leviathan* masterpiece the life of the living man during the Little Ice Age as "poor, nasty, brutal, and short."

France was struck hard by relentless winters and poor harvests when the country was the scene of religious wars. For example, between 1562 and 1598 alone, about four million French men and women fell victim to wars, starvation, and epidemics. Through extreme climatic events, the Little Ice Age exacerbated the population's suffering. In 1570, the rivers in the south of the country (Provence and Languedoc) froze completely. In 1594, the port of Marseille was no longer navigable due to ice.

A hallucinatory episode, narrated by Blom, exemplifies an unimaginable tragedy suffered by the inhabitants of Paris. In 1590, during the bloody war with the Catholic League, the Protestant King of France, Henry IV (whose beard froze in his sleep!) besieged the city to retake it. The tactic chosen was starvation. On May 7, his army surrounded the city, set fire to the windmills that produced flour and blocked the streets through which Parisian markets were usually supplied.

The inhabitants of Paris, who had already suffered from the winter frosts, were now enduring a terrible famine. At first, horses and donkeys were eaten. Then the dogs and cats were boiled in communal boilers. Desperate, many people threw themselves into the Seine.

In June, survival had become virtually impossible due to hunger. At that time, the Spanish Ambassador, Bernardino de Mendoza, suggested to the city's rescue committee that the bones of the dead in the famous *Cimitière des Innocents* be exhumed, crushed, and ground, and bread be made from the flour obtained. By August 30, 1590, when Catholic troops liberated the city about 45,000 people, representing a fifth of the population of Paris, had died of starvation and disease.

In the 1780s, France suffered from a series of compromised harvests. The population's extreme vicissitudes due to famine contributed significantly to the resentments and despair that fueled the 1789 Revolution.

In 1601, after a cold and humid summer caused the almost ripe crops to rot in fields full of water, a famine broke out in Russia as well. Another two years of poor harvests followed when summer temperatures during the night were below freezing. Climatologists believe that this extreme climatic phenomenon was caused by the Huaynaputina volcano's eruption in Peru in 1600. The widespread famine killed two million Russians, or a third of the population. Also, the country faced riots, civil war, and foreign occupation by Poland until 1612. What Russian historians call *Смýтное врéмя* (*Time of Trouble*, 1598–1613) was a period of terrible trials for the Russian people, fueled and exacerbated by the effects of global cooling.

Although the Ming dynasty in China had successfully stood for 276 years (1368–1644), the Little Ice Age dealt a fatal blow, causing poor harvests, floods, and epidemics. During the famine that preceded the dynasty's collapse, 2 kg of rice could be bought with two children. In the chaos that followed the collapse of the dynasty, more than a million Chinese perished.

In Europe, large areas affected by the Thirty Years' War (1618–1648) suffered great losses—a third or more—of their population. In France, the civil war called *La Fronde* (1649–1653) caused one million deaths. And in Great Britain between 1638 and 1660, various civil wars were responsible for the deaths of 7% of the population, much more than the 2% of victims of the First World War.

The end of the seventeenth century recorded new periods of famine, followed by loss of life. In France (1693–1694), Norway (1695–1696), and Sweden (1696–1697), the population of each country decreased by approximately 10%. In Estonia and Finland, the famine of 1696–1697 caused the death of 20% and 33% of the national population, respectively.[4]

The Little Ice Age also produced cold summers and freezing winters in New England, where, beginning in 1609, the first European settlers began to arrive. It is not known how the local tribes resisted because there are no documents. But the colonists faced the vicissitudes of global cooling. During the Great Snow of 1717 and the Good Friday of 1810, a series of snowstorms buried houses, and people died inside when temperatures dropped sharply by 16°C in less than a day. The American Revolutionary Army, led by General George Washington, suffered terribly in the winters of 1777–1780, leading to riots among the soldiers, who lacked adequate clothing and footwear.

According to Alfred W. Crosby, the so-called Columbian Exchange is well known in the world of historians. It took place after the expeditions led by Columbus and his successors in the two Americas. Willingly or accidentally, many biological materials were exchanged between settlers and natives, from viruses to plants and domestic animals.

For indigenous peoples, the Columbian Exchange meant not only the introduction of dogs, pigs, and horses but also the outbreak of epidemics to which they were not immune: smallpox, tuberculosis, bubonic plague, and cholera. These epidemics almost completely killed local people.

Another fatal weapon that exterminated many of the local tribes was alcohol. The natives of the Americas have a genetic "defect" that Europeans do not possess: the lack of two protective genes in the liver against rapid intoxication and rapid death caused by alcoholism. Until the Europeans' arrival, the locals had not tasted and did not know how to distill fruits and cereals to make alcohol like whiskey. But after tasting it, they liked it. And today, alcohol causes the most deaths among Native Americans and Alaska Natives (11.7%).

Native Americans still have one of the highest rates of fetal alcohol syndrome (FAS). According to the Centers for Disease Prevention and Control, between 1981 and 1991 the rate of FAS cases in the entire United

States population was 2.1/10,000 births. Among Native Americans, FAS cases were 31/10,000 births, almost 15 times more. Details are presented in the article "Genetic factors influencing alcohol dependence."[5]

Moreover, it is hypothesized that the disappearance of these populations favored the understanding and afforestation of the lands they worked, meaning they contributed to the decrease of CO_2 concentration, thus increasing global cooling through positive anthropogenic feedback. This hypothesis was discussed in March 2019 in the article "Earth system impacts of the European arrival and great dying in the Americas after 1492."[6]

The main conclusions are:

- The arrival of the Europeans in 1492 produced an estimated 56 million victims by 1600.
- The massive population reduction led to the reforestation of 55.8 million hectares and the sequestration of 7.4 billion tons of carbon.
- The decrease in atmospheric CO_2 concentration was partially caused by the decimation of the Americas' indigenous populations.

Mighty storms in the North Sea have caused catastrophic floods in northern Europe (i.e., the Netherlands, Belgium, and Germany), starting around 1300 and continuing in various installments until the eighteenth century. The storms' names are suggestive: The Flood of St. Marcellus or Grote Mandrenke (or the Great Drowning of the People, in Dutch), the Flood of St. Lucia, the Flood of St. Elizabeth, and more, each signifying the biblical dimensions of the effects of global cooling. Flooding cities and villages and destroying bridges and dams, the floods in the north of the continent produced up to 100,000 victims.

It was a rare occasion when the harvests began to be compromised from year to year due to the prices of agricultural products being doubled when the sun appeared in the sky in the summer months. A toxic combination of bad weather and fear occurred. People began to believe that God was punishing them for their wickedness. And the result was a strong and widespread suspicion that witches caused the Little Ice Age's unfortunate events.

One by one, since the 1580s, witch trials have taken place in Germany, Luxembourg, France, northern Italy, and Catalonia. Historians say that during the Little Ice Age, about 110,000 trials of witchcraft and black magic took place in Europe and 50,000 of them ended in convictions and death at the stake.

The Little Ice Age's detrimental effects in Western Europe also manifested themselves in an area of great social importance: viticulture. Wine was a very precious commodity and therefore, since the sixteenth century, well documented with product descriptions, prices, quantities of grapes harvested, and, most importantly, harvest dates.

Until the middle of the nineteenth century, wine was more than a luxury; it was a necessity, especially in cities where it was difficult to find clean drinking water. Because the knowledge of boiling to destroy germs had not yet been discovered, the only solution was to add alcohol to the drinking water, that is, to pour wine or beer down the throat instead of plain, impure water. Global cooling and reduced growing and ripening periods negatively affected wine and cereal production.

What was gained during the Little Ice Age?

The Little Ice Age meant, in principle, an agricultural crisis extended over the long term and with continental expansion. At the beginning of the modern era for fragile societies, two consecutive years without harvests, especially grain, meant famine. The frozen rivers no longer allowed the mills' operation or transport to the cities, cutting off their food supply sources. Cereal crops did not return to their old values until after 180 years.

But this crisis is, paradoxically, responsible for what I call "the gains of the Little Ice Age."

Before the hard times associated with the Little Ice Age, the European socio-economic system had functioned relatively well for almost a millennium, centered on feudal property and close cooperation between the church and the king/emperor. Most of the population was made up of peasants and serfs working with rudimentary means (predominantly wooden plows, which barely scratched the ground) on the lands ruled by the local nobility. Very few agricultural workers could afford to use oxen for plowing because the maintenance of animals in winter was expensive. The agriculture practiced was almost monoculture, which led to low productivity.

The situation changed in the seventeenth and eighteenth centuries. Columbus' expeditions to America brought new plants to Europeans: corn, potatoes, tomatoes, tobacco, and pumpkins.

Of all the American imports, I would emphasize the corn and potatoes.

With its 80–100 large grains on a single cob, corn, compared to the 12 small grains in a wheat spike, provided a fundamental food source which was more abundant and cheaper for the people of the country and many townspeople.

Potatoes emerged as a consequence of long wars, such as the 30-year war. Most armies had limited food resources and had to do their best. This meant robbing local people and, in particular, requisitioning their food. Most commanders resorted to scorched earth tactics and the poisoning of wells to hinder the advance of enemy armies. Whole fields of ripe grain could be burned quickly, but it was much more difficult to set fire to potato crops. Potato plants do not burn quickly, and to destroy them, they had to be uprooted individually. Therefore, potato growers had higher food security than those who relied solely on cereals.

However, their introduction into agricultural practices on the old continent was not immediate. For example, the potato was at first a curiosity in botanical gardens, admired for its flowers. It took a long time for the folk people to realize that the tubers hidden in the ground are good to eat. Consequently, cereal production mostly consumed locally, was predominant. The price of flour and bread, respectively, was the gold standard of the time.

When the Little Ice Age's effects threatened this standard, when the peasants were left with a surplus of grain from one year to the next to ensure their survival, the feudal socio-economic system collapsed.

In Blom's view, the significant consequence of this situation was a paradigm shift: the medieval acceptance of human economic life as cyclical and stable was rejected in favor of the idea of continued economic growth based on exploitation and built on continuous imperial and industrial expansion. It is not difficult to see that the modern and contemporary eras, for which uninterrupted economic growth is a political mantra, have their roots in the Little Ice Age.

The reorganization of land use and ownership (i.e., how communal pastures have been restricted/closed) has changed existing power relations and social structures, favoring increased agricultural productivity and availability for an extensive trade of farm products (mainly cereals). The development of trade imposed the development of transport. The construction of new roads and commercial boats for the new sea routes established in the era of great geographical discoveries had begun. Transport development meant large investments. The ability to buy or sell for cash or equivalent had become increasingly important. At the same time, the cities that were important centers of transport and financial assistance became the political and cultural leaders of the Little Ice Age. The most eloquent example is Amsterdam, which has been transformed, from somewhere in the Habsburg Empire, into a multirelational shopping center (a hub, so to speak today), with a population that has grown tenfold in a century. And the Netherlands, until then a country of fishermen, farmers, and a handful of merchants, metamorphosed overnight into the greatest naval power of the time and into a place of an economic, artistic, and even philosophical renaissance (Spinoza and Descartes being two examples).[7]

In 1602, Amsterdam founded one of the first companies with foreign for-profit activities, the Dutch East India Company, which specialized in spices. In the same year, a new institution appeared, *beurs*, meaning the stock exchange. In 1621, the West India Company was founded, which helped Dutch emigrants establish the first settlement in the south of Manhattan in 1624, called New Amsterdam, and trade in beaver furs.[8] Today, the world's largest stock exchange, the New York Stock Exchange, is located on the perimeter of the former Dutch colony in Manhattan, on Wall Street.

The idea that markets and their rules play an essential role in economic activities was born and strengthened because of the Little Ice Age ravages in Europe.

Thanks to the first agronomists and the first specialized books, the gradual transformation of agricultural practices, the emergence of distance trade and landowners interested in profit, the development and professionalization of tax collecting administrations, and state bureaucracies, the foundations of a new Europe were created. But that was not enough. There was also a need to increase the level of education. Since 1600, in Europe, more and more children (mostly boys) went to school to learn to read, write arithmetic, understand religion, and know the rudiments of geography and history. The Protestant Reformation (with Martin Luther, John Calvin, etc.) and Catholic Counter-Reformation used schools for cultural advancements.

On another level, the Little Ice Age period witnessed large-scale cultural events, such as the Renaissance, followed by the Enlightenment, the invention of the scientific method and printing, and the activity of titans of literature, painting, and philosophy. However, we must be careful when considering a presumption of direct causation between the effects of the Little Ice Age and cultural feedback. Other causes had their role. Therefore, I do not think that we are dealing with a simple linear relationship and putting this interdependence under the analytical microscope requires detailed analyses and a space that is not the subject of this book.

Don Quixote and the Little Ice Age

Cervantes' masterpiece appeared in 1605 (and the second part after ten years), and one can speculate that the writer incorporated among the many adventures of *The Ingenious Gentleman Don Quixote of La Mancha* some realities of his time related to the Little Ice Age.

For example, when the natural order seemed to be tested by climatic vicissitudes, many people began to speak of an impending Last Judgment. Any louder thunder was interpreted as the first herald of the Apocalypse, or the four horsemen's horses' hooves, bringing famine, disease, death, and destruction to sinners. Following this logic, repentance and other forms of personal piety became increasingly popular in Spain, France, southern Italy, and the Alps. Religious processions, in which holy relics and other worship objects were carried, followed by flagellants whipping themselves to blood, were spectacles that Cervantes probably followed.

Processions to invoke rain were common in Spain because prolonged and devastating droughts were an ordeal for many people, mostly the peasants. Even in Barcelona, a seaside town, two or three rain processions took place annually around 1600.

Such a procession is described in *Don Quixote* when the Knight of the Sad Figure approached participants. He had just confused a statue of the Blessed Virgin carried by the faithful with a noble young lady seized against her will and, therefore, desperate to be saved by a mighty knight. But, as we know, the rescue attempt ends badly for the noble and brave knight.

Little Ice Age, the first fake news and the first clickbait headlines

During the Little Ice Age, Amsterdam was not only an international, commercial, and cultural center of the first order but also one of the numerous publication activities. Until the eighteenth century, intense lucrative activity was related to the publication of censored books, coming clandestinely from France and other European countries. People read the Bible and popular novels, such as *Mariken van Nieumeghen*, *Till Eulenspiegel*, *Amadis de Gaula*, and *Floris and Blancheflour*. Books about the Dutch pirate Claes Compaen and the captain and merchant Willem Ijsbrantszoon Bontekoe of the Dutch East India Company were also printed.

News from around the world was also popular and appreciated in Amsterdam, a port with international connections, which could be reached relatively quickly. During wartime the news was essential, and its informational value was critical. Many times, however, the news was controversial. And distorting the truth and making fake news is not a Trump-era invention.

For example, abbot Wouter Jacobszoon, who took refuge in Amsterdam in 1572, complained that the war news read in one-page pamphlets and sold cheaply on the city streets was nothing more than empty words and fabrications to spread lies about Catholic Spain. The abbot decided not to read such papers, which only spread sensationalist news, fear, and disgust in good Catholics' hearts.

Because the reading public wanted sensational stories, the market adapted to the demand. In the middle of the seventeenth century, four hundred booksellers were active in Amsterdam, most of whom were also publishers. The publication, in large print and using many illustrations, was cheap, except for the covers. That's why the books were sold in stacks of unbound pages and advertised directly on the street by the boy-sellers with headlines such as, "A miracle!" or "Shocking news!"

Some pamphlet newspapers, sold on the streets of Amsterdam, survive in the city's archives. Journalist Philipp Blom found many clickbait headlines, similar to those in today's press: "A terrible murder in Delft!" "The terrible fire in Wilda!" "An amazing ghost in Brussels!" "Come and see how three students from Cloppenburg raped two girls and killed four!" "See how 64 witches killed over a thousand people and six thousand cows!" Honestly, I do not know precisely where to place these Dutch contributions. They could be losses or gains made during the Little Ice Age.

Et pour la bonne bouche . . . Have you ever wondered why Stradivarius, Guarneri, or Amati violins produce an excellent, rich sound and cost very high prices, too? One possible answer suggests another gain from the Little Ice Age.

The famous Italian luthiers benefited from the wood of the coniferous forests around Cremona, a city located to the south of the Alps. In 2003, Lloyd Burckle at Columbia University and Henri D. Grissino-Mayer at the University of Tennessee published a study suggesting that the extraordinary features of Italian stringed instruments in their golden age could be related to a unique climatic situation in the period 1645–1715, called the Maunder Minimum. It was a period of low solar activity, which contributed to lower temperatures and tree growth rates. In other words, the trees needed more time to grow and mature. Consequently, the spruce wood, used by Antonio Stradivari and the other famous luthiers, had closer and more uniform annual rings forming a denser structure, which favors a sound with superior qualities and a more intense resonance. Since the wood for the instruments was dry and aged for a generation, it turns out that the trees used around 1700 must have been felled no later than 1680, meaning they grew and matured during the Maunder Minimum at the height of the Little Ice Age.

The unique combination of low temperatures during the Little Ice Age and the environmental properties (i.e., topography, elevation, and soil conditions) characteristic of spruce forests in the Cremona area has never been repeated since the golden age of Stradivarius.[9]

Conclusions

The Little Ice Age, a rebellion by nature, and the global crisis it generated form a unitary interpretive framework, from which some legitimate questions arise: Does climate change transform human societies as well? If so, in what way and how deep? And what do you gain, though, when something is lost? Are there lessons for the humanity of the twenty-first century, frightened by a possible climate apocalypse with a changed (+) sign?

In the seventeenth century, human life had become, according to Hobbes, short, nasty, and brutal. And the world was a confluence of wars, changes in political regimes, popular uprisings, and unprecedented climate disasters. Although the seventeenth century was probably the most turbulent (e.g., climatic, economic, political, social, and military) of the entire Little Ice Age period, Europe found new metaphors to reinvent itself. It was the quintessential phoenix bird.

Forced by cold and misery, Europe conceptualized anew nature and a new, realistic, empirical, and pragmatic approach to human society. Europe's economic and intellectual hegemony was born out of the chaos and stepchildren of the Little Ice Age.

Blom believes that the climate crisis has accelerated a social and economic dynamic driven by a growing middle class by more developed trade, more empirical knowledge, expanding knowledge, growing markets, inventing market mechanisms, and intellectual renewal. Economic disasters and social unrest have destroyed old hierarchies and rewarded the most inventive and mobile societies. The Little Age, as a catalyst, transformed the West and formed the present.

The complex transformation of European societies started during the most severe decades of the Little Ice Age and played a decisive role in building western countries' hegemony as the dominant world powers for the next four centuries. In contrast, it should be noted that during the same climatic period, severe winters, a devastating famine, wars, and civil wars in Russia, China, and the Ottoman Empire did not lead to changes similar to those in Europe in agriculture, economy, and culture. Therefore, it can be said that the West has gained global dominance through the qualities and ideas intrinsic to European culture, developed during and because of global cooling.[10]

The Little Ice Age history offers us lessons to apply in our time of global warming / climate change / extreme events. It is clear that humanity, going through 500 years of unprecedented climatic vicissitudes, has not succumbed, despaired, and disappeared. In the Middle Ages, innovative, market-oriented societies were saved from the Little Ice Age's real apocalypse.

Through ingenuity and talent, adaptation solutions have been found. The Little Ice Age was the greatest human climate adaptation project, a triumph that deserves to be reproduced today.

CHAPTER 21

IS THERE AN AVERAGE TEMPERATURE OF THE PLANET? ABOUT THE SIMPSON PARADOX AND ITS IMPLICATIONS

Whenever polar ice waves fall over the planet, the ad hoc explanation is as follows: cold waves, like heat waves, have a common cause: anthropogenic global warming. How can one single cause explain these opposite weather extremes? The answer is simple, with the main emphasis on the upward trend of a statistical parameter called global mean temperature (GMT), as seen in Figure 21.1.

GMT was inaccurate from the beginning, and I have been trying to find answers to some simple questions for a long time: Why use one average and not another? Are global air temperatures averaged by season, day, night, altitude, and location to finally produce an annual average, which will then be averaged over five-year intervals?

Temperature variations are a pretty good approximation of the overall heat content, but do they have enough significance?

Despite popular thought, temperature and energy are not equivalent. Temperatures can be very high at very low energies. While heat is a form of energy, the temperature is fundamentally a measure of how energy is spread in quantum states. For example, radiation from a small laser, powered by flashlight batteries, can have temperatures peaking at ~ 10^{11} K. These are higher than those found in many stellar interiors, but the heat of such beams cannot be felt even by hand.[2]

The most disturbing aspect of the parameter called "global mean temperature" for me is that statistically calculated values are considered to represent *real* temperatures and that the climate system, in a state of thermodynamic non-equilibrium, would have *only one temperature*. In Figure 21.1, that temperature would have been, in 2017, 0.9°C higher than the base value, which, in turn, is an average of the temperatures of 1951–1980. But an average of the temperatures measured in an unstable thermodynamic system is not a temperature. And the earth is not in thermodynamic equilibrium either with its inner components or with the surrounding space. Therefore, we cannot speak of *a single* and significant temperature[3] (*et passim*).

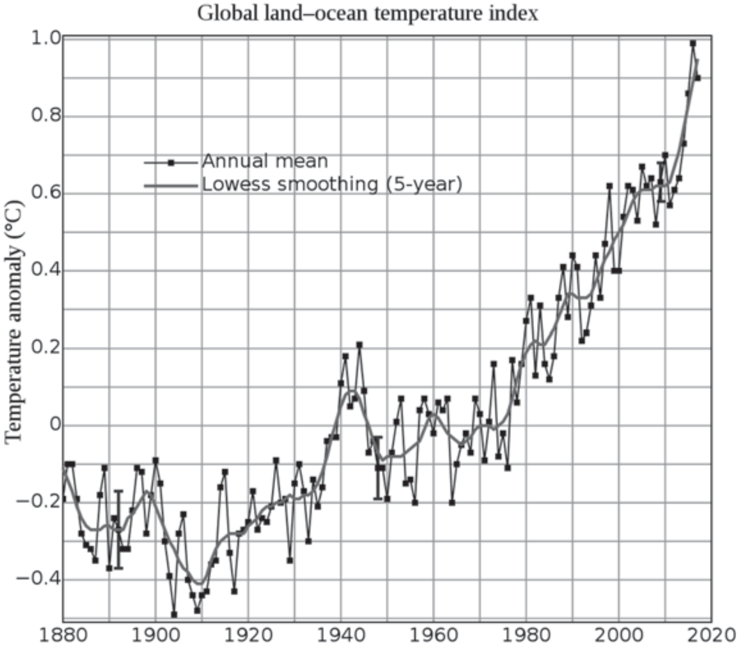


Figure 21.1. The variation of the global mean temperature since 1880. The blue bars of uncertainty indicate the 95% confidence range.[1]

Extensive variables and intensive variables

Extensive variables (e.g., volume, mass, distance, energy, entropy, electric charge, the water content of rocks) are proportional to the size of the system they come from and are based on the logic of part-integer relationships. These variables are additive, which means that their summed or mediated values will retain their original meanings and be representative of the systems from which they come. For example, if I pour two liters of wine into a bottle containing one liter of wine, I will get three liters of drink.

Intensive variables, based on the logic of covariation, are independent of the system size from which they come and represent a property of that system, such as temperature, electrical potential, water flow potential, and more. The combination of two intensive variables is not additive, which means that a sum of two subsystems will not produce an intensive variable quantitatively equal to the components' sum. For example, if I pour a liquid composed of 20% wine and 80% water into a vessel containing 60% wine and the rest water, I will not get a liquid with 80% wine because the final concentration depends on the proportions of the subcomponents, not their sum!

Another example: Because intensive variables are not additive, summing the temperatures of two identical subsystems will not generate twice the initial components' temperature. And calculating an arithmetic mean, or the sum of the components divided by the number of components, is therefore without a well-defined physical meaning. In the case of temperature, the average weighting is currently used, considering circumstances that could (theoretically) approximate the equilibrium conditions after summation. But such a test is irrelevant in the case of the earth's climate, an unbalanced thermodynamic system par excellence.

A correct definition of temperature T in such a system makes physical sense. It occurs in the entropy production rate Σ, an important parameter that measures the distance of a system to the equilibrium state and, at the same time, the speed of approach to that equilibrium. The parameter S has a generic form based on the expression of equilibrium in the case of the partial entropy derivative, $\partial S = \partial Q/T$, where ∂Q represents the partial derivative of heat or random energy, or the variation of the energy of the system when the volume and number of particles are kept constant. The above relation shows that temperature describes the particular ratio between the partial derivative of a system's internal energy and the partial derivative of the entropy of the same system: $T = \partial Q/\partial S$.

When the system is not in equilibrium, the entropy Σ does not show a clear dependence on the system's total energy, and the definition of temperature becomes ambiguous. However, to obtain a working value of temperature, a fundamental requirement must be applied. The whole system is decomposed into subsystems whose entropies depend only on the energies of each subsystem. That is, the unbalanced system must be broken down into subsystems that each have their own equilibrium. Under these conditions, there is no need for a balance of the whole system.

In everyday life, the temperature is rarely measured as defined above. Indirect or proxy measurements are used: variation of a volume, bending of a bimetallic lamella, radiation spectra, width of the rings in a tree trunk (dendrochronology), the thickness of sediments, the composition of sediments, the difference between the relative concentrations of oxygen isotopes, etc.

All these measurements are based on various assumptions that must be fulfilled a priori. Although well known in the world of physicists and chemists, these metrological restrictions are not found in measuring/calculating average values of the temperature index, as seen in Figure 21.1. Notwithstanding, those values are used as a supreme argument in current debates on climate change. Moreover, there are no physical arguments in favor of using a certain statistical parameter, like the global average temperature index. Yet that index is considered the main manifestation of the current climate change.

If the International Organization for Standardization (ISO) has already published metrological standards for measuring greenhouse gases (i.e., ISO 14064 and ISO 14065), the same has not happened with adopting an international standard for measuring global average temperatures. However, it has been promised for many years.

The statistical parameter, called GMT, is just a particular type of average. It is not the only AVERAGE possible because there is a myriad of legitimate mathematical options. Over 100 different temperature mediation methods have been used in meteorology and climatology articles, and new proposals appear regularly.[4] ISO tried to impose a unique, universal method but failed.

Why? Because, according to Popper, there is no practical experiment or theoretical way of falsifying a particular choice of environment. If the environments are proclaimed to be real temperatures, we will be struck by the consequences of a paradox, as discussed by Edward Simpson in 1951.

The Simpson paradox—is the average of averages an average?

The Simpson paradox is a phenomenon present in probability and statistics. The association of two variables in a subset of data (discrete or continuous) of a population may be similar to the association of variables in another subset but separate from the association of variables of the total population. If the initial association indicates a trend, it is possible that in the final association (the combination of data subsets), that trend disappears or is reversed.

Consider that discrete temperature data were recorded at different latitudes in two different geographical regions, as shown in Figure 21.2. If we represent these data, it can be noted that for each subset (red or blue region), there is a negative trend between temperature variations and latitude values (dashed blue and red lines, respectively). As the latitude increases, temperatures tend to drop. But if we ignore the two regions' positions and combine them in a single set of temperatures, then individual (decreasing) trends of each region are reversed (the dashed black line shows an increasing trend).

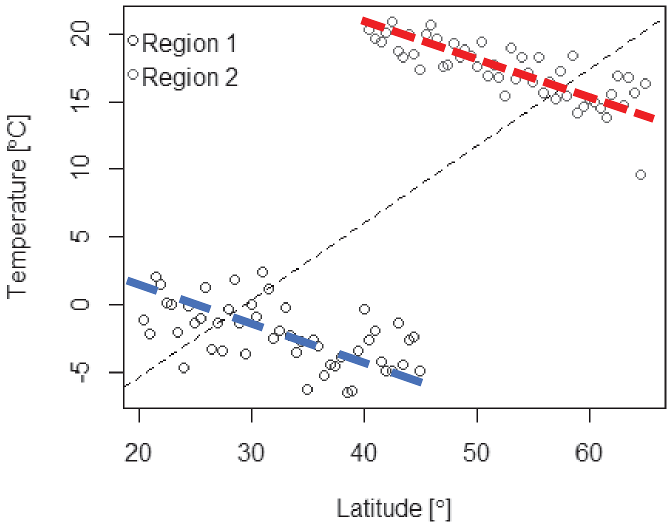


Figure 21.2. Scatterplot of the temperature (°C) recorded at various latitudes (°) in two different geographical regions (simulated data) as an illustration of the Simpson paradox: the trend that is observed within each region is reversed when they are combined (modified).[5]

A mathematical version of the situation in Figure 21.2 can be written as:

$$\frac{x_1}{y_1} < \frac{z_1}{w_1}$$

$$\frac{x_2}{y_2} < \frac{z_2}{w_2}$$

But the combination of the two data sets does not necessarily generate a relationship such as:

$$\frac{x_1 + x_2}{y_1 + y_2} < \frac{z_1 + z_2}{w_1 + w_2}$$

For example:

$$\frac{1}{10} < \frac{3}{17} \; ; \; \frac{8}{10} < \frac{6}{5}$$

But

$$\frac{9}{20} > \frac{9}{22}$$

To demonstrate that the mean of the averages is not an average, as is the case for measurements of temperature, sea level, humidity, and more, average math can be used:

4; 5; 6; 6; 5.5

The arithmetic mean of the set is **26.5/5 = 5.3**

Let's now divide the original set into two subsets:

4; 5
6; 6; 5.5

The average of the first subset is: **9/2 = 4.5**

The average of the second subset is: **17.5/3 = 5.83**

The average of the two subsets is **5.17**, which is lower than the initial average (**5.3**). That is, the average of the averages is not an average.

The above inequality is valid only for sets with unequal numbers of components, which is the current case for sets with temperature data. Natural sets of temperatures are never equal in the number of individual components for historical reasons. In the beginning, there were much fewer measured temperatures than there were in the 1990s, and then the station number decreased again when some weather stations were eliminated for various reasons.[3]

Consider another example:

On your kitchen table, you place a cup of water and ice (temperature 2°C) next to a cup of coffee (temperature 34°C). The two cups do not touch each other because they are insulated systems and are allowed to relax at room temperature (20°C), according to Newton's law of cooling/heating fluids. If you wait 10 minutes, how will you characterize the environment in your kitchen in terms of the "climatic" evolution of the two cups with different liquids? Global "warming," global "cooling," or something else? What kind of thermodynamic system is your kitchen? Can you apply the

Simpson paradox to assess the state of the kitchen system + cup of ice water + cup of coffee?

A possible answer would be: In a system in non-thermodynamic equilibrium, we can experience simultaneous heating and cooling. Following the graph in Figure 21.2 and what happens to the two cups, it turns out that a system "heats" or "cools" depending on the choice of average temperature, a choice that is independent of the system itself.

In 2013, Jürgen Scheer and Esteban Reisin presented examples of the clear manifestation of the paradox in the case of atmospheric temperature data. They conclude that increasing the volume of data does not simplify the analysis of identified trends. To solve the Simpson paradox, the authors recommend additional efforts to diagnose and remove the impact produced by instrumental artifacts along with considering other geophysical variations with long-term contributions.[11]

But if the GMT statistical values calculated by various climate organizations (e.g., NASA, NOAA, GISS, and HadCRUT) are not real temperatures, what are they? How can they be used as climate alarm signals? Aren't they just ad hoc numbers that exemplify the infinity of choices available for calculating GMT?

To date, proponents of anthropogenic global warming have not provided a plausible answer to these questions. The fact that too few people ask these natural questions, accepting, instead, the consensus of the 97% of experts who agree with anthropogenic global warming,[6] can be partly explained by the power of habit. People hear and use the concept of average intensely and accept it without shouting, even though often, the media is a stateless statistical parameter. Personal income and height make sense both at the individual level and on average at the level of a population. But for phone numbers, which make sense and are useful on an individual level, summing up and calculating their average are meaningless actions.

For anthropogenic global warming supporters, the lack of metrological and physical clarity of the parameter called GMT seems to have less ontological relevance. Instead, they are concerned with apocalyptic prophecies, some of which are entirely miserable but attributable without exception to global warming: viral infections in frogs,[7] encephalitis in horses,[8] decreased male fertility,[9] increased abortions among women who live near the ocean or on the banks of rivers.[10]

The consequences of the Simpson paradox on the calculation of GMT must be considered. Because that magical value (GMT), used as the supreme argument of climate policies to argue for anthropogenic global warming, is constructed as the average of several environments. NASA and NOAA, the largest United States federal organizations responsible for measuring global temperatures and issuing climate alarms, use different methods to calculate average temperatures.

Conclusions

Physical, mathematical, and observational reasons indicate no physically significant average temperature for the entire planet. The motivation for this assertion, convincingly stated by Essex et al. (2007), is found in "the properties of the state equation" that govern the "local thermodynamic equilibrium" and in the unavoidable consequences of substituting physics with statistics.

A particular temperature domain can be interpreted simultaneously as both "heating" and "cooling," rendering the concept of heating in the context of global warming an ill-posed problem from a physical point of view.[2]

The Simpson paradox, through its consequences, suggestively illustrates the dangers that accompany different methods of statistical calculation of GMT. Avoiding it requires careful exploration of the data before analyzing them and drawing erroneous conclusions.

To the question in the title of the article by Essex et al. (2007), "Does a global temperature exist?" the authors answer unequivocally:

There is no global temperature.

Chapter 22

Electric Vehicles and Their Dependence on Big Oil

The debate about electric vehicles usually omits an oxymoronic aspect: electric vehicles are dependent on Big Oil, more precisely on the petrochemical industry. Without this dependence, electric vehicles would not have been able to successfully compete with internal combustion engines.

Leaving aside ecological idiosyncrasies, fossil hydrocarbons have produced an impressive list of human civilization benefits, from the 1860s to the present. Let's just think that, as I have shown recently, oil is the Achilles' heel for modern agriculture[1] and that thousands of products we use every day are derived from oil and gas. The beneficiaries' list must also include electric vehicles, whose plastic and carbon fiber components are derived from oil and gas.[2]

Why are plastics so crucial in electric vehicles? Because the "cars of the future" must be as light as possible to increase the distance traveled between two successive power supplies. If an electric battery weighs up to 600 kg, which is a quarter of the total mass of an electric vehicle, the designer and the manufacturer must find solutions not to make the car much heavier. And solutions mean the use of many plastic components.

The automotive industry's symbiosis with the petrochemical industry began in 1916 when Rolls Royce decided to use a formaldehyde-based resin in automobiles. In 1941, Henry Ford began experimenting with plastic on the steel chassis, achieving a considerable reduction (500 kg) in vehicle mass. Gradually, various polymers embedded in plastics and carbon-fiber-reinforced materials have made their way into cars' structure, exceeding 1,000 components but weighing less than 160 kg in total.

Plastic accounts for over 50% of vehicle volume but only 10% of the mass. The oil and gas derivatives used in the automotive industry have other qualities that make them indispensable for modern vehicles, including electric ones. They are cheap, abundant, durable, easy to mold in various forms, fire-resistant, quiet and comfortable, recyclable, and more.

The dependence of electric vehicles on Big Oil is often overlooked in contemporary medicine and the pharmaceutical industry. For example, disposable plastic items are an essential component of modern medical services. During the current Covid-19 outbreak, it was estimated that,

> if the global population adheres to a standard of one disposable face mask per day… the pandemic could result in a monthly global consumption and waste of 129 billion face masks and 65 billion gloves … The global plastic packaging market size is projected to grow from USD 909.2 billion in 2019 to 1012.6 billion by 2021, at a compound annual growth rate of 5.5%, mainly due to pandemic response.[9]

Since aspirin's synthesis in 1897, oil and natural gas products have saved doctors and patients' time and money. They are essential in diagnosing and treating a long list of medical conditions. In fact, many medical advances would not even be possible without polymers and other petrochemicals.

Attempts have indeed been made to produce biopolymers, in which a small part comes from renewable resources, like corn and sugar cane, and the rest from fossil carbon.[3] However, high production costs make them uncompetitive with Big Oil polymers.

As more and more electric vehicles are demanded on the market, their dependence on the petrochemical industry is also reflected in the spectacular increases in plastics production. The global demand for polyethylene, the most common polymer in plastics, doubled between 1999 and 2018, reaching 100 million tons per year.[4] To complete the picture, we must also add the increased productions of polypropylene, polystyrene, polyolefin, nylon, and others.

In 2018, 3.66 billion tires were manufactured.[5] Each tire contains 60% synthetic rubber, which is an elastic polymer made of hydrocarbons. Every year, 15.13 million tons of synthetic rubber are produced.[6] Depending on the model, the production of a single standard tire requires between 15 and 38 liters of petroleum.[7] This means that just the tire production of 2018 consumed anywhere from 54 billion to 139 billion liters of oil.

Unless natural rubber can completely replace synthetic rubber, the alternative for future cars would be wooden tires.

Electric vehicles and anthropogenic global warming

The strongest point of advertising for an electric vehicle is the lack of CO_2 emissions. I'm only talking about pure electric vehicles, like Tesla, not hybrid ones, which emit CO_2 when they switch to petrol/diesel. It is even supposed that, with total electrification of land transportation (for now; later in the future, naval and air transportation), humanity would produce 25% less CO_2. Reducing the remaining 75% of anthropogenic greenhouse gas emissions from agriculture, construction, and other fields does not raise the same environmental belief and passion that transportation inspires.

Thus, electric vehicles' dependence on fossil fuels, the deadly "enemies" of the environmentalists, is stronger than ever, and no early signs of divorce are seen.

But what about the carbon footprint of electric vehicles? Is it zero, as it lets us understand the companies' excellent advertisements that produce such cars?

The statement, "Electric vehicles (EV) pollute little and emit insignificant amounts of greenhouse gases," is counteracted by the fact that EV generate considerable environmental externalities:

a) greenhouse gas emissions from the use of nonrenewable electricity
b) pollution resulting from the production and dumping of batteries
c) high water consumption during production

If the electricity used to charge the batteries does not come from a renewable source, it means that we have thrown the dead ecological cat from our garage in the yard of the thermal power plants powered by coal, fuel oil, and natural gas. In other words, the truth of the sentence, "electric vehicles do not emit greenhouse gases," depends directly on the primary source of electricity.

Figure 22.1 lists the CO_2 emissions of electric vehicles by country.

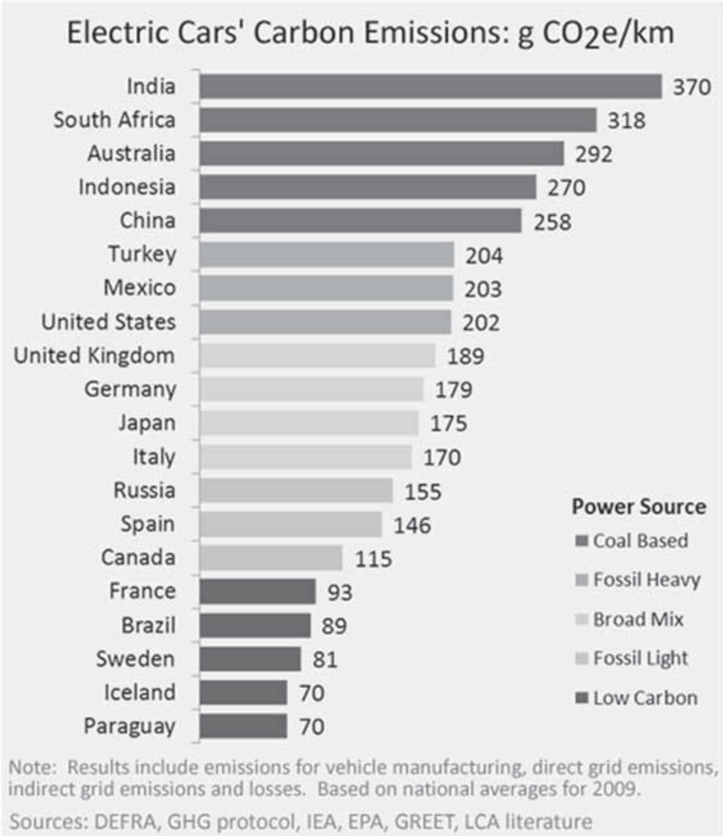


Figure 22.1. Emissions of electric vehicles by country, in gCO_2/km[8]

It can be noted that electric cars running in China, India, Indonesia, Australia, and South Africa, countries whose energy is mainly produced from coal, will have CO_2 emissions four to five times higher than those of cars running in Iceland, Sweden, Brazil, Paraguay, or France, where electricity is generated predominantly from noncarbon sources (hydro and nuclear).

Instead of emissions in gCO_2e/km, another parameter allows a direct comparison between the emissions of a petroleum-fueled vehicle equivalent to those of an electric vehicle in terms of fuel economy, as shown in Figure 22.2.

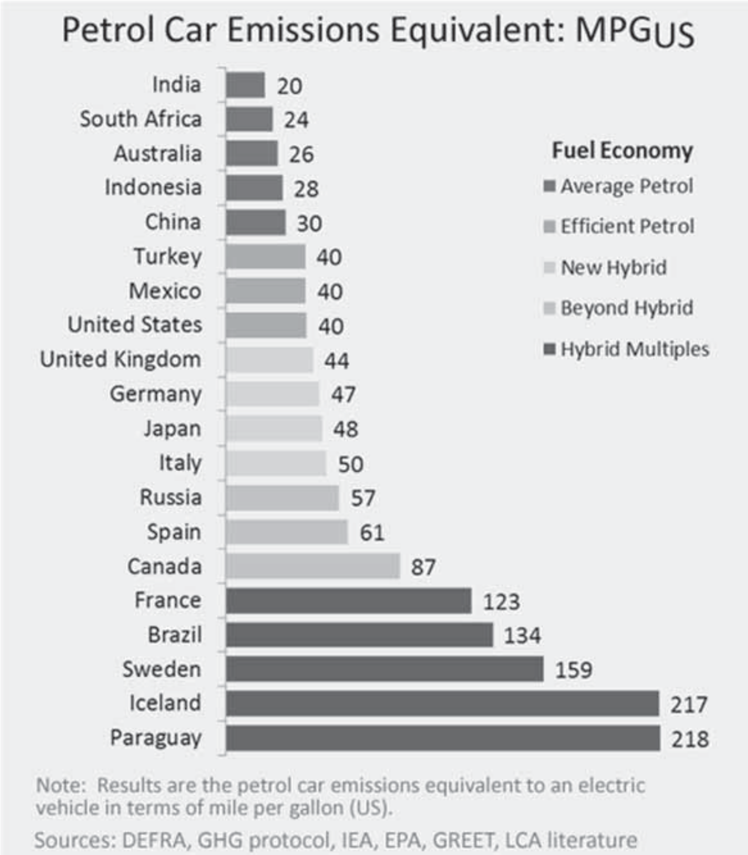


Figure 22.2. Comparisons between electric and internal combustion vehicles based on fuel efficiency.[8]

What can be inferred from the data illustrated in Figure 22.2? Depending on the country and its primary energy sources, the CO_2 emissions of electric vehicles range from values similar to the emissions of petroleum-based vehicles to values less than half of the most powerful hybrid vehicles.

For example, in Paraguay, an electric vehicle produces emissions equivalent to gasoline vehicles that would consume 1 liter/100 km. At the other extreme, in India, an electric vehicle will generate CO_2 emissions equivalent to those of a gas-fueled vehicle with a consumption of 12 liters/100 km.

In the United States in 2009, the emissions of electric vehicles were equivalent to those of gas-fueled vehicles with a consumption of 9 liters/100 km.

In Canada and France, electricity is produced predominantly from hydro and nuclear power, respectively. In these countries, electric vehicles' emissions are equivalent to those of oil vehicles with a consumption of 2.7 liters/100 km and 1.9 liters/100 km, respectively. The potential of electric vehicles to reduce CO_2 emissions is significant in both countries.

Conclusions

The carbon footprint of electric vehicles varies depending on the primary energy used to produce electricity. In other words, the massive introduction of electric vehicles in countries with billions of inhabitants, such as China, India, Indonesia, will not generate the much-desired reduction in CO_2 emissions as long as those countries burn coal in thermal power plants. Perhaps the advertisements for Tesla should contain warnings: "Our electric vehicles **apparently** do not emit greenhouse gases. In reality, there are just externalized emissions of the type."

The dependence of electric vehicles on plastics, resins, adhesives, and more will not disappear soon. Increased demand for such vehicles triggers proportional demand for petrochemicals. Even if all transport in the world became 100% electric, Big Oil will not perish in the absence of gasoline, diesel, and natural gas buyers. Big Oil will continue to exist and thrive. It will move massively on petrochemistry and expand its current activities in other economic branches and electric vehicles, such as agriculture, medicine, pharmaceuticals and cosmetics, paints, thinners, lubricants, and others. Only when oil and gas run out will we have to find substitutes similar to today's petrochemicals in terms of being light, cheap, and abundant.

CHAPTER 23

IT IS DIFFICULT TO MAKE PREDICTIONS, ESPECIALLY ABOUT THE FUTURE . . .

That's what an old proverb says. And yet, people don't stop from always trying. Maybe, the proverb will turn out to be wrong in the end.

Every year, government agencies, organizations of all kinds, exploration and production companies, consultants, bankers, and others launch new predictions about energy demand and supply in the public space, with the (currently mandatory) discussion of future CO_2 emissions.

As in the case of climate predictions, we are also dealing with models starting from different reference situations (e.g., initial conditions, limit conditions, more or less independent and/or relative parameters, data sets varying in size and content). A direct consequence of this approach is that we do not have, in the end, a single prediction, but instead, several futuristic scenarios with different coordinates and parameters.

The principal value obtained from these predictive models is their capacity to capture the range of individual opinions of those interested in energy issues at a specific point in time. That is, each prediction delivers unique predictions and perspectives based on various assumptions. Like climate systems, global energy systems are influenced by so many variables it is unlikely that all predictions will be correct. I find it more interesting to study how plausible the proposed scenarios are because they define the limits of how circumstances can evolve.

To illustrate the above statements, I consulted four such predictive energy reports:

- Global Energy Perspective 2019: Reference Case January 2019, published by the management consulting firm McKinsey & Co., New York.[1]
- Annual Energy Outlook 2019 with projections to 2050 (AEO2019), published by the Energy Information Administration, Washington DC.[2]
- BP Energy Outlook 2019 Edition, published by British Petroleum.[3]

- Oil 2019 Analysis & Forecast to 2024, published by the International Energy Agency in Paris.[4]

More energy = More wealth

A typical and common scenario, on which the four predictions agree, is that as the world becomes richer over time, the availability of increasing amounts of energy will become an essential predictive element. Sustained economic growth, stimulated and sustained by rising energy demand and supply, offers larger and larger populations the chance to raise their living standards.

Compared to 1970, world GDP grew by 250% in 2016, and the population exceeded 7.7 billion. BP's forecast predicts a doubling of GDP by 2040; the McKinsey & Co. report suggests that doubling will happen by 2050.

Will there be, however, a "decoupling" between energy demand and society's wealth?

As national economies grow and mature, they reach a threshold beyond which the rate of energy demand differs from the rate of GDP growth. Why? Because there is a transition from the subsistence economy to the manufacturing economy to the service economy. As a corollary, the energy intensity of those savings decreases, but economic growth will continue, only it will require less energy to sustain that growth.

Figure 23.1 shows this inverse correlation. Although global GDP (in real terms) will double between 2016 and 2050, global primary energy demand will increase by only 14%, from 571 million TJ to 650 million. TJ. McKinsey & Co. comment about this: "It is the first time in history that rising energy demand and economic growth are 'decoupled.' "

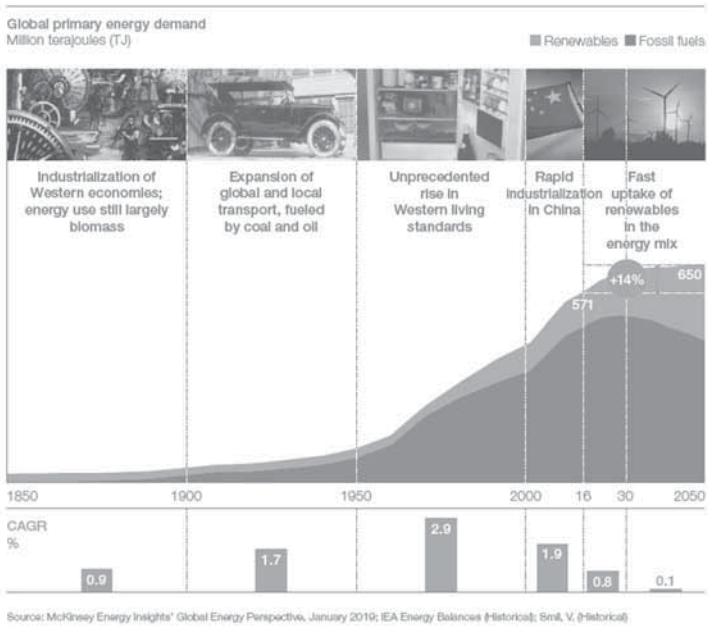


Figure 23.1. After more than half a century of rapid growth, global primary energy demand will be capped around 2030. This is the compound annual growth rate (CAGR) of energy demand.[1]

In the other predictions I studied, I did not encounter this dramatic situation. For example, Figure 23.2, produced by BP, does not show an energy demand plateau around 2030. However, BP notes that global energy demand will occur at a significantly lower growth rate than in the last 20 years.

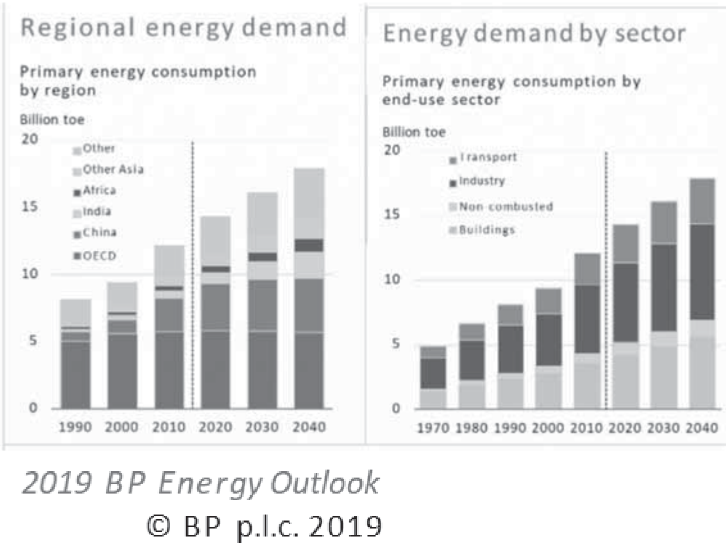


Figure 23.2. Energy demand by sectors, on the right, and by regional energy demand, on the left.[3]

Considering the domestic and international demand for oil and gas from the various sectors mentioned above, the United States EIA Administration notes:

> The United States will become a net exporter of energy in 2020 and will remain so throughout the forecast period [2019–2050] due to the large increase in the production of crude oil, natural gas and liquefied natural gas, associated with a slow increase in energy consumption in the USA.
>
> In the baseline scenario [see Note 5], US crude oil production will continue to set annual records until 2027 and remain above 14.0 million barrels per day (bpd) until 2040. Crude oil production development shale from the 48 mainland states continues to be the main source of growth in total US crude oil production.
>
> Liquid natural gas production increases by 32% between 2018 and 2050 as a result of increasing global demand in the petrochemical industry.

The prediction made by IEA covers a shorter period (2019–2024) than the other three attempts. The International European Agency is not shy to highlight the epoch-making importance of the triumph of American shales:

> The United States will lead to an overall increase in oil supply over the next five years, thanks to the remarkable power of shale production, triggering a

rapid transformation of world oil markets. By the end of the forecast, US oil exports will surpass those of Russia and move closer to those of Saudi Arabia, generating a greater diversity of supply.

While global growth in crude oil demand will slow down, especially as China slows down its development, there will still be an average annual increase of 1.2 million bpd by 2024. However, the IEA continues to see no peak demand in oil demand, as petrochemicals and aviation fuels remain key growth drivers, especially in the United States and Asia, over-compensating for declining gasoline demand due to increased efficiency and electric cars.

The evolution of the energy mix

Another common point of the predictions analyzed here is the evolution, or transition of the energy mix in the next 20–30 years toward a higher share of renewable energies. According to the BP report, renewables (i.e., wind, solar, geothermal, biomass, and biofuels) will increase by 7.1% per year, to represent 15% of total energy consumption in 2040, as shown in Figure 23.3. Currently, their share is 4%.

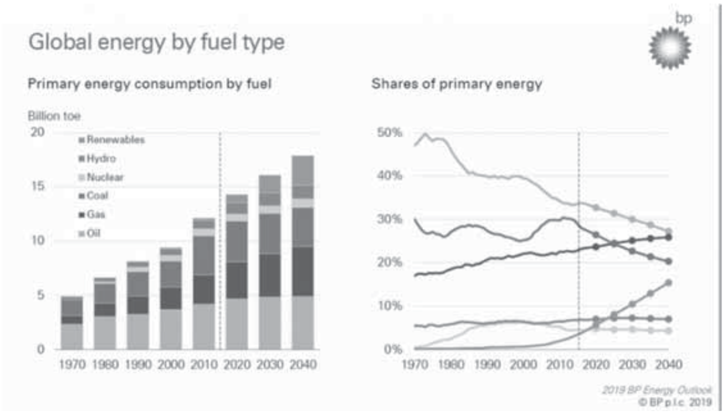


Figure 23.3. Primary energy consumption between 1970 and 2019, and predictions until 2040, according to BP 2019.[3]

The prediction made by McKinsey & Co. includes the category of renewables and other energies (nuclear, biomass, and hydro), thus providing more generous predictions than those made by BP. According to Figure 23.4, we will probably see a decrease in the demand for fossil fuels (i.e., coal, oil, and gas) from 75% in 2035 to 65% in 2050. Electricity consumption will double by 2050, and the share of renewable energy (i.e., wind, solar, biomass, hydro and nuclear) will increase from 25% in 2025 to 34% in 2050.

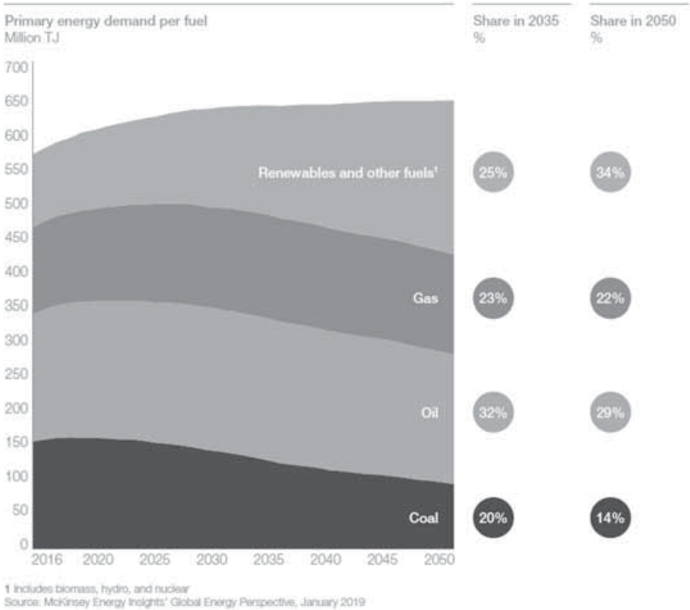


Figure 23.4. Primary energy demands in 2035 and 2050, respectively, according to the prediction of McKinsey & Co (2019). Fossil energy will decrease from 75% in 2035 to 65% in 2050. Electricity consumption will double by 2050, and the share of renewable energy (i.e., wind, solar, biomass, hydro and nuclear) will increase from 25% in 2025 to 34% in 2050.[1]

The prediction made by EIA 2019, shown in Figure 23.5, suggests an increase in gas demand by 5% between 2018 and 2050 and in the share of renewable energy by 13%. During the same period, nuclear energy's contribution will decrease from 19% to 12%, and coal's contribution from 28% to 17%.

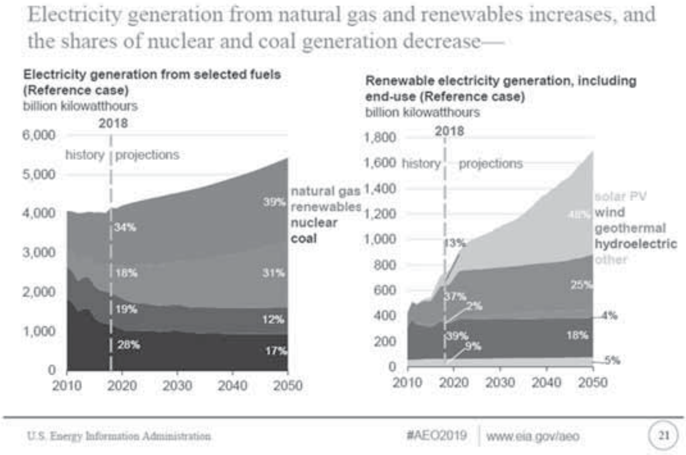


Figure 23.5. Selected sources of electricity and their share in the period 2010–2050, according to EIA 2019. The prediction refers only to the United States.[2]

The optimistic future of renewable energies could face an unexpected situation, which I analyzed in the article "A paradox: when renewable energies become cheaper, electricity becomes more expensive!"[6] Countries and states where wind and/or solar energy have advanced in the energy mix face nontrivial increases in electricity prices (e.g., Germany, Denmark, Australia, and California).

In 2013, Lion Hirth estimated that the economic value of wind energy in the European grid would decrease by 40% when the penetration rate reaches 30% of total electricity produced, while the value of solar energy will decline by 50% when it represents only 15% of the electric mix.[7]

The four predictions analyzed here do not discuss this paradox.

Will CO_2 emissions be reduced due to the increase in renewable energies?

In 2019, McKinsey & Co. predicted that global carbon emissions from energy consumption will peak in 2024, after which they will fall by around 20% by 2040 as coal consumption, predominantly in China and the power plant sector, falls.

But a scenario with global temperatures as low as 1.5°C or even 2°C remains far from reality. To achieve the desired goal, so dear to environmentalists, there should be either deep decarbonization or a reduction in energy demand in all economic sectors.

Hydrogen fuel cells could play an important role if sale prices fell in the United States to $3.5/kg or less.

Of the four scenarios proposed by BP, only the one called rapid transition (RT) offers hopes for reduced emissions; in 2040 it would be of the order of 18 Gt CO_2 per year, from about 33 Gt per year, as they are at present. The other three scenarios indicate a slower or more aggressive increase in carbon emissions, as shown in Figure 23.6.

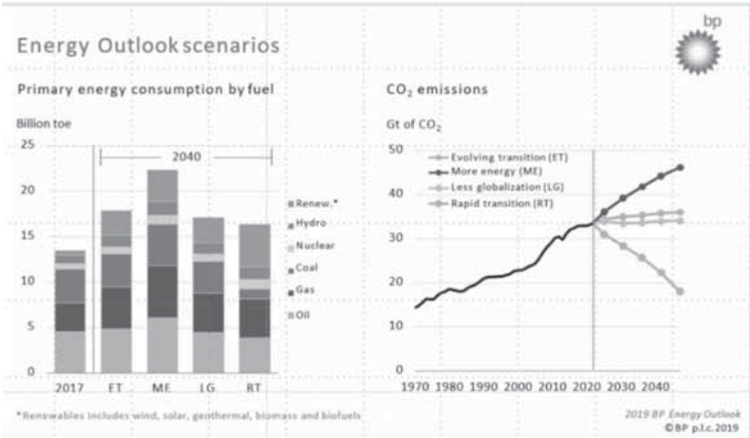


Figure 23.6. Four energy scenarios proposed by BP. Primary energy consumption for each fuel type (left); CO_2 emissions allocated to each scenario (right).[3]

What will happen to oil?

Although slow, oil demand will grow by 1% per year, reaching a cap of 108 million barrels a day around 2030. In 2050, the share of oil in the global energy mix is estimated in Figure 23.4 to be 29%, approximately equal to the share of natural gas shown in Figure 23.3. With natural gas, the oil will account for about 51% of global energy needs in 2040, demonstrated by Figure 23.4.

If the predictions come true, it means that oil geologists will be responsible for providing ***half of humanity's energy needs*** over the next 30 years. And this responsibility is not simple or easy. To meet this challenge, petroleum geologists will have to find, explore, and extract 108 million barrels of oil a day, year after year, at least until 2050! That is, there is still much room for oil geology in the twenty-first century.

Conclusions

Like predictions about the planet's climate future, energy market projections are undermined by great uncertainty, as many of the events shaping energy markets, as well as future developments in technology, demography, and resources, cannot be predicted with certainty.

The analysis of the four predictions presented here highlights the fact that a double challenge generates the greatest uncertainties of this period. On the one hand, we face the need for more energy to support continued economic growth and increased prosperity. On the other hand, there is a strong call for faster transitions to a low-carbon future. Some energies will be favored, and others will reach the museum and the pages of history books.

And let's not forget the current world's energy dilemma. Without a cheap, abundant, reliable, and scalable low-carbon energy source, we are stuck between two alternatives: energy poverty vs. high greenhouse emissions.

Chapter 24

Does Global Warming Mean Less or More Snow?

Au milieu de l'hiver, j'apprenais enfin qu'il y avait en moi un été invincible.

Albert Camus
Retour à Tipasa

At first . . . less snow

The earth has a fever, we are always told. Science has solved everything, and the debate is over. Experts are (almost) unanimous in their opinion that climate change is real and man-made, and we need to act immediately to stop or reverse it.

Over the last twenty years some climate experts, as well as a large part of the media, have told us and continue to tell us that global warming is accelerating everywhere and that winters are suffering more and more from this rapid warming. They say that the snow disappears rapidly, becoming a memory.[1] To them, snow and winter sports will become memories for future children that they see in the grandparents' photo album or a virtual reality created on the computer.

In short, we have been obstinately told that a direct consequence of anthropogenic global warming translates into *less snow*, followed soon by the disappearance of winters.

From the huge library of prophecies about the disappearance of snow, uttered by some of the 97% climate experts and amplified by most media, I chose a small list, which could be easily doubled or tripled:

2000—Dr. David Viner, Climate Research Unit (CRU), University of East Anglia

[In a few years, the snow will become] a very rare and exciting event . . . snow is starting to disappear from our lives.[1]

2000—Prof. Mojib Latif, IPCC expert, Max Planck Institute for Meteorology, Hamburg, Germany

Winters with heavy frost and a lot of snow like twenty years ago will no longer exist in our latitudes.[2]

2001—Intergovernmental Panel on Climate Change (IPCC) Third Assessment Report – Climate Change 2001: Working Group II – Impacts, Adaptation, and Vulnerability

Lower winter temperatures will reduce the number of massive snowstorms . . . [Warmer winters] and fewer frosty periods due to climate change.[3]

2004—Mark Lynas, British author, journalist, and environmental activist

Snow has become so rare that when it does fall – often just for a few hours – everything grinds to a halt. In early 2003 a ‘mighty’ five-centimeter snowfall in southeast England caused such severe traffic jams that many motorists had to stay in their cars overnight. Today’s kids are missing out . . . Many of these changes are already underway, but have been accelerating over the last two decades. Termites have already moved into southern England. Garden centres are beginning to stock exotic sub-tropical species, which only a few years ago would have been killed off by winter.[4]

2005—*Nature* magazine

In a warmer world, less winter precipitation falls as snow and the melting of winter snow occurs earlier in spring.[5]

2005—Christopher Krull, Black Forest Tourism Association

Planning for a Snow-less Future . . . Our study is already showing that that there will be a much worse situation in 20 years.[6]

2005—George Monbiot, a journalist at *The Guardian*

Winter is no longer the great grey longing of my childhood. The freezes this country suffered in 1982 and 1963 are, unless the Gulf Stream stops, unlikely to recur.[7]

2006—Deutsche Welle

New weather models predict arid summers and less time for winter sports in Germany if climate changed isn't turned around.[8]

2007—BBC "One Planet Special"

It seems that the winters of our youth are unlikely to return. Climate experts interviewed by the BBC predict warmer winters for the UK and the northern hemisphere.[9]

2007—*Western Mail* (Wales Online)

Former head of the Met Office Sir John Houghton, who is one of the UK's leading authorities on climate change, said all the indicators suggest snowy winters will become increasingly rare.

He said, 'Snowlines are going up in altitude all over the world. The idea that we will get less snow is absolutely in line with what we expect from global warming.'

Sir John, a former chairman of the United Nation's Intergovernmental Panel on Climate Change, added, 'Kilimanjaro in Africa will lose its snow and ice in the near future. The places which get snow will become snowless.'[10]

2007—*Die Zeit*: Winter ade

Goodbye, winter . . . At first the snow disappears and then in the winter.[11]

2008—*The Telegraph*

A study of snowfall spanning 60 years has indicated that the Alps's entire winter sports industry could grind to a halt through lack of snow . . . In some years the amount that fell was 60 per cent lower than was typical in the early 1980s, said Christoph Marty, from the Swiss Federal Institute for Snow and Avalanche Research in Davos, who analyzed the records. 'I don't believe we will see the kind of snow conditions we have experienced in past decades,' he said.[12]

2014—*The New York Times*

If greenhouse gas emissions continue to rise . . . then snow, winter and skiing will no longer exist as we know them by the end of the century.
The effect on the ski industry has already been significant. Between 1999 and 2010, the snowy years cost the industry $1 billion and up to 27,000 jobs.

The truth is, it's too late for all this. The greening of the ski industry is commendable, but far from it. Nothing but a change in national policy on how we produce and consume energy will keep our mountains white in winter—and slow global warming to a safe level.[13]

Then . . . more snow

Contrary to the false news uttered in the last 20 years by some climate experts and most mass media, the reality is different. The snow shows no signs of rapid disappearance. An anticipated "winter death" is just a rumor.

I chose to present below real data about the evolution of snowfalls published by specialized institutions. Figures 24.1 to 24.6 speak for themselves, which is why I left out the comments.

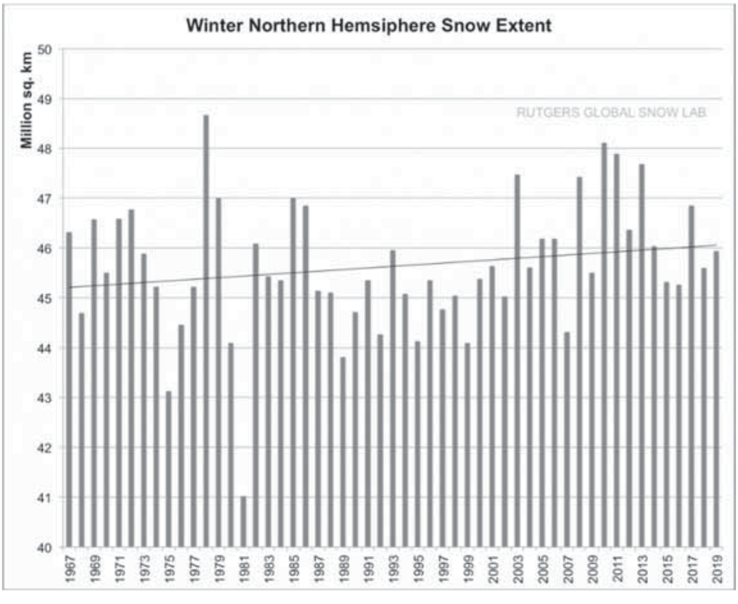


Figure 24.1. Between 1967 and 2019, there is a growing trend of snow-covered areas in the northern hemisphere.

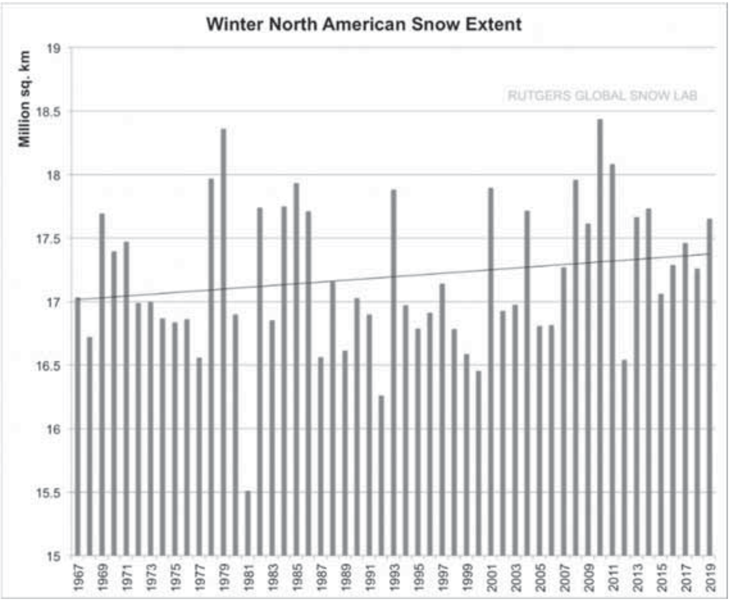


Figure 24.2. Between 1967 and 2019, there is a growing trend of snow-covered areas on the North American continent.

December 7, 2018 – North America had the most extensive snow cover in November in at least half a century.[14]

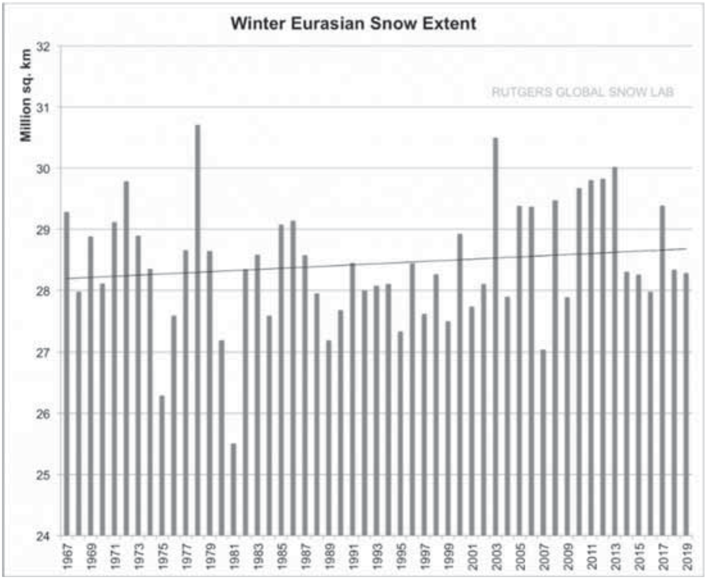
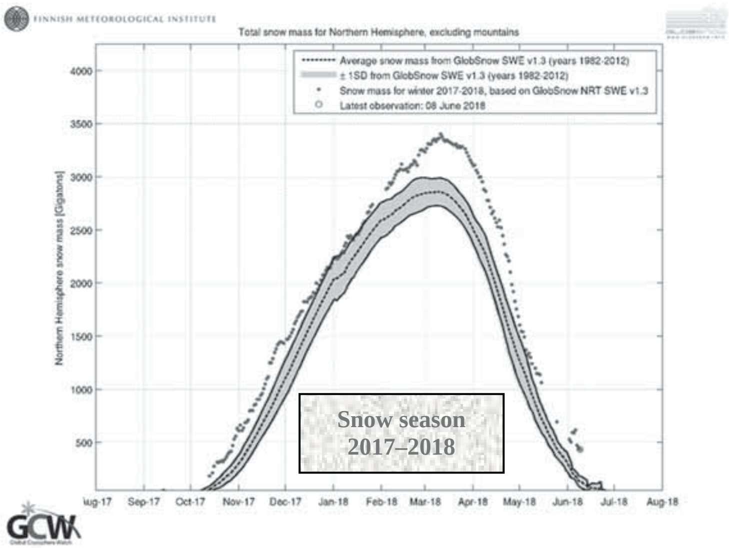


Figure 24.3. Between 1967 and 2019, there is a growing trend of snow-covered areas in the Eurasian area.[15]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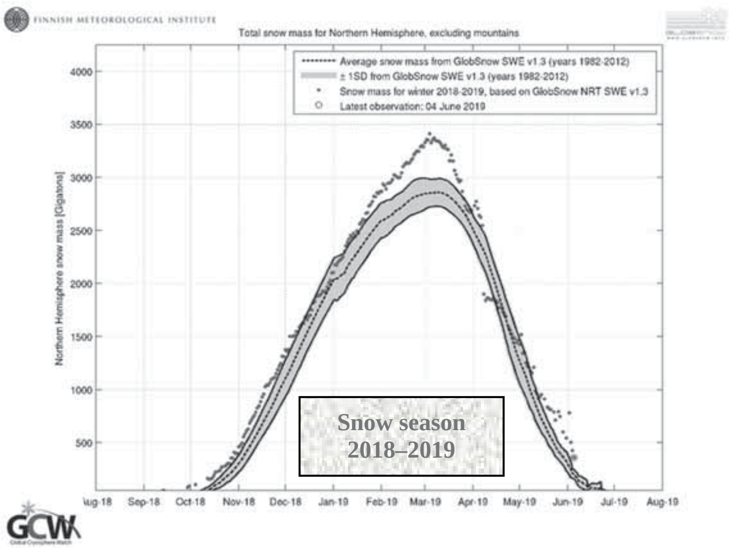
Snow season 2017–2018
Sep-17 Oct-17 Nov-17 Dec-17 Jan-18 Feb-18 Mar-18 Apr-18 May-18 Jun-18 Jul-18 Aug-18
GCW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Latest observation: 04 June 2019
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Snow season 2018–2019
Sep-18 Oct-18 Nov-18 Dec-18 Jan-19 Feb-19 Mar-19 Apr-19 May-19 Jun-19 Jul-19 Aug-19
GCW

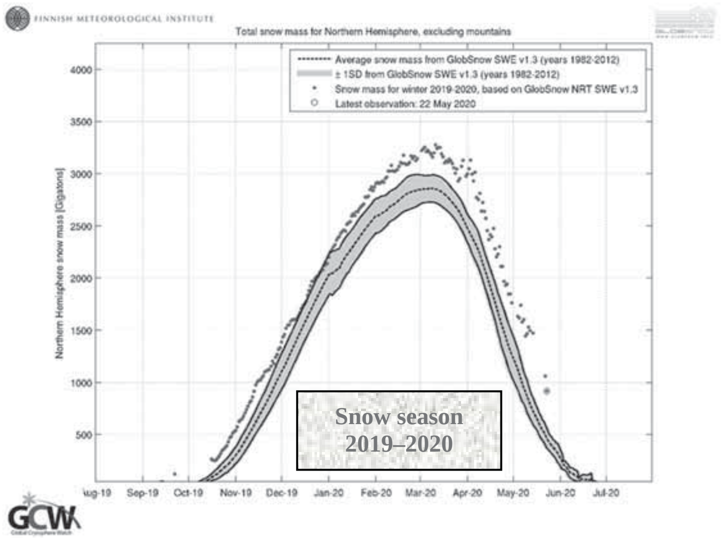


Figure 24.4. The total mass of snow accumulated in the northern hemisphere (excluding the mountains) between October 2017 and May 2020 mostly exceeds the average of the 1982–2012 period (modified from the World Meteorological Organization, Global Cryosphere Watch).[16]

The importance of data presented in Figure 24.4 cannot be overemphasized. In the last three snow seasons (2017–2020), the northern hemisphere accumulated **yearly** around 600–700 gigatons of snow above the average of the 1982–2012 period. So, not only did the region experience some of its snowiest seasons, but the snow also held on well into late spring and the beginning of summer. We should remember that this is the way glaciers form and grow. In the past, when the phenomenon persisted, this was the way the ice ages started.

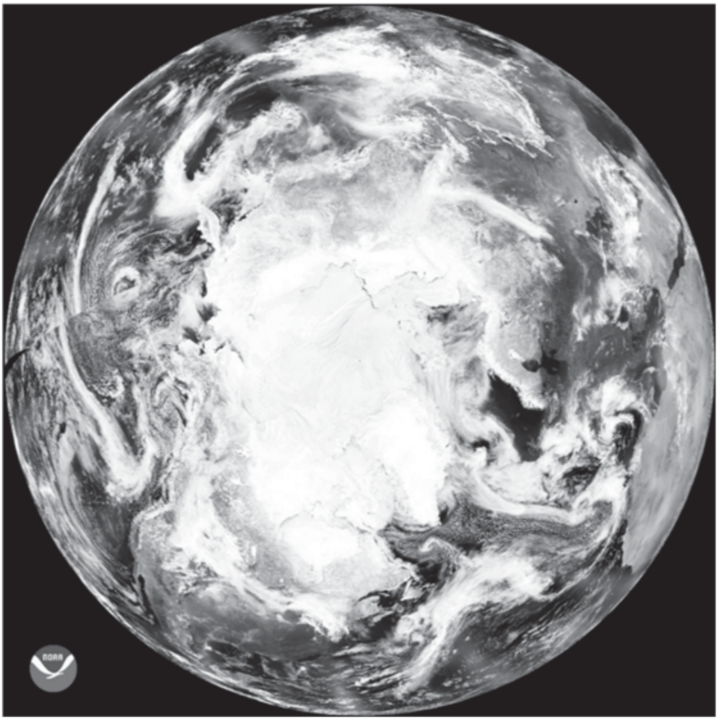


Figure 24.5. Image of the northern hemisphere captured on April 20, 2018. The ice-covered area of the North Pole is in the center. On the left, the North American continent and the Baja California Peninsula can be seen. The image was captured by the new NOAA-20 satellite at an altitude of 824 km.[17]

Figure 24.6. Snow canyon (17 m high) in the Murodo Snow Corridor in Tateyama, Japan, 2018.[18]

How can two diametrically different situations be reconciled? Does global warming mean less or more snow?

I find it interesting that some scientists today, faced with data indicating a rising trend in snowfall over the past 40+ years, are declaring that climate change (aka anthropogenic global warming) is also causing this increase! The reason? Warmer air would contain more moisture and more water vapor, leading to more massive snowfall. Of course, the trick requires the existence of sufficient amounts of cold air to produce that snow. For example, in Boston, hit by heavy snow in recent decades, almost all years with more than 1.5 m of snow recorded colder temperatures than average years.[19] The fact is that cooling, not heating, increases the snowfall.

We cannot talk about the *disappearance of snow* due to anthropogenic global warming in the last two decades or so, and then, faced with objective data from the previous four decades, also invoke the *same cause* to argue the opposite, or the *increase of snow*.

Because otherwise, we leave science and enter into the full Camusian metaphor: "

In the middle of winter, I finally found there was, within me, an invincible summer.

Conclusion

And what did the winters look like before global warming? Are we experiencing Orwellian newspeak: Cooling is warming?

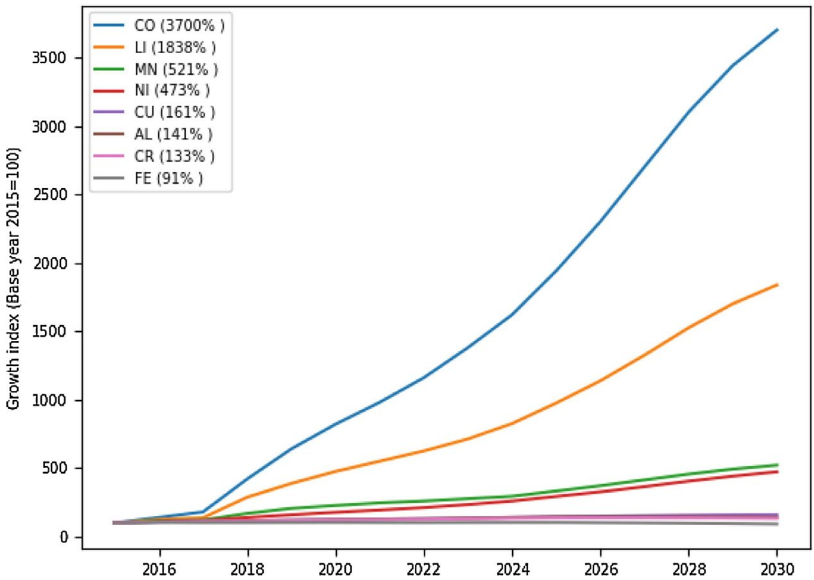


Fig. 1-2. Increased demand for metals for electric vehicles in 2030 compared to 2015

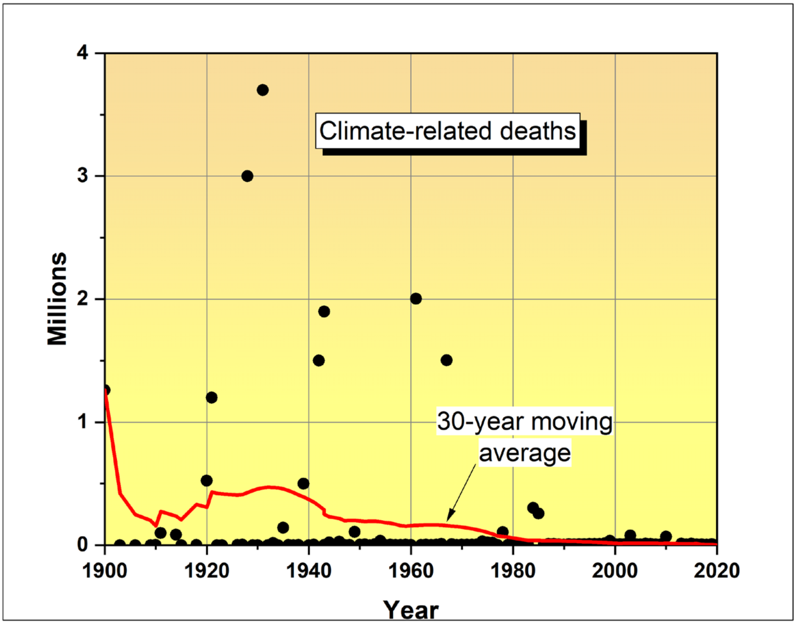


Fig. 5-1. Deaths caused by climate disasters between 1900 - 15 July 2020

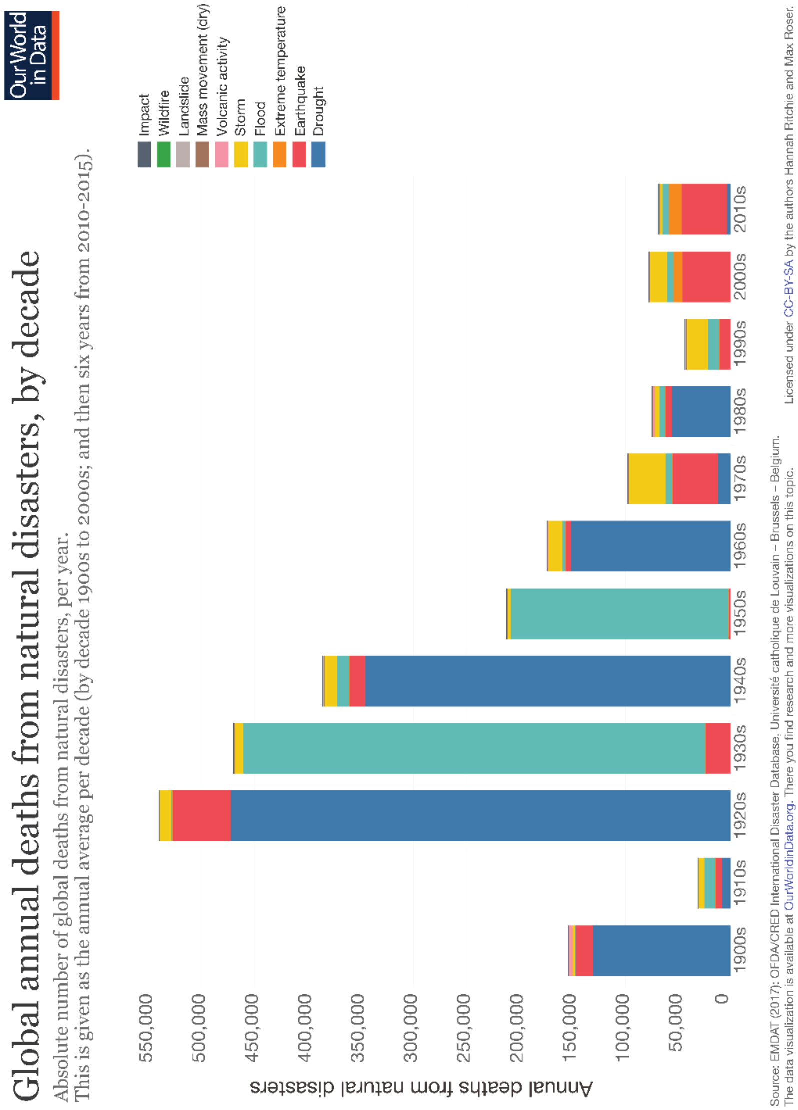


Fig. 5-2. Annual global deaths caused by natural causes, per decade (1900 - 2015)

Fig. 12-1. The maximum-minimum temperature sensor (MMTS) installed by NOAA in Ardmore, Oklahoma, on street corner in full viewshed of multiple heatsinks and within few feet of the traffic intersection at City Hall (from Watts et al., 2015). A typical example of minimum quality (CRN 5) of temperature measurements. The phenomenon of urban thermal island is predominant in such a location.

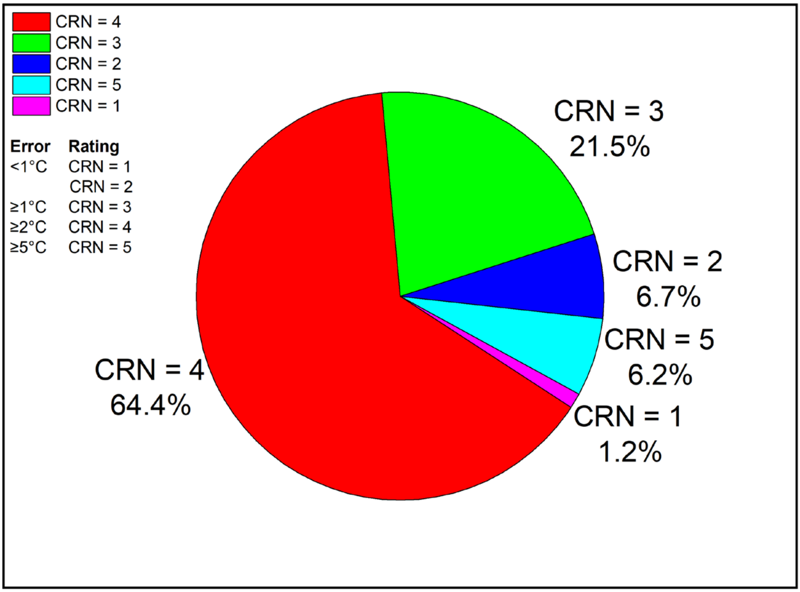


Fig. 12-2. Distribution of the quality of weather station locations used by NOAA to measure and record maximum and minimum temperatures. Of the 1007 stations examined, 92.1% produce erroneous temperatures ≥ 1°C - 5°C higher than NARR (North American Regional Reanalysis) temperatures (Data from Fall et al., 2011)

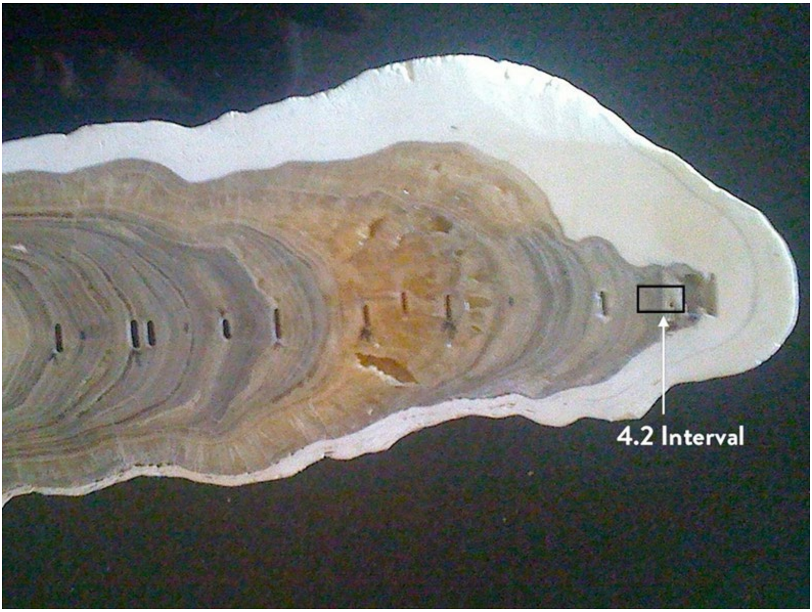


Fig. 15-2. A portion of the Indian speleothem that was sectioned and analyzed layer by layer to identify the early Meghalayan age, 4,200 years ago. (Modified from [5])

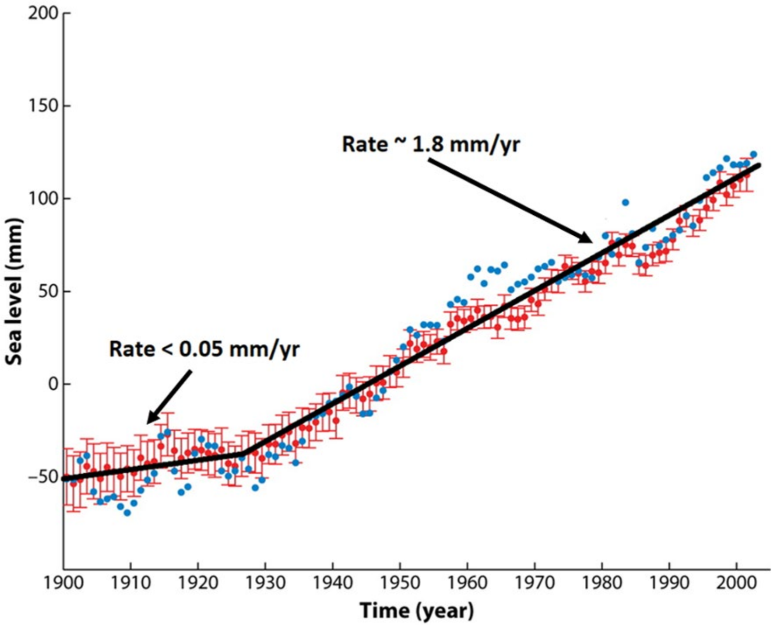


Fig. 19-2. GMSL tide measurements between 1900 and 2001. Modified from [5]. The red dots are data obtained from Church et al. (2004), and the blue ones from Jevrejeva et al. (2006). Growth rates are personal estimates.

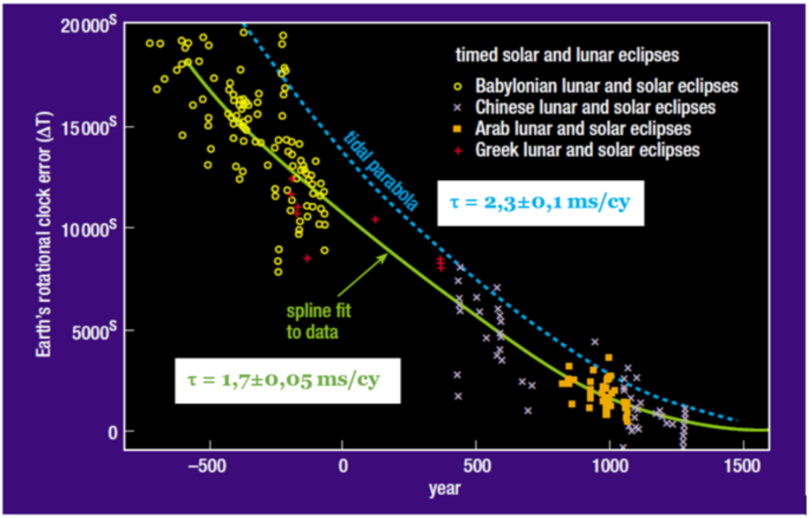


Fig. 19-3. The analysis of ancient eclipses derived from the Babylonian, Chinese, Arab and Greek eclipses suggests a slowdown of the Earth's rotation sufficient to produce a time error DT of ~5 hours (18,000 s) during 700 BC - 1990 AD. (Modified after [13])

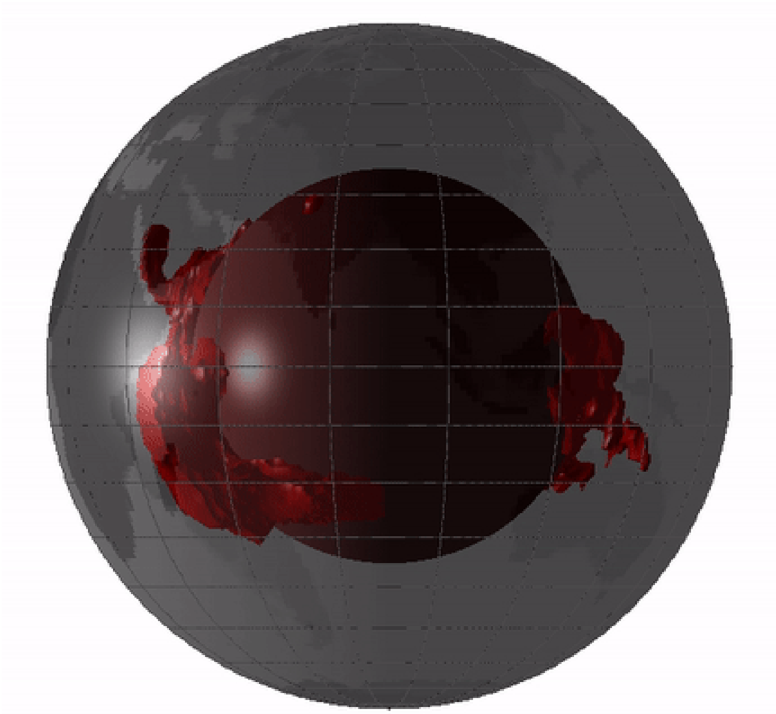


Fig. 19-4. Near the base of the earth's mantle there are two structures, called blobs, the size of some continents, made of hot and compressed rocks.
Source: Cottaar and Lekic [https://commons.wikimedia.org/wiki/File:LLSVP.gif]

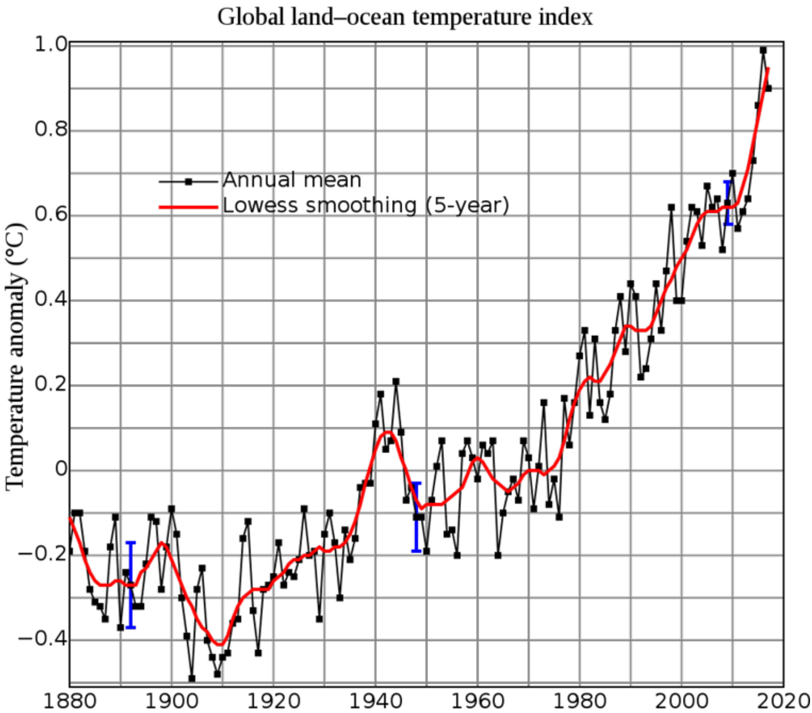


Fig. 21-1. The variation of the global mean temperature (GMT) since 1880. The blue bars of uncertainty indicate the range of 95% confidence. (Source: NASA GISS, http://data.giss.nasa.gov/gistemp/)

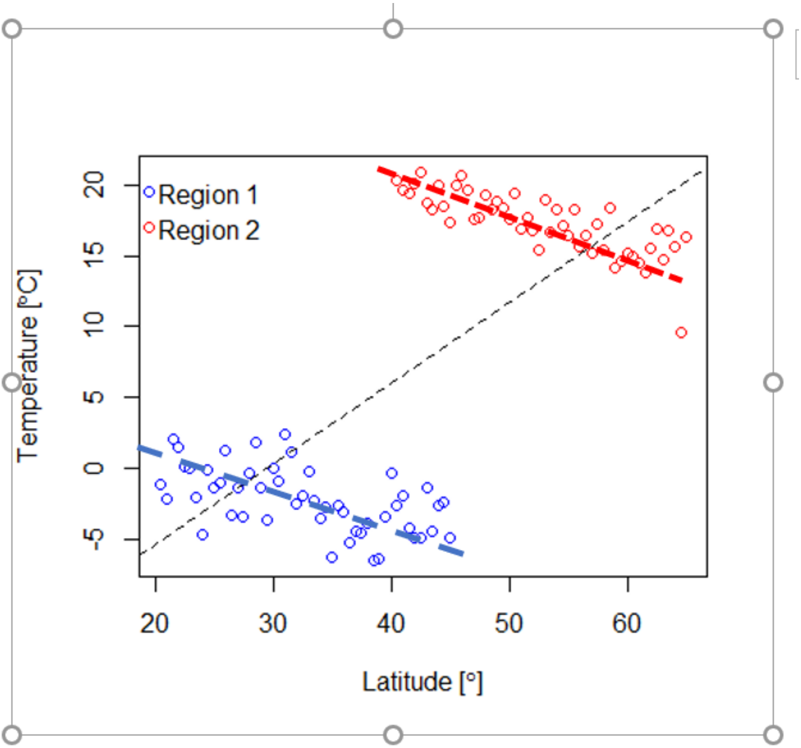


Fig. 21-2. Scatterplot of the temperature (°C) recorded at various latitudes (°) in two different geographical regions (simulated data) as an illustration of the Simpson paradox: the trend that is observed within each individual region is reversed when they are combined (Modified from [4])

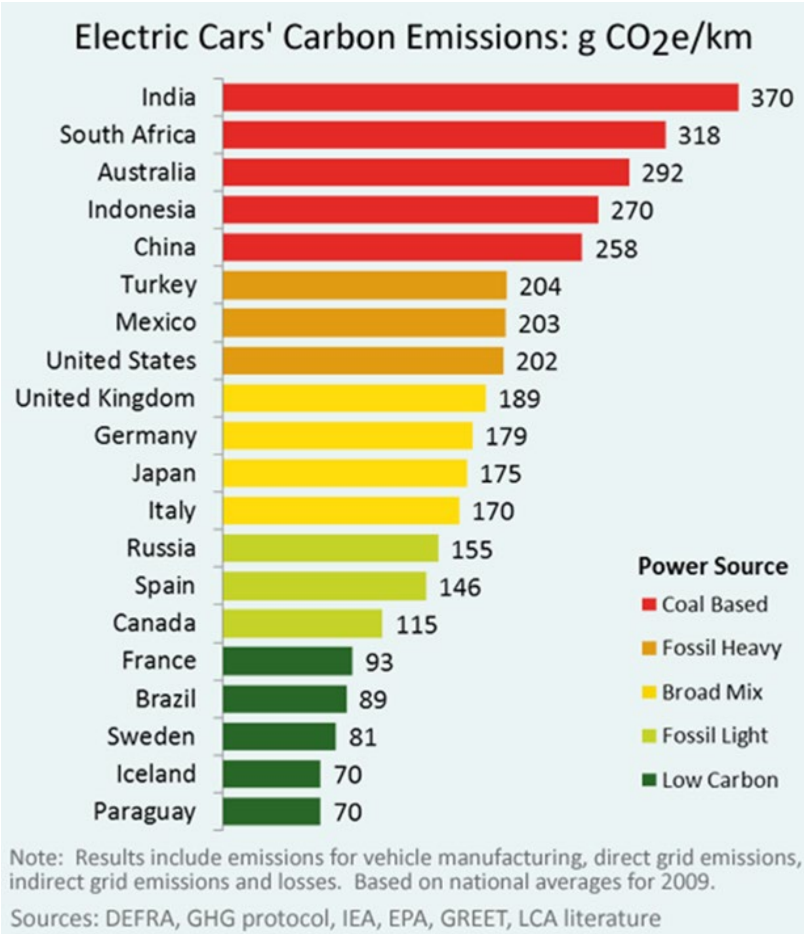


Fig. 22-1. Emissions of electric vehicles by country, in gCO_2e km (Source [8])

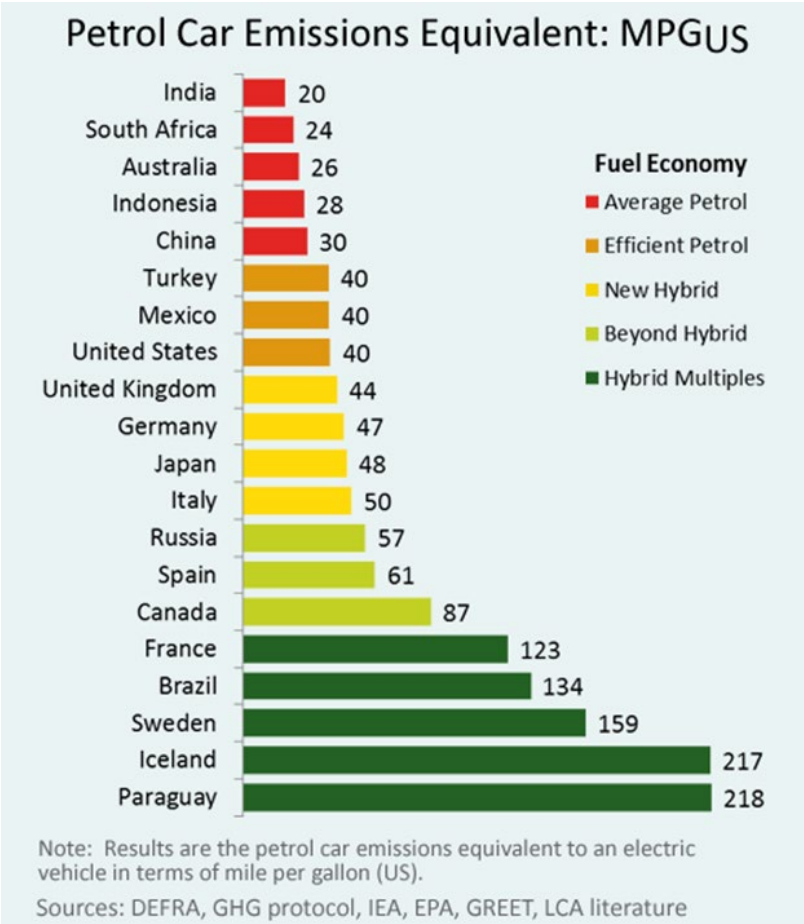


Fig. 22-2. Comparisons between electric and internal combustion vehicles based on fuel efficiency (Source [8])

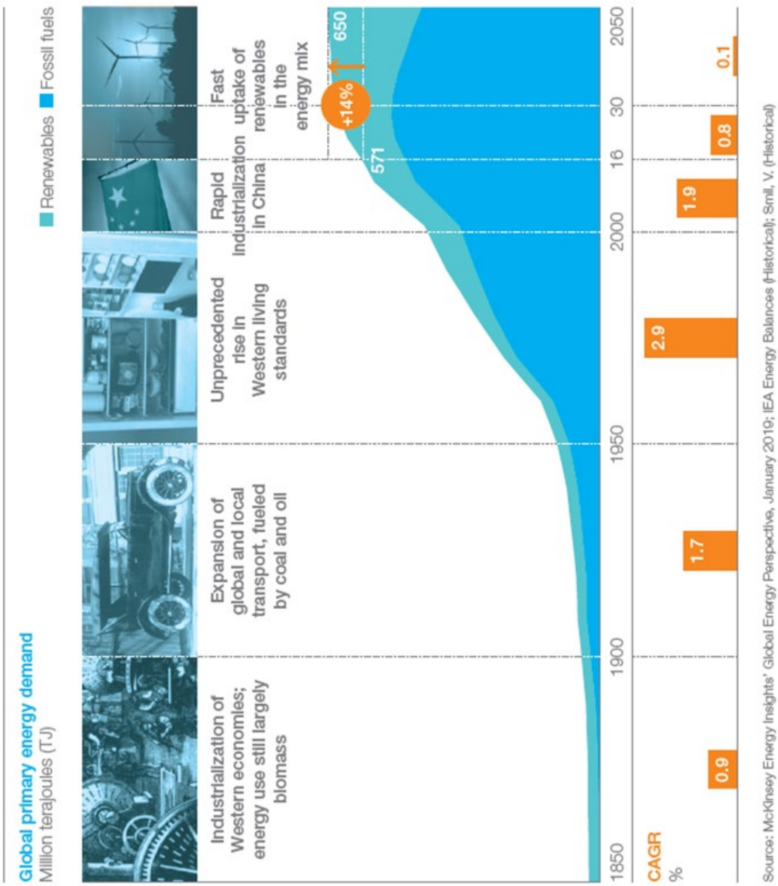


Fig. 23-1. After more than half a century of rapid growth, global primary energy demand will be capped around 2030. (CAGR- Compound Annual Growth Rate) (from [1])

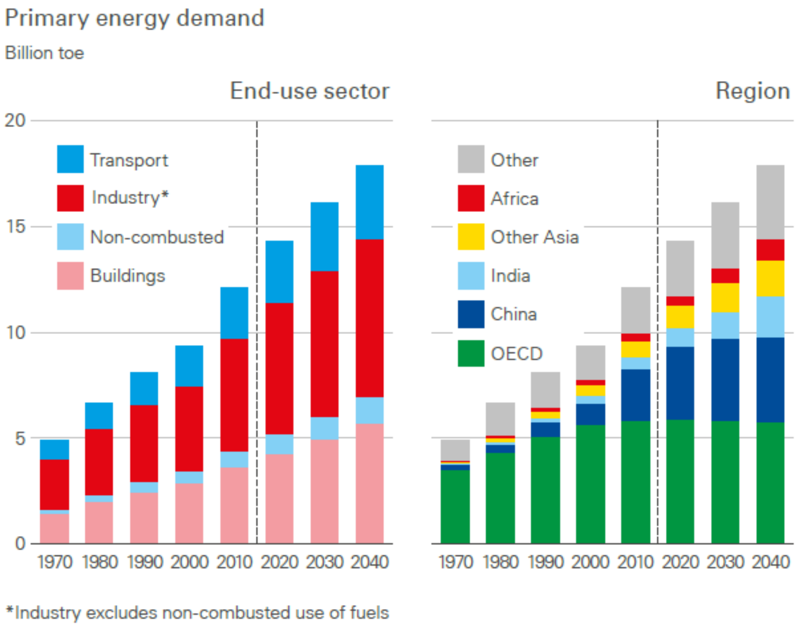


Fig. 23-2. Primary energy demand by sectors (left), and by region (right) (from [3])

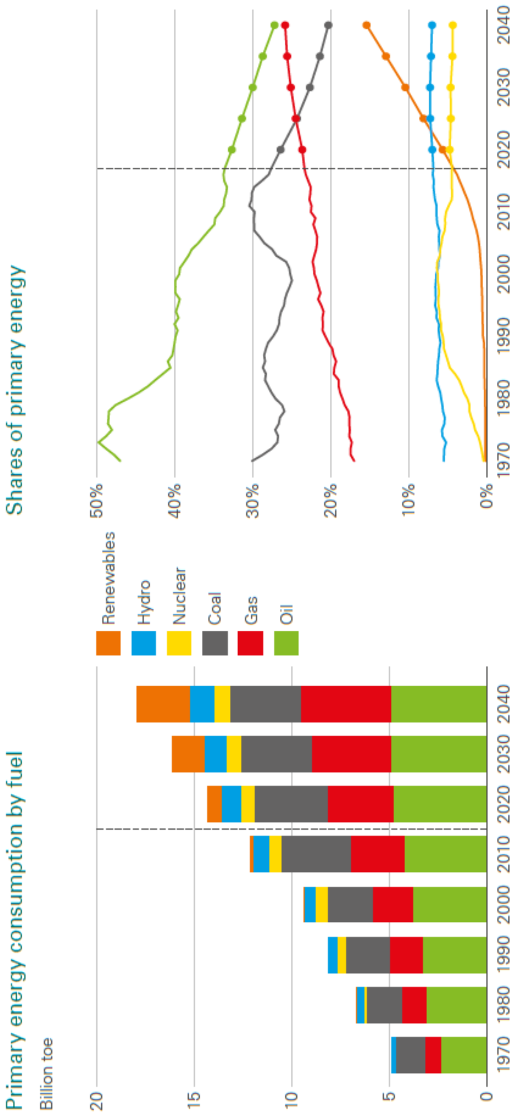


Fig. 23-3. Primary energy consumption between 1970 - 2019 and predictions until 2040, according to BP 2019 (from [3])

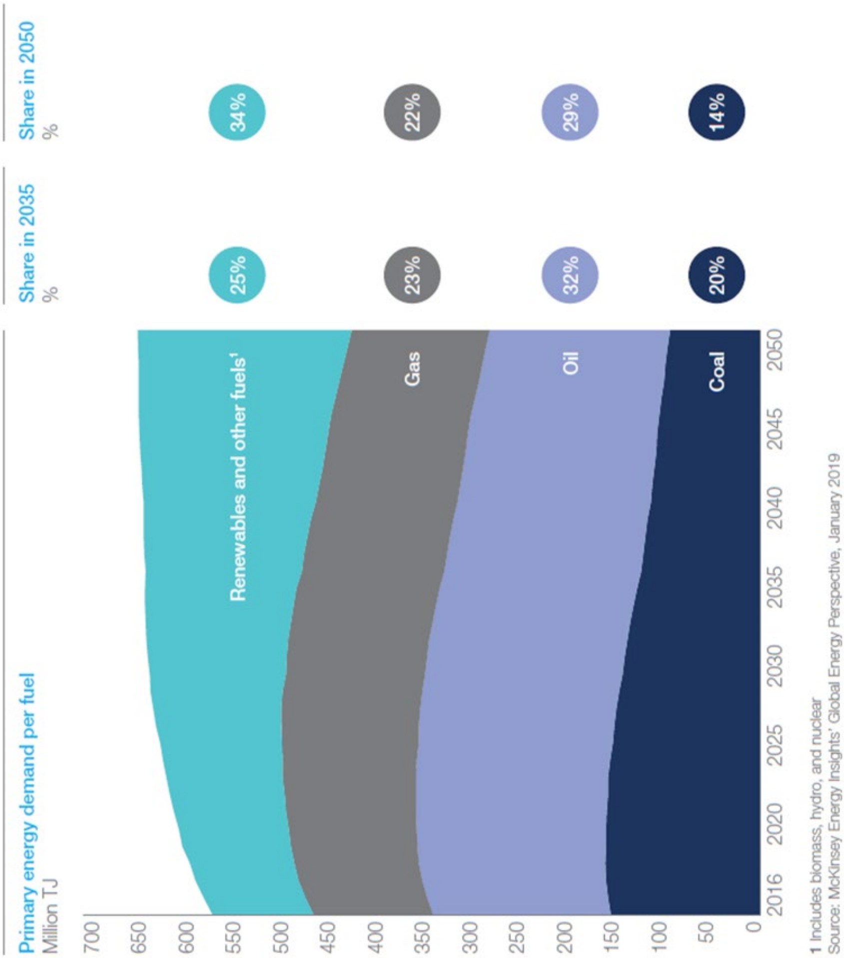


Fig. 23-4. Primary energy demands in 2035 and 2050, respectively, according to the prediction of McKinsey & Co (2019). Fossil energy will decrease from 75% in 2035 to 65% in 2050. Electricity consumption will double by 2050, and the share of renewable energy (wind, solar, biomass, hydro and nuclear) will increase from 25% in 2025 to 34% in 2050. (from [1])

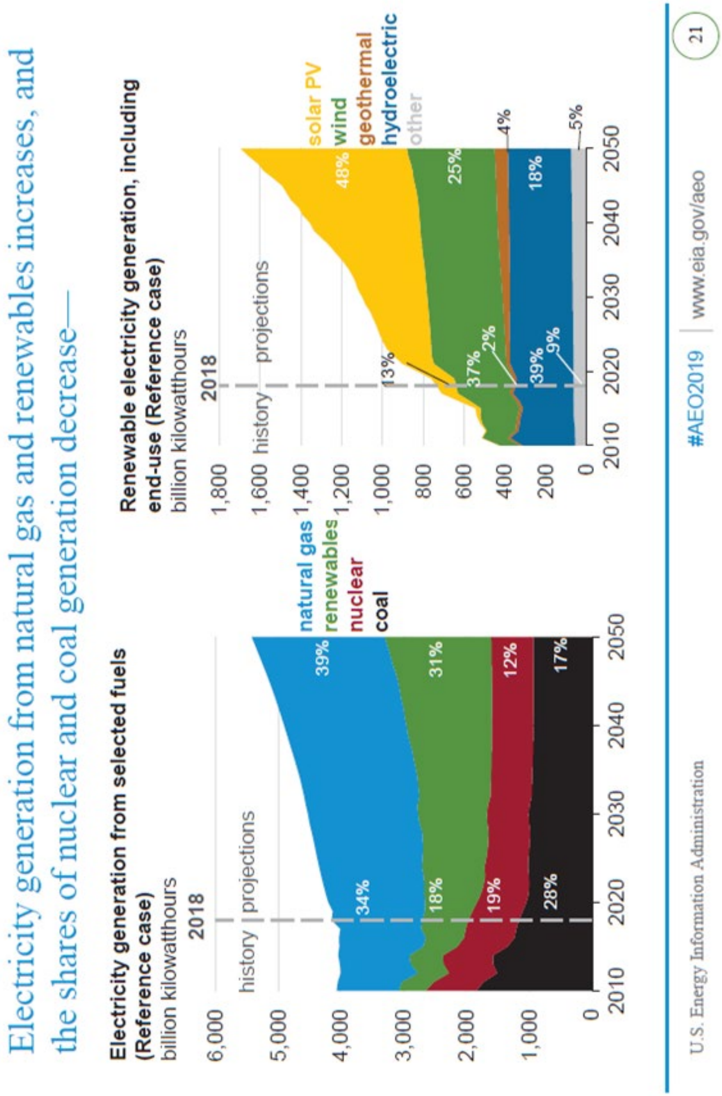


Fig. 23-5. Selected sources of electricity and their share in the period 2010-2050, according to EIA 2019. The prediction refers only to the USA (from [2])

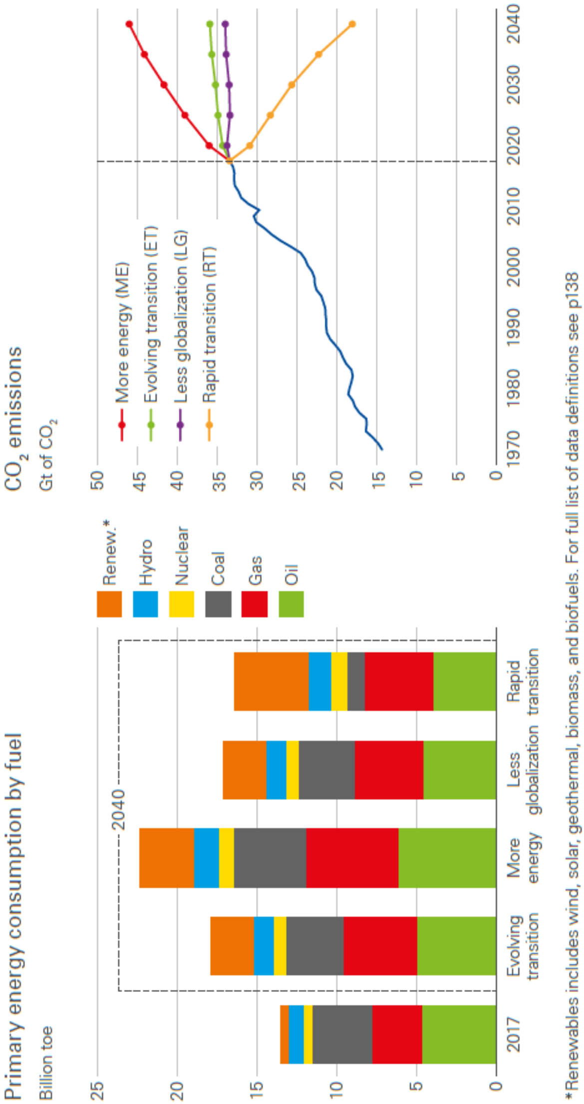
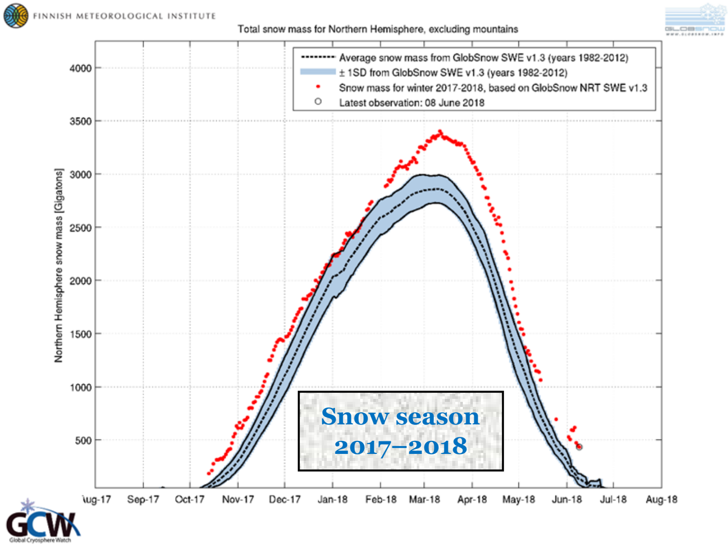


Fig. 23-6. Four energy scenarios proposed by BP. Primary energy consumption for each fuel type (left). CO_2 emissions allocated to each scenario (right) (from [3]).



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4000
3500
3000
2500
2000
1500
1000
500
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Aug-17 Sep-17 Oct-17 Nov-17 Dec-17 Jan-18 Feb-18 Mar-18 Apr-18 May-18 Jun-18 Jul-18 Aug-18
GCW
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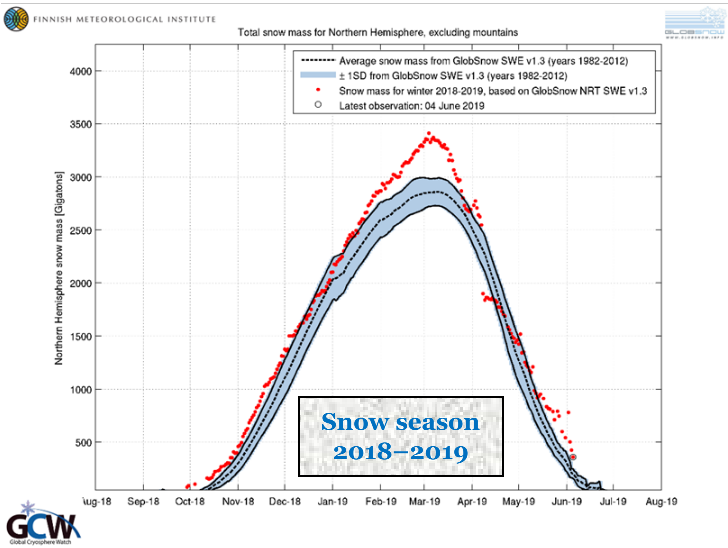

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Snow season 2018–2019
Aug-18 Sep-18 Oct-18 Nov-18 Dec-18 Jan-19 Feb-19 Mar-19 Apr-19 May-19 Jun-19 Jul-19 Aug-19
GCW
Global Cryosphere Watch

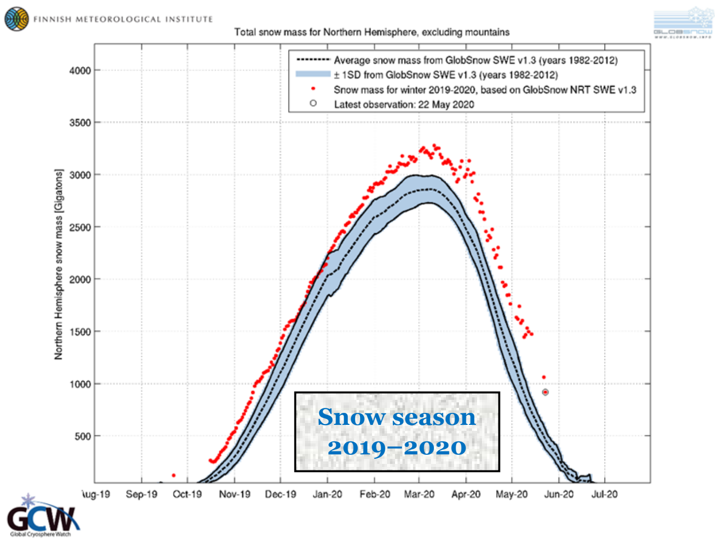

Fig. 24-4. The total mass of snow accumulated in the northern hemisphere (excluding the mountains) between October 2017 and May 2020 mostly exceeds the average of the 1982–2012 period (modified from the World Meteorological Organization, Global Cryosphere Watch).

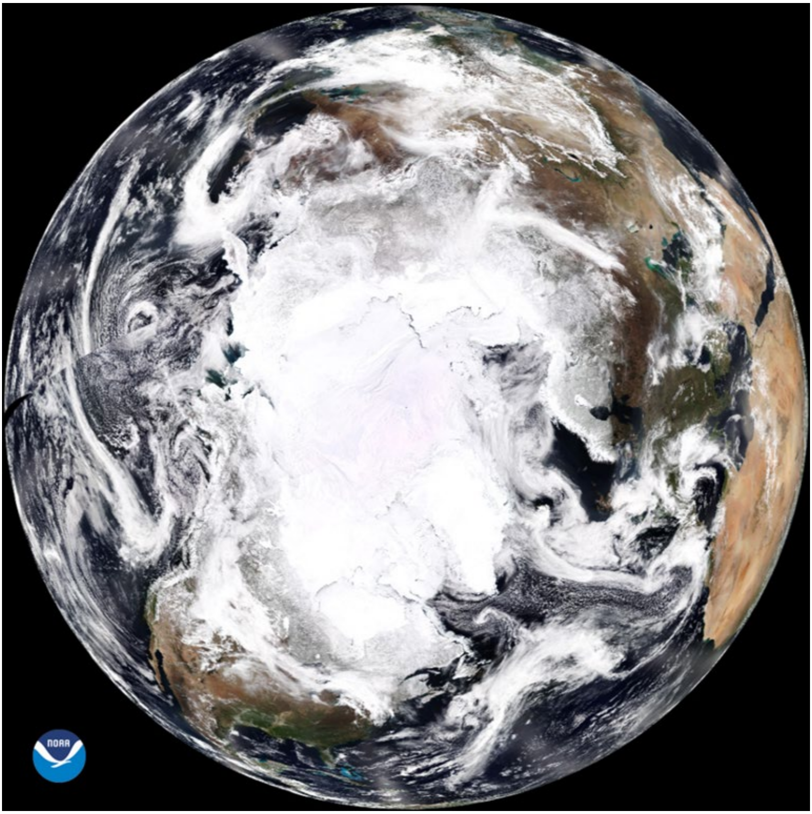

Fig. 24-5. Image of the northern hemisphere captured on April 20, 2018. The ice-covered area of the North Pole is in the center. On the left one can see the North American continent and the Baja California Peninsula. The image was captured by the new NOAA-20 satellite at an altitude of 824 km.

Fig. 24-6. Snow canyon (17 m high) in Murodo Snow Corridor in Tateyama, Japan, 2018.

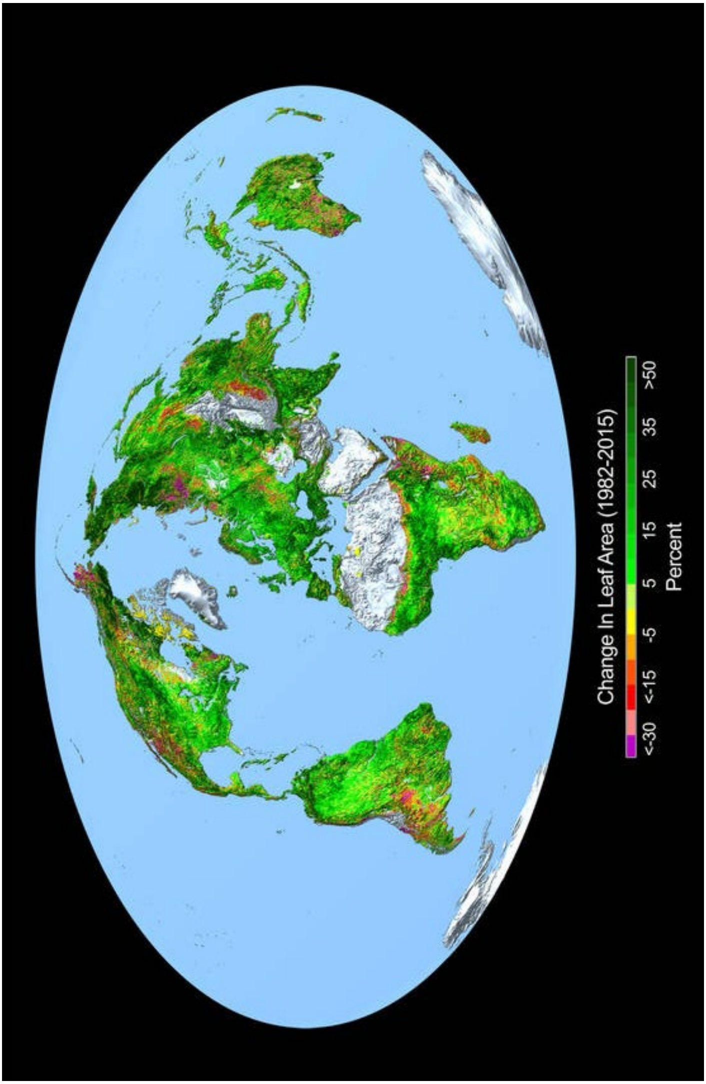

Fig. 27-1. A significant “greening” of the Earth has taken place in the last 33 years. Vegetation growth occurred on areas representing between 25% and 50% of the land area. The decrease of vegetation was registered on only 4% of the surface. The fertilization produced by carbon dioxide explains 70% of the greening effect.

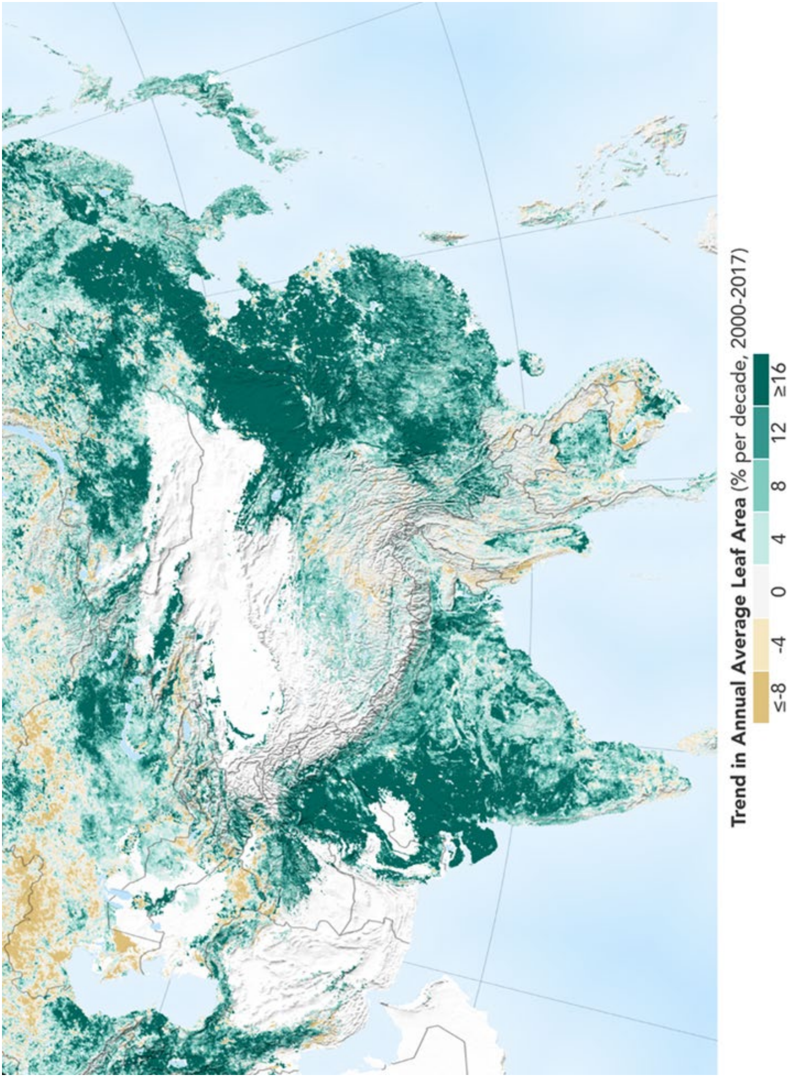

Fig. 27-2. The world is a greener place than it was 20 years ago and two of top CO_2 emitters on the planet are the counterintuitive source: China and India.

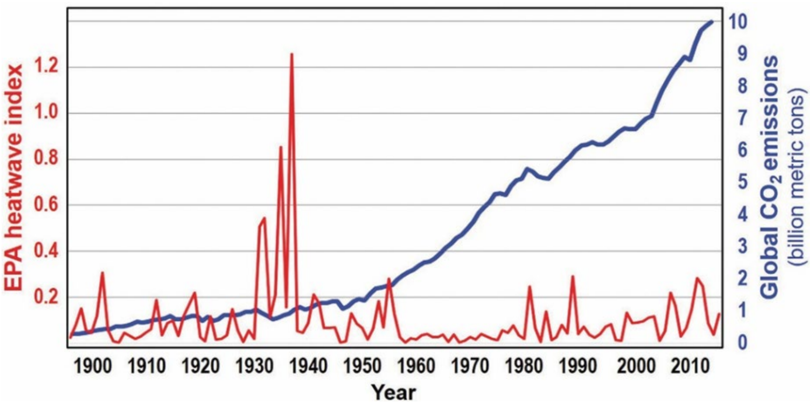

Fig. 27-3. Heat waves do not become more frequent due to global warming. The official index of heat waves in the US in the period 1895 - 2015, together with the variation of global CO_2 emissions.

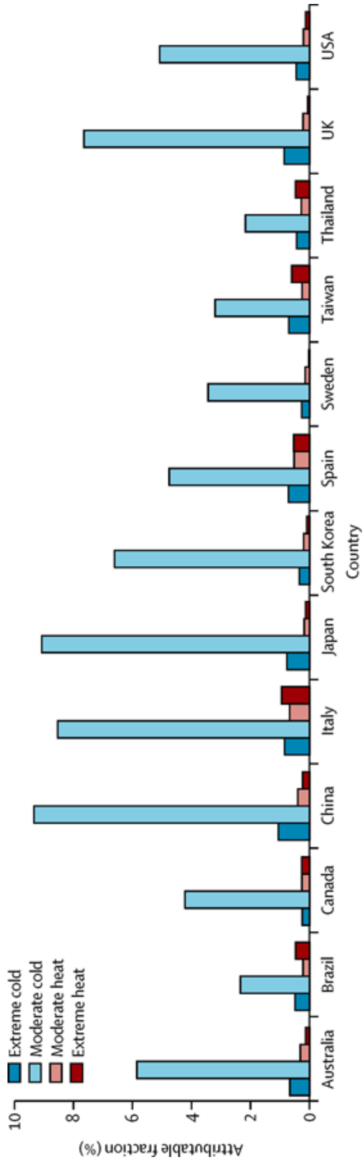

Fig. 27-4. Cold waves, not heat waves, are the real climate killer. Fraction of all-cause mortality attributable to moderate and extreme hot and cold temperature by country.

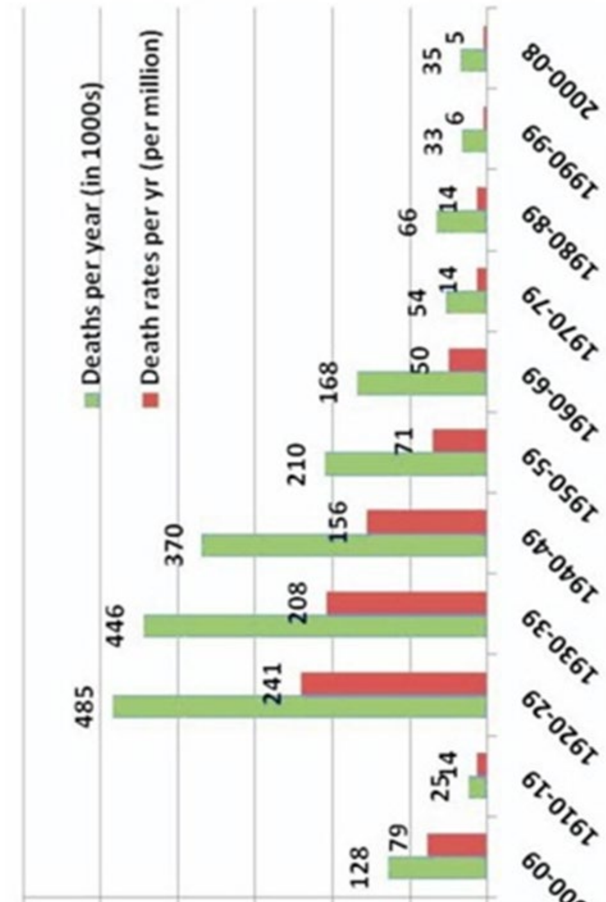

Fig. 27-5. Since 1920, the United States has seen a ~93% decrease in deaths from extreme weather events. A modest global warming was recorded in the same period (1920 -2008).

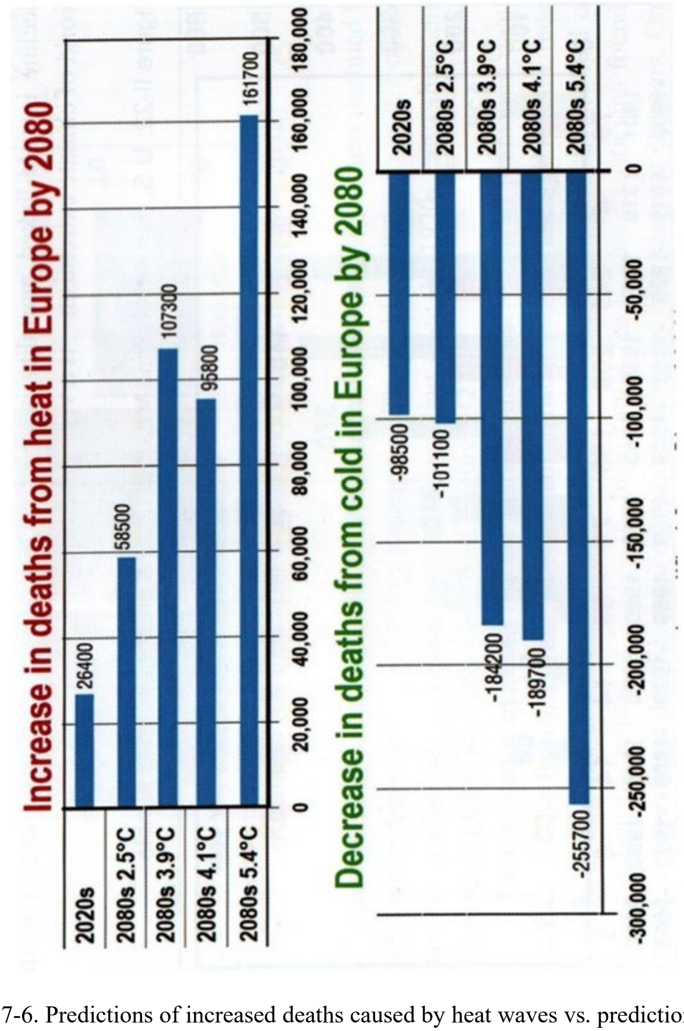

Fig. 27-6. Predictions of increased deaths caused by heat waves vs. predictions of a simultaneous decrease in deaths caused by cold waves in Europe in the 2080s. Four scenarios for increasing global warming are presented. In any scenario, more lives will be saved from death by freezing than those lost due to heat waves.

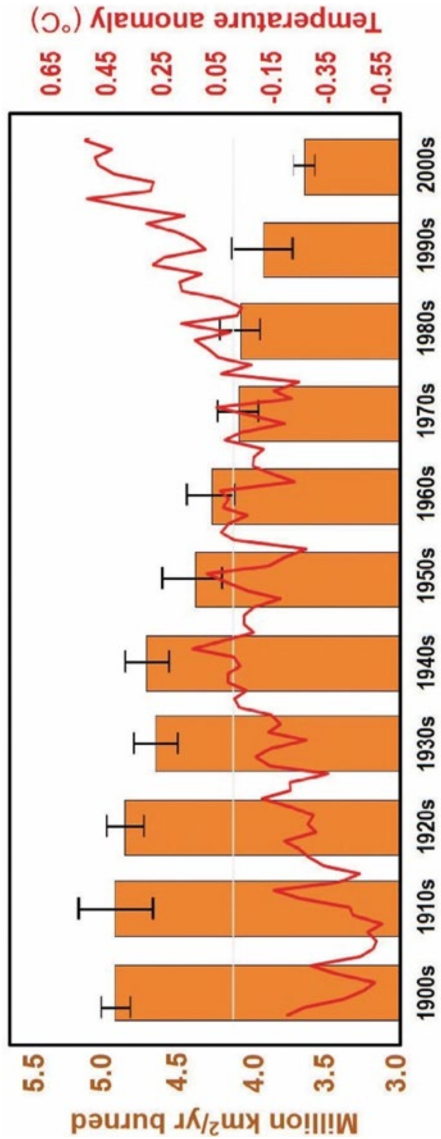

Fig. 27-7. Areas burned in wildfires and temperature variation (Data source: Yang et al., 2014, for burned areas,[16] and HadCRUT4, 2017, for temperature[17], according to [20]).

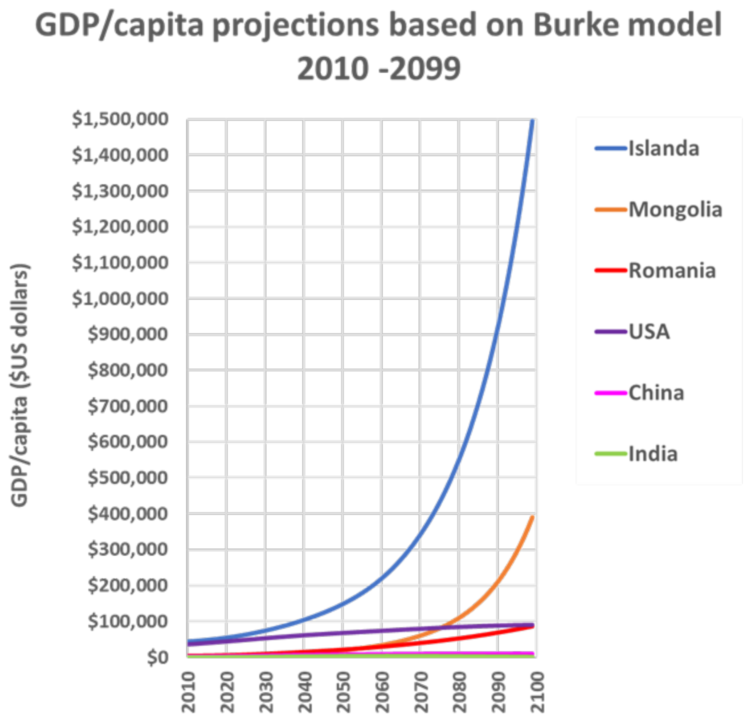

Fig. 28-1. GDP/capita projections, following climate change from 2010 to 2099. Data source: Burke et al., 2015; Replication data, available at https://web.stanford.edu/~mburke/climate/data.html, "Projected per capita GDP with climate change (based on SSP5 and RCP8.5), 2010 - 2099"

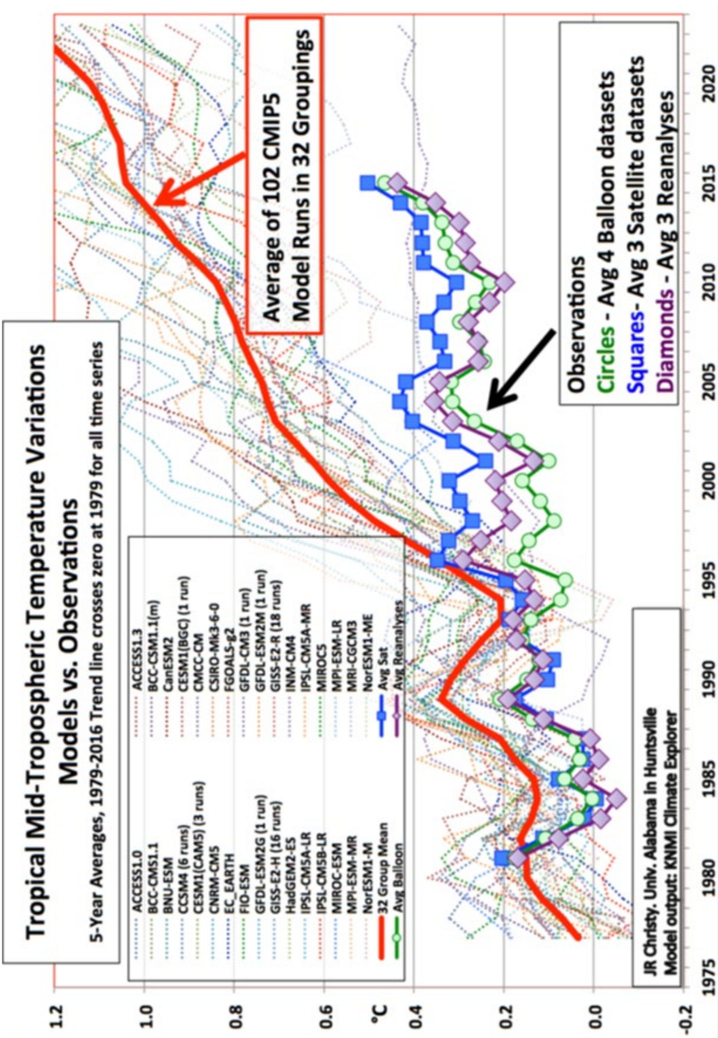

Fig. 32 - 1. Five-year averaged values of annual mean (1979-2016) tropical bulk mid-troposphere temperatures as depicted by the average of 102 IPCC CMIP5 climate models (red) in 32 institutional groups (dotted lines). The 1979-2016 linear trend of all time series intersects at zero in 1979. Observations are displayed with symbols: Green circles - average of 4 balloon datasets, blue squares - 3 satellite datasets and purple diamonds - 3 reanalyses. Since 1996, there has been a significant difference between the models containing anthropogenic greenhouse gases and the three sets of observations. (from Christy, 2017)

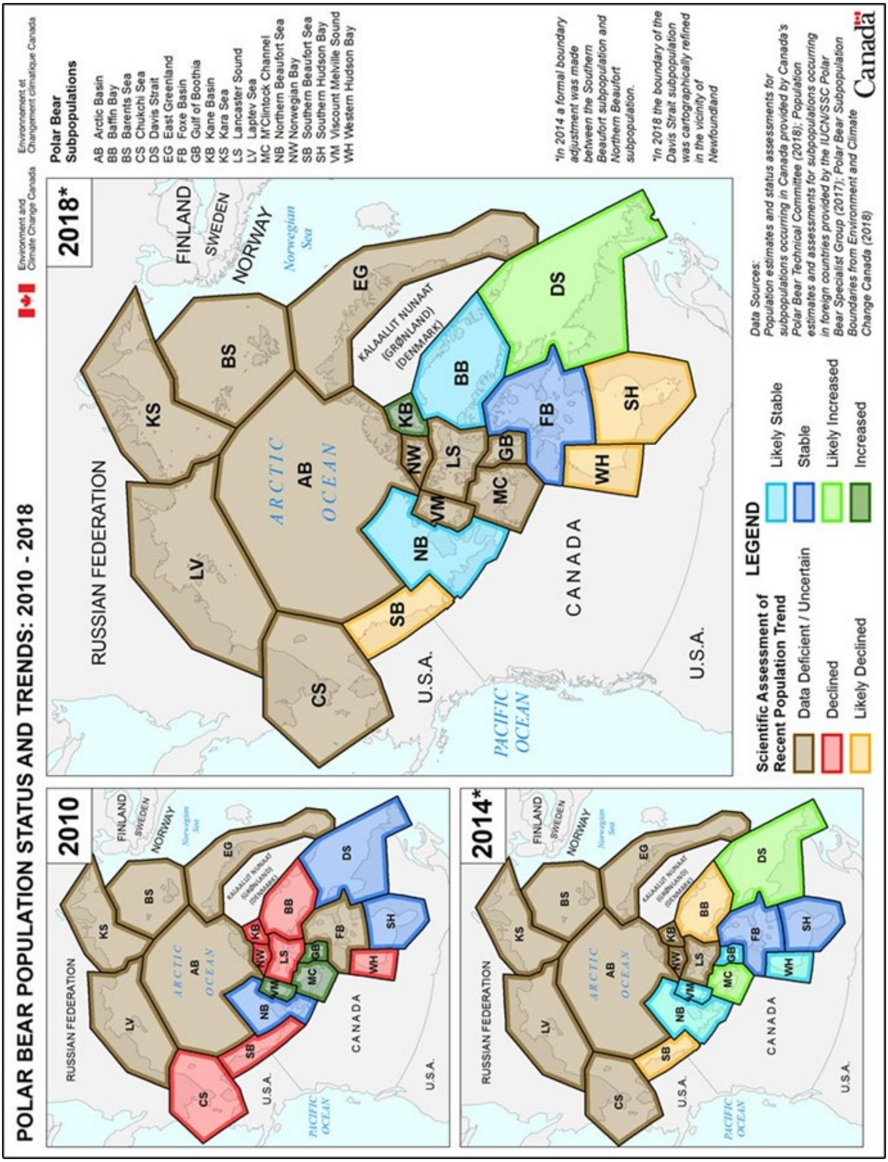

Fig. 35-1. Maps of polar bear subpopulations in Canada between 2010-2018 (from [9]).

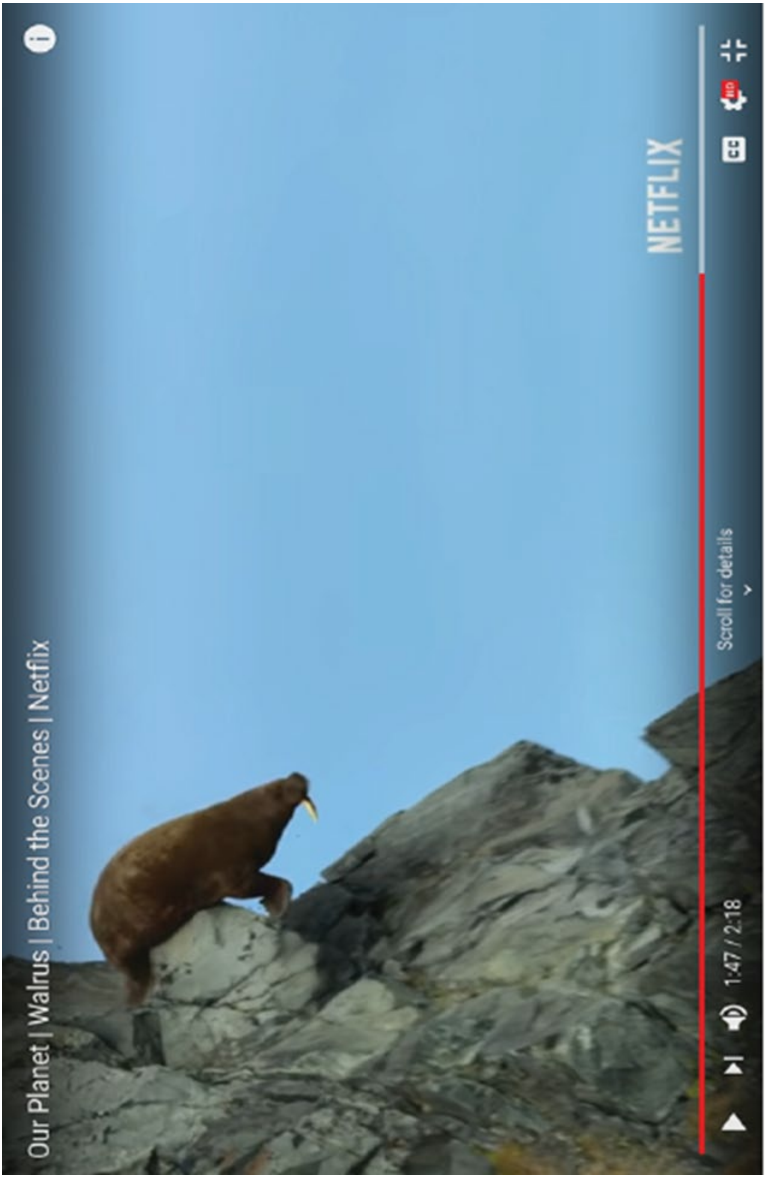

Fig. 35-2. Capture from the series “Our Planet”, episode 2, of the moment when a first walrus falls from an 80 m high rock.
Source: www.youtube.com/watch?v=qVJzQc9ELTE

Fig. 35-3. Identical images showing the moment of the dead fall of a walrus in the series **Seven Worlds, One Planet**, BBC (left) and the series **Our Planet**, Netflix (right).

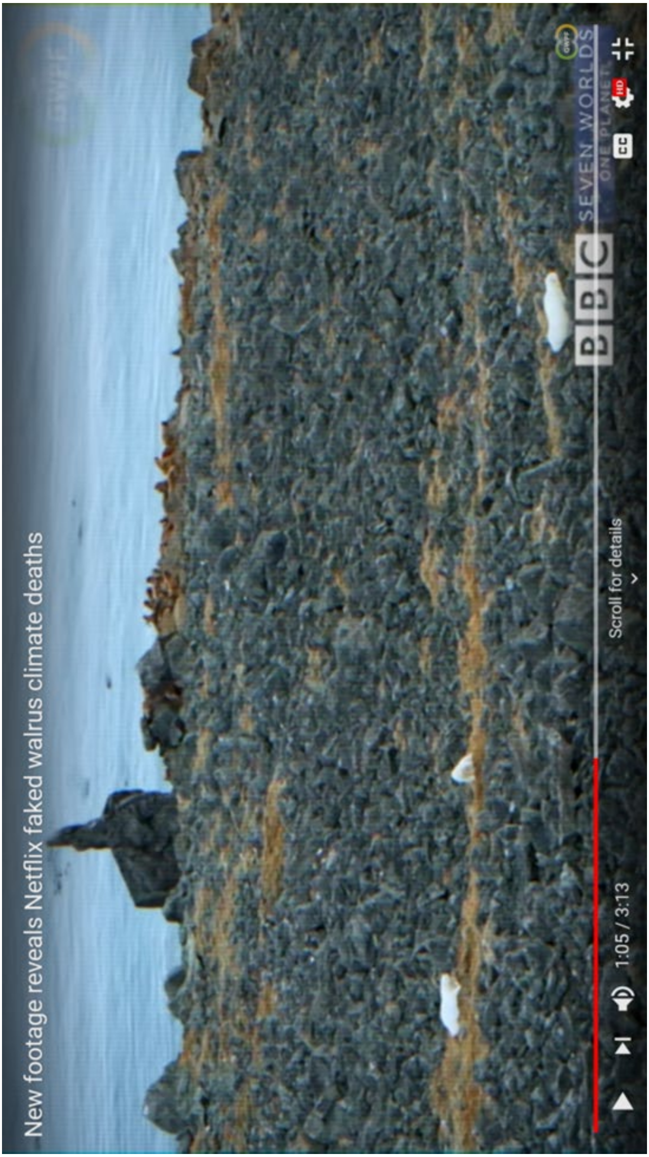

Fig. 35-4. Capture from the BBC series **Seven Worlds, One Planet**, in which three polar bears can be distinguished near the rock populated by suicidal walruses. November 19, 2020, - New footage reveals Netflix faked walrus climate deaths.

Fig. 36-2. The coastal outcrop exposure in Ellis Bay on Anticosti Island, Québec, preserves rocks stored during the Hirnantian glaciation (445 million years ago). Recent research on the rocks here confirms the functioning of the planetary thermostat (from [2]).

Chapter 25

"4 Per Mille"— A French Climate Initiative Without any Chance of Success

It's easier to fool people than
to convince them that they have been fooled.

Mark Twain

At the COP21 conference in Paris, before the Climate Agreement in December 2015, the French Ministry of Agriculture—under Stéphane Le Foll's leadership—launched an ambitious international program signed by over 100 countries. The program, originally dubbed "4 per mille" in French, was later renamed "4 per 1000" for unknown reasons.[1] The French initiative's major goal was/is to mobilize the countries participating in increasing the global organic carbon content of the soil by 4‰ (0.4%) per year. The idea, based on summary calculations, is deceptively simple and has been synthesized graphically in Figure 25.1:

> If we increase by 4 ‰ (0.4%) per year the amount of carbon sequestered in the soil, we can stop the annual growth of CO_2 in the atmosphere, a gas that is a major contributor to the greenhouse effect and climate change.

Soil research (pedology) is a relatively well-funded public money activity, at least in the United States.[2] And the adherence of a growing number of governments to this French initiative proves the special attraction it exerts on politicians as well.

Preliminary data show that the industry, transport, and domestic use of fossil fuels currently produce almost 10 Gt CO_2 per year. In 2014, agriculture alone was estimated to contribute around 5.0–5.8 Gt CO_2 per year, not including land changes (e.g., forests transformed into arable land).[3] In other words, agriculture is responsible for about half of these emissions.

As reality stands, there is little immediate hope that we will see a drastic reduction in emissions.

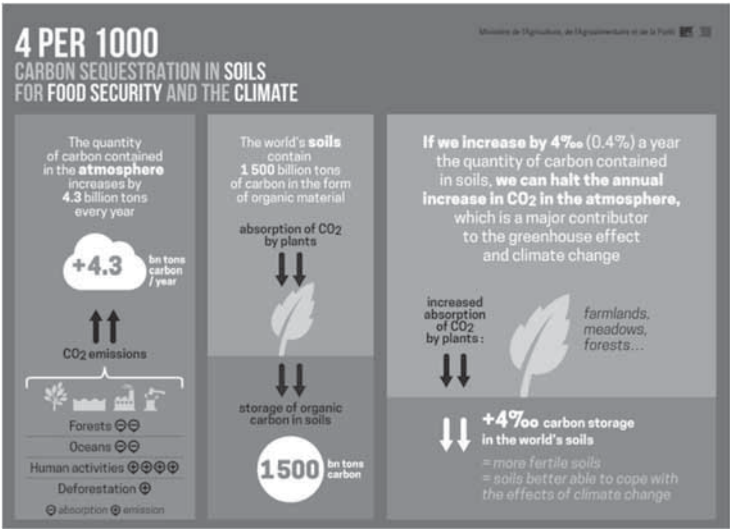

Figure 25.1. Schematic diagram of the French "4 per mille" initiative.[1]

For almost two decades, pedologists have been studying and estimating the potential for carbon sequestration in soil organic matter. Their working premise is perfectly rational. In the approximately 10,000 years of agriculture, soil organic matter has lost about 116 Gt of carbon, an amount equivalent to over ten years of industrial emissions at the current rate.[4] Following simple logic, by changing agricultural techniques, a significant amount of this carbon can be reintroduced into soils and thus appear to be a useful tool to mitigate climate change.

Unfortunately, the French government's proposal to decarbonize the world through the 4 per mille initiative has proved to be over-optimistic and inherently wrong due to various cultural and scientific confrontations.

Just one year after the launch of the French initiative, criticisms were made by specialists, not by the politicians who saw in 4 per mille a panacea meant to solve the problem of anthropogenic CO_2 emissions simply.

For example, seven American and German researchers from prestigious universities analyzed several terrestrial climate models, which estimated a significant decrease in soil carbon emissions by 2100. But the dynamic evolution of carbon determining this response has not been systematically tested based on real measurements and observations. Using data collected from 157 globally distributed soil profiles, the authors demonstrated that the analyzed climate models underestimated the average age of soil carbon by a factor of more than six (430 ± 50 years compared to 3,100 ± 1,800 years). Consequently, the same models overestimated the potential for carbon sequestration by a factor of almost two (40 ± 27%).[5] These inconsistencies suggest that terrestrial climate models need to better represent the processes of carbon stabilization and the running time of slow and passive pedological reservoirs when trying to simulate the future dynamics of carbon dioxide in the atmosphere.

French pedologists, members of the French Academy of Agriculture, have recently published a devastating critique of the initiative made by fellow politicians.[6] Among other things, they point out a silly mistake, also visible in Figure 25.1. Soils appear as just a "trap" for carbon, not as a source, too, which they really are. That is, in addition to the down arrows, Figure 25.1 should, with respect for scientific truth, also include arrows pointing upwards, designating the natural CO_2 emissions of soils. If the quality of soil CO_2 sources was also considered, the potential to stop annual increases in CO_2 in the atmosphere by sequestering carbon would be automatically called into question.

Another issue not addressed by the authors of the 4 per mille initiative is the presence of inorganic carbon in soils. In some cases, the content of inorganic carbonates is significant. Microbial activities, including dissolving and acidifying soils containing inorganic carbon, can increase CO_2 emissions into the atmosphere beyond optimistic assumptions based only on organic carbon.

Recently, Ronald Amundsen and Léopold Biardeau of the University of California, Berkeley, published an analysis of the French initiative, which they describe as an illusory method of climate improvement.[7]

American researchers rightly ask: Is it possible, economically and politically, that which the French have proposed, and many governments have signed, to be true? They criticize the initiators that common sense questions related to implementing the 4 per mille program were mostly ignored or, at best, superficially considered. Most of the mass media, always eager to report positive news from the front of the battles against global warming, fueled a false optimism. Why?

For 4 per mille to become a reality, and not a propaganda ghost, the French initiative should be implemented immediately on all fronts of the planet, and soil carbon sequestration practices should continue uninterrupted for decades. The French initiators have probably overlooked how the aspect that the program proposed by them in 2015 will affect, for decades, the entire planet, or 570 million farms that employ about 3 billion people.[8] How will all these people react when asked to give up the traditional annual plowing? Or, worse, to voluntarily transform, for many years in a row, the agricultural lands destined for various crops into ravines on which only perennial weeds will grow, whose mission is to store carbon dioxide from the atmosphere? How will the food security of the 10 billion people, estimated to live in 2050, possibly without petroleum and natural gas, be ensured? [9]

Several cultural, economic, and physical barriers do not make the storage of carbon in soils a serious means of reducing global warming, as the authors of the 4 per mille initiative proclaim, but rather an indicator of political propaganda, inadequate knowledge of farmers' psychology, and lack of appreciation or understanding of the reality on the ground.

In the United States, for example, farmers are among the most conservative people, possessing a system of values in which personal independence prevails, to the detriment of social support programs. They also have great respect for authority, to the detriment of egalitarian views. According to the classification I made in the article "Climate change and their cultural perceptions: Are you egalitarian, fatalistic, hierarchists, or individualistic?" American farmers (and others in various parts of the world) fall into the latter category.[10] It should come as no surprise, then, that the American farmers, even those who have adopted new, innovative ways of working the land, become suspicious when contacted by "city professors," who have a visible ecological agenda. They dislike the idea that researchers advise them to give up fossil fuels, which is their only significant energy source. Also, based on many years spent on the Oklahoma plains, collecting rock samples or performing various geophysical measurements, I can testify that climate change, aka global warming, leaves farmers there a bit cold (pun intended). For them, much more important than the 0.9°C that would have increased the average global temperature compared to the preindustrial period are government regulations, threatening their income and independence. Their skepticism is exacerbated by the interventions of nonexperts, those who have never worked on a farm, but who are damn good at giving them advice on how to alter agricultural practices to increase the amount of carbon incorporated into the soil. Pedological researchers, whether or not they support the French initiative, should understand that farmers are infinitely more interested in the weather than the climate.

Returning to specialists' views from the French Academy of Agriculture[6], they sound a serious alarm: the prospect that the goal excuses the means in the case of the 4 per mille initiative is a terrible threat to the credibility of soil science. How many more promises can pedologists make before they become ridiculous in the international academic community?

Fifteen years ago, various soil fertility improvements were widely trumpeted as the solution to alleviating hunger in Africa, although soil degradation was not the main cause of famine and malnutrition on the Dark Continent.[6]

Ten years ago, the media "rumbled" with triumphant news, claiming that climate change would be ameliorated by incorporating massive amounts of biochar or agrochar into the soil. "Turn garbage into biochar and experts assure you that harmful carbon dioxide is tightly sealed and can no longer be released into the atmosphere" was an ecological mantra of the day. Unfortunately, many experts were skeptical, and also, there was no serious research to support the idea scientifically. But that hasn't stopped many researchers in many countries from using it to apply for funding.

The use of biochar has "heated" environmental fans so much that it has come to be considered a panacea for global warming, a win–win solution or even a *winfinity* solution (the irony here belongs to Professor Janice Thies from Cornell University).

Finally, I have a few comments about the study *Creating a Sustainable Food Future. A Menu of Solutions to Feed Nearly 10 Billion People by 2050*, published by the World Resources Institute (WRI), an environmental organization.[11]

We are told that significant "progress on climate change" requires not only cars and factories becoming cleaner, but also a radical efficiency change of our "cows and wheat fields."

Using the current trends, the authors calculated that the "crop yields [should] grow by 56% between 2010 and 2050." To satisfy this demand, farmers will have to clear more land by removing more forests and ecosystems to make way for new crops and pastures, as has often been the case in the past. These activities will create an agricultural area twice as large as India.

In turn, this situation could make it almost impossible to keep global warming below 2°C (the international target agreed in Paris in 2015 and discussed at Katowice in 2018) even if global fossil fuel emissions were eliminated quickly. When forests are transformed into agricultural land, large carbon deposits stored in those trees are released into the atmosphere (unless those trees become furniture).[11]

The WRI study authors collaborated with French colleagues, but they do not mention the 4 per mille initiative at all! Instead, they suggest other alternative methods of increasing the agricultural productivity of existing soils and limiting greenhouse gas emissions.

Conclusions

In the motto at the beginning of the article, Mark Twain points out that it is much easier to sell snake oil to people than to make them accept that they have been ruthlessly fooled.

The French climate initiative 4 per mille is a kind of ecological snake oil with no real chance at success.

CHAPTER 26

FROM NEW AMSTERDAM TO NEW YORK— A STORY ABOUT FURS AND CLIMATE CHANGE

Even old New York was once New Amsterdam
Why they changed it, I can't say
People just liked it better that way.

The Four Lads – Istanbul (not Constantinople)[1]

The song of the four lads from Canada may sound appealing, but the bands are not known for their historical accuracy of changing a city's name. It is not as if the citizens of New Amsterdam decided to hold a meeting in the center of the city in 1664 and decide: "Let's rename our settlement, let's call it New York from now on!" Both names are seen in Figure 26.1.

Figure 26.1. The official entrance to the City Hall of Manhattan, with the two names of the city.[2]

The real story of the transition from New Amsterdam to New York is a bit more complicated. Not too bloody, but “furry” enough! And flavored with spices. And on top, sprinkled in abundance with a natural climatic sauce, unaltered by humans.

From the New Amsterdam . . .

The first explorers of North America were the Vikings. In the 1100s, taking advantage of a period of global warming called the Medieval Warm Period (MWP), they sailed beyond Iceland and Greenland to Newfoundland, Canada.

But when the English explorer Henry Hudson tried to find a northern route to China in 1609, he failed because the first part of the seventeenth century was the coldest period of the Little Ice Age (LIA), and the northern seas were frozen, as shown in Figure 26.2 (Varekamp, 2006).

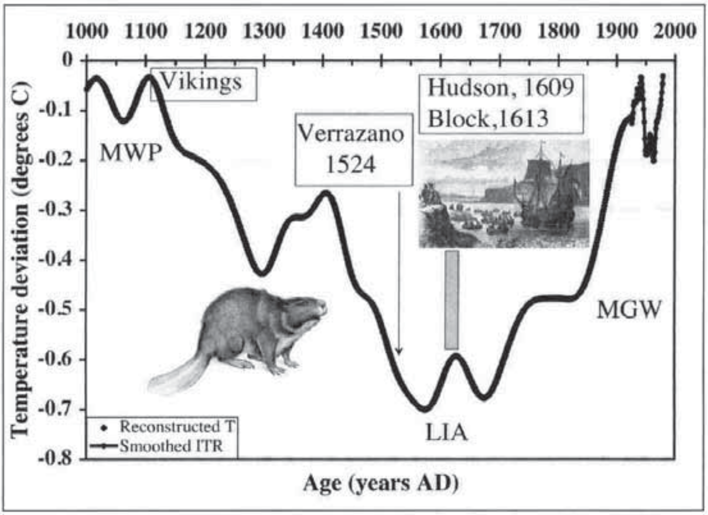

Figure 26.2. This shows the expeditions of the first explorers of the North American east coast together with the reconstructed temperature variation. The thick line indicates the temperature deviation from the average value of the period 1961–1980. The dotted line segment represents the instrumentally recorded temperature data (IRT).[3]

Instead, Hudson informed his employers, the East India Company of the Netherlands, about the possibility of exploiting beaver furs in the new territory discovered on the east coast of North America. Between 1609 and 1614, based on Hudson's information, several private trade missions investigated the fur trade's reliability.

On October 11, 1614, "The United New Netherland Company" was founded, and in 1621, the West India Company was founded. Dutch emigrants founded the first settlement in southern Manhattan in 1624.

The official date of birth of the new city, New Amsterdam, is considered to be May 4, 1626, when the official representative of the Dutch Republic, Peter Minuit, bought the island of Manhattan from the local Indians for $24 (or "60 guilders worth of trade," an amount worth approximately $1,143 in 2020 dollars) paid in beads, mirrors, glassware, knives, teapots, and similar articles.

What accelerated the emergence and further development of the new southern Manhattan city so much? The answer is unexpected (for some): climate change.

The 1600s were extremely cold due to the peak of the Little Ice Age, as seen in Figure 26.2. The people of Europe tried to find solutions to adapt to severe and prolonged frosts. In those conditions, fur was more than a luxury; it was a necessity. Fur-lined clothes, fur scarves, fur hats, fur sleeves, and fur gloves were essential measures of protection against frost. Beaver fur was especially prized because it has a unique feature: under the layer of shiny and long hair, there is another layer, consisting of short and thick hair. This layer was transformed into the felt from which all kinds of hats were produced, women's and men's, all good quality and very warm.

Russia was the first major source of beavers and other furs. The decline in the population of fur animals there coincided with the French discovery of territories with large populations of beavers in Canada. This was during Henry Hudson's expedition on the river that bears his name today. The West Indies Company founded New Netherland not as a colony to grow Dutch settlements in the New World, but as an efficient means for the rapid and profitable exploitation of "soft gold" in the region. Within a few years of Hudson's voyage in 1609, Indians from many local tribes began trading beaver furs at Dutch trading posts.

The fur trade was stimulated by demand in Europe, which increased as temperatures dropped. Turnover was impressive. For example, in a period of only seven years (1626–1632), the Dutch sent home 52,584 furs.[4] Another author uses much higher figures: the trading post in Albany (now the capital of New York, located on the Hudson River) exported an average of 46,000 furs per year, which lasted until the 1670s.[5] Varekamp (2006) estimates that the number of beavers killed in North America was 50 million.

Around the 1650s, the climate entered a brief warming period, which can be seen in Figure 26.2. It was enough for fashion to change according to the climate, and it caused the demand for furs to decrease. The Dutch trade in New Amsterdam began to suffer. The beaver population had also decreased due to intense hunting. Increasingly frequent wars with the native tribes, as well as those between the tribes, aggravated the situation of the Dutch settlers. Together, all these events marked the beginning of an economic nightmare for fur traders. The time was approaching for the transition from New Amsterdam . . .

. . . to New York

Disputes between England and the Netherlands about trade supremacy over transport routes resulted in three wars between 1652 and 1674. Having high-performing fleets, both countries sought to ensure trade hegemony through various means—military and diplomatic. By analogy with the present times, we can consider these conflicts similar to current international trade disputes, in which each party has a powerful fleet and is not afraid to use it.

At its peak, only about 9,000 people lived in the New Netherland colony, a number that made it vulnerable to attacks from England. And the end of this story occurred in March 1664, when English King Charles II granted the land of Manhattan to his brother, the Duke of York.

A few months later, on August 28, 1664, four warships with English soldiers anchored in the port of New Amsterdam. The commander of the expedition, Colonel Nicolls, asked the Dutch governor Peter Stuyvesant to hand over the city. For ten days, the governor tried to mobilize his citizens in defense of the city, but to no avail. When Nicolls sent a final ultimatum, New Amsterdam capitulated without firing a single shot. On September 8, 1664, the Dutch tricolor was lowered, and the white flag of capitulation was raised in its place.

New Amsterdam became New York.

Epilogue

The unconditional surrender of New Amsterdam aroused the fighting spirit of the Dutch at home.

The Second Anglo-Dutch War lasted two years, from 1665 to 1667.

Toward the end of the war, after several naval battles, Admiral Michiel de Ruyter dealt a severe blow to England, advancing on the Thames and capturing the British fleet's flagship HMS Royal Charles near Chatham, in front of the entrance to the port of London. The imperial capital panicked. A few weeks later, the Breda Treaty was signed. Manhattan remained under British control, but the Netherlands received in return, as a consolation prize, Run Island in the Banda Islands group of the South Pacific.

Apparently, the Dutch were fooled. Maybe they should have asked for more during the peace negotiations, we would say today. But we must not judge the past in the light of the present.

We have to think that 350 years ago, the spice trade was the main engine of the global economy. In the seventeenth century, spices were not found on all the shelves in food stores or the populations' kitchens. They were so rare and expensive that a French saying said you could buy the freedom of a serf with a pound of pepper.

And of all the spices of that time, in great demand, hard to buy, and overpriced, nutmeg was the undisputed star. It was believed that it could cure the plague, and so nutmeg's value was greater than its weight in gold. For example, in the Banda Islands, ten pounds of nutmeg cost an English penny equivalent. In London, the same quantity was easily sold for two pounds, ten shillings, that is, with a profit of 60,000%![6] Since nutmeg trees then grew only on the Banda Islands, the Dutch did an excellent deal, obtaining an island, Run, in exchange for a settlement with white settlers, whose main trade—beaver furs—was no longer of interest.

The Third Anglo-Dutch War lasted two years, from 1672 to 1674.

In 1673, two Dutch admirals docked 23 ships in New York Harbor and began landing troops. The story of 1664 was been repeated in reverse. The English commander had no chance but to capitulate unconditionally and surrender the city.

New York then became Nieuw Oranje, or New Orange, so named in favor of the Dutch Prince de Oranje, who in 1689 would become King William III of England.

The signing of the Treaty of Westminster in 1674 put an end to the third war between England and the Netherlands. As part of the peace arrangements, Manhattan's territory reverted to Britain, and New Orange was renamed New York. The Netherlands received Suriname in South America in return. The West India Company's shareholders considered the transaction profitable. They preferred a tropical country, with sugar cane plantations and slaves, in exchange for a non-profit colony.

Conclusions

The story of the two names of today's most influential American city is closely linked to climate change and the beaver fur trade. In the early 1600s, the planet was affected by the coldest period of the Little Ice Age. Intense and long-lasting frosts in Europe stimulated trade in beaver furs, which were used as a means of protection against glacial temperatures. It can be speculated that the emergence of the great metropolis on the island of Manhattan is due to the combination of two factors: climate change and beaver fur exports. It's a less common point of view, but one I assume.

CHAPTER 27

ARE THERE, HOWEVER, BENEFITS OF CLIMATE CHANGE?

If we don't change course by 2020,
we risk missing the point where
we can avoid runaway climate change.

António Guterres, UN Secretary-General
September 10, 2018

If we were to give credence to the United Nations Secretary-General, in 2021 we are one year beyond the tipping point he indicated where we had to change the course of current climate change to avoid its falling out of our control. His statement adds to the many articles and reports in the media about climate change caused by humans. Practically, the daily climate litany has become a modern feature of the speeches of politicians and eco-activists.

Numerous researchers from government and private institutions have vested interests (i.e., time, energy, and professional prestige) in promoting the narrative of the impending climate apocalypse induced by human activities. A gloomy atmosphere of the end of the world, of climate Armageddon, penetrates insidiously but persistently, into politician speeches, environmental activists' actions, media productions, and the inexhaustible blogosphere. Under these conditions, any positive news about how the planet and its population could still benefit from climate change automatically becomes blasphemy, heresy, lèse majesté, whistling in the church, etc. Who or what to believe?

The answer was suggested in 2016 by Scott Adams (*Dilbert*'s creator) as a possible solution to *the problem of nonexperts*. People suspect that something is wrong with the flood of mono/color information about the climate catastrophe in the next, let's say, 16 months, but they are not fully scientifically equipped to evaluate and judge them themselves. Therefore, throughout many articles and books, I have tried to provide nonexperts with well-documented scientific information, with plausible and easy-to-understand data on climate change. At the same time, I have highlighted many deep flaws that climate disaster advocates display.

I will continue to argue that the climate "devil" is not as black as many politicians, eco-activists, the Pope, and others suggest. Climate change does bring not only catastrophic tragedies because of people who burn fossil fuels relentlessly, but it also produces many benefits to the planet and humans, which we should consider in the Last Judgment.

1. Increasing the *greening* of the planet

A suggestive example of the planet's prosperity in the current climatic conditions comes from a scientific report published by an international team (thirty-two researchers, twenty-four institutions, eight countries)[1] and is seen in Figure 27.1.

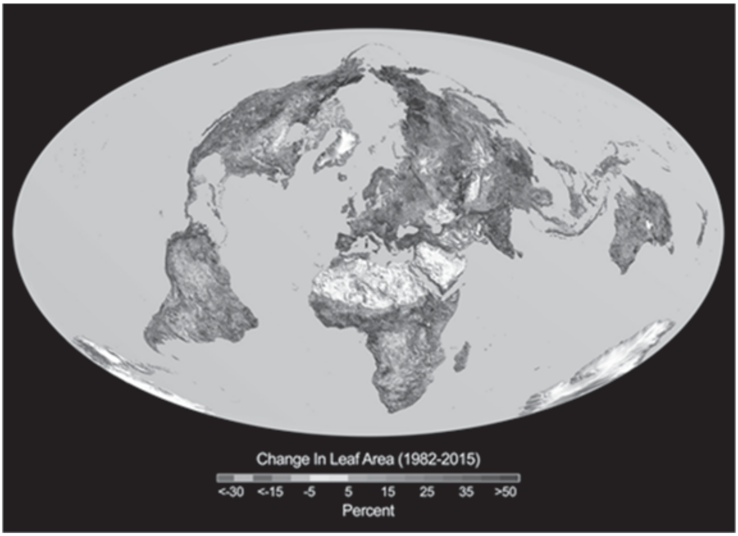

Figure 27.1. A significant "greening" of the earth has taken place in the last 33 years. Vegetation growth occurred in areas representing between 25% and 50% of the land area. The decrease of vegetation was registered on only 4% of the surface. The fertilization produced by carbon dioxide explains 70% of the greening effect.[2]

The team led by Zaichun Zhu, a researcher at Peking University, China, used three data sets (GIMMS3g, GLASS, and GLOMAP) produced by

NASA and NOAA satellites. According to the article's authors, between 25% and 50% of the earth's surface has increased vegetation (green colors), while only 4% show a net decrease (non-green shades).

Several factors have contributed to the greening of the planet. The most important, in a proportion of 70%, is the effect of fertilization produced by CO_2. There is also the increase in soil moisture and, to a lesser extent, the tundra's withdrawal due to gradual heating. A fabulous history, bypassed in the media, is represented by the area of sub-Saharan Africa, where 300,000 square kilometers of the Sahel region have been transformed from desert to an area with abundant grass.

The greening of the planet, as a result in part of the increase in CO_2 concentrations, also has a clear climatic effect. Plants become more numerous and more robust, and remove increasing amounts of carbon derived from CO_2 annually from the atmosphere, which they store in their tissues. Other benefits (e.g., economic, social, food, and medical) of abundant vegetation can be discussed in separate articles.

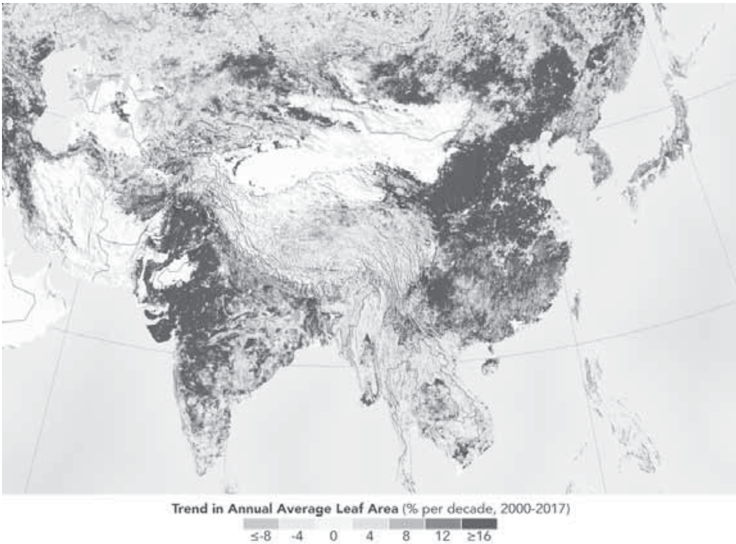

Figure 27.2. The world is a greener place than it was 20 years ago and two of the top CO_2 emitters on the planet are the counterintuitive source: China and India.[3]

In 2019, another team of scientists provided evidence of earth's greening due to CO_2 emissions by two of the biggest "polluters," China and India during 2000–2017, which can be seen in Figure 27.2.[4] According to NASA, the greening of the planet over the last two decades represents an increase in leaf area on plants and trees equivalent to the area covered by all the Amazon rainforests. There are now more than two million square miles of extra green leaf area per year, compared to the early 2000s – a 5% increase." The results are quite surprising, considering that "China and India account for one-third of the greening, but contain only 9% of the planet's land area covered in vegetation.[5]

2. Deaths caused by extreme weather events

It has become commonplace for rating media (as well as for consumers of "bloody" news) to present, with too many details sometimes, the so-called heatwaves caused by global warming. And, of course, the main element of that news is the number of deaths due to excessive heat.

Like many others, this is a propaganda myth. Let's look at the official data, which presents us with a completely different situation in Figure 27.3.

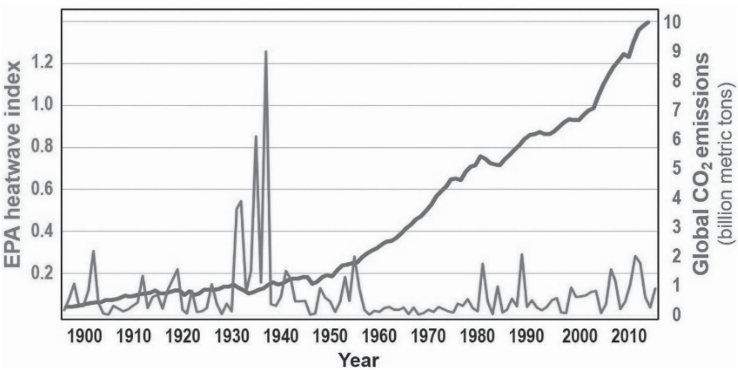

Figure 27.3. Heatwaves do not become more frequent due to global warming. The official index of heatwaves in the US in the period 1895–2015[6], together with the variation of global CO_2 emissions is shown here.[5,6,20]

Official data, published by the Environmental Protection Agency (EPA) in 2016, clearly shows that there has been no significant increase in heatwaves in recent times. On the contrary, it is remarkable that in the period 1930–1940, heatwaves were about six times more numerous than recent ones, although global warming was then far from what it is today.

Another myth, propagated by climate extremists, predicts that heatwaves and high temperatures related to global warming will kill more and more people around the world. If the preachers of climate Armageddon were right, the warming of the last 150 years should have caused more casualties due to the heatwaves. Or the reality is exactly the opposite of propaganda.

Cold waves kill considerably more people than heat. By far, on a global scale, the cold is the biggest killer of the climate.

3. Cold waves—a politically incorrect reality

A heatwave is a popular term associated with anthropogenic global warming. Since 2003, when Europe suffered the effects of such a phenomenon, almost all discussions about the future consequences of anthropogenic global warming use that event as a starting point. The famous Al Gore, for example, stated in 2006 in *An Inconvenient Truth* that,

> We have already begun to see the kind of heat waves that scientists say will become more common if the problem of global warming is not solved. In the summer of 2003, Europe was hit by a massive heatwave that killed 35,000 people.

And Sir David King, the British Government's chief scientific officer, even had a vision in 2004 that,

> an ice-free Antarctica is likely to be the world's only habitable continent by the end of this century if global warming remains unchecked.[7]

When I read such prophecies of some climate Cassandras, I get a strong feeling that something is weird: could this be true indeed? An alternative answer would be the documented discussion about *cold waves*, not just heatwaves. I know, I know, it's not politically correct to talk about cold waves because then all the propaganda with anthropogenic global warming goes to hell. But let's give it a try.

In 2014, a National Health Statistics Report, titled "Deaths attributed to heat, cold, and other weather events in the United States, 2006–2010," reported death certificate data gathered by the Center for Disease Control (CDC). The results of the study indicate that,

> during 2006–2010, about 2,000 U.S. residents died each year from weather-related causes of death. About 31% of these deaths were attributed to exposure to excessive natural heat, heat stroke, sun stroke, or all; 63% were attributed to exposure to excessive natural cold, hypothermia, or both; and the remaining 6% were attributed to floods, storms, or lightning.[8]

Using similar CDC data from 1979 to 1999, Dixon et al. (2005) reported 3,829 heat-related deaths and 15,707 cold-related deaths. Hypothermia from excessive natural cold weather was responsible for more than four times the number of deaths than those related to heat.[9]

In October 2020, a study authored by researchers from the University of Illinois Chicago, "Clinical outcomes of temperature-related injuries treated in the hospital setting, 2011–2018," showed that cold temperatures were responsible for 94% of temperature-related deaths in Illinois between 2011 and 2018. There were 1,935 cold-related deaths and 70 heat-related deaths.[10]

Using data published by WHO in 2004, Lomborg (2007) calculated that "in Europe as a whole, about two hundred thousand people die from excess heat each year. However, about 1.5 million Europeans die annually from excess cold. *That is more than seven times the total number of heat deaths*"[11] (emphasis added).

Similar figures, shown in Figure 27.4, were advanced by a study published in 2015 by an international group of researchers, led by British Professor Antonio Gasparrini of the London School of Hygiene and Tropical Medicine.

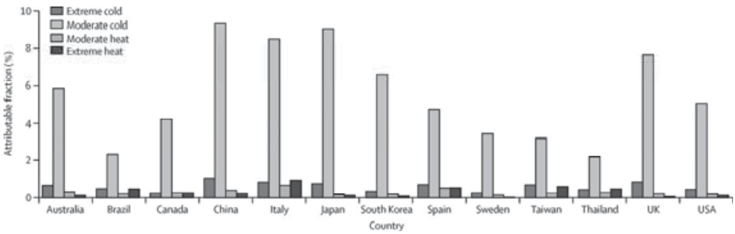

Figure 27.4. Cold waves, not heatwaves, are the real climate killer. This shows the fraction of all-cause mortality attributable to moderate and extreme hot and cold temperature by country.[12]

Collecting data from 384 localities in Australia, Brazil, Canada, China, Italy, Japan, South Korea, Spain, Sweden, Taiwan, Thailand, the United Kingdom, and the United States, the researchers found a shocking fact. Between 1985 and 2012, the thirteen countries recorded 74 million deaths total. Of these, 5.4 million were caused by cold waves and only 311,000 by heatwaves.[12] I mean, the cold kills 20 times more people, and we complain about anthropogenic global warming? What could such an attitude be called?

During the 2001–2017 period alone, at least eighteen cold waves were recorded in Europe and North America, with countless victims. For example, on January 5, 2017, the temperature in Europe dropped to −45.4°C, causing at least 60 deaths.

You can read more about the cold waves and their victims in India at NDTV “Cold wave death toll.”[22]

In the United States between 1979 and 2006, mortality caused by excessive heat accounted for 27.1% of all deaths caused by major weather events (i.e., extreme heat, extreme cold, tornadoes, hurricanes, lightning, and floods). But in the same period, the number of victims killed by excessive cold events was about two times higher (50.1%).[13]

Goklany (2009) concludes that overall, both deaths caused by major weather events and their rate have decreased significantly since the 1920s, as shown in Figure 27.5.

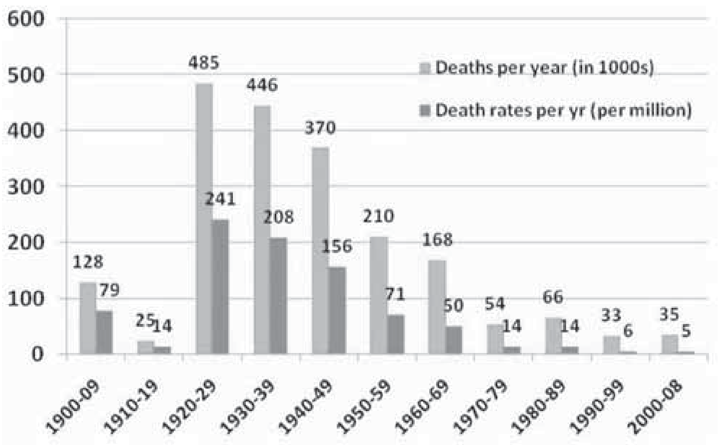

Figure 27.5. Since 1920, the United States has seen around a 93% decrease in deaths from extreme weather events. Modest global warming was recorded in the same period (1920–2008).[13]

A study by specialists from the European Union analyzed the relationship between lives lost due to heatwaves and those saved from death by frost, which can be seen in Figure 27.6.[14]

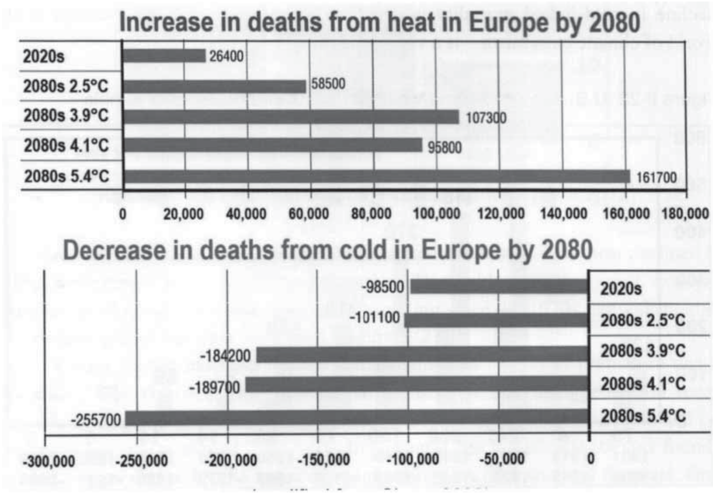

Figure 27.6. Predictions of increased deaths caused by heatwaves vs. predictions of a simultaneous decrease in deaths caused by cold waves in Europe in the 2080s. Four scenarios for increasing global warming are presented. In any scenario, more lives will be saved from death by freezing than those lost due to heatwaves (modified from Ciscar et al., 2009[14])

If temperatures rise, for example, by 5.4°C in the 2080s, the number of victims of heatwaves in Europe would rise to 161,700. Under the same conditions, rising temperatures would save 255,700 people from freezing to death, 94,000 more than those killed by the heat.

Summarizing the above examples, don't you think that some eco-activists cynically use two different units of measurement for human life? Why don't I hear or read any words or official statements about the deaths caused by the cold waves? Do they not deserve our compassion, as do the victims of earthquakes, tornadoes, hurricanes, and other natural disasters? Should only heatwave deaths be presented as casualties of climate change?

4. Global warming and wildfires

A 1998 study by Canadian Forest Service researchers compared temperatures and concentrations of CO_2 vs. the frequency of forest fires over the last 150 years in North America and northern Europe.[15] Their results contradict the predictions of climate alarmists. The authors demonstrated the presence of a link between the concentration of CO_2 in the air and the decrease in the number of planetary natural fires. They attributed this decrease to a combined effect of CO_2 fertilization and rising temperatures, leading to higher soil moisture.

> Despite increasing temperatures since the end of the Little Ice Age (ca. 1850), wildfire frequency has decreased as shown in many field studies from North America and Europe. We believe that global warming since 1850 may have triggered decreases in fire frequency in some regions and future warming may even lead to further decreases in fire frequency.[15]

A similar conclusion was expressed by a study published in 2014.[16] Reconstructing the history of wildfires in the twentieth century and the beginning of the current century, the authors found that the average global area destroyed by fires between 1901 and 2007 was around 442×10^4 km^2/year, with a notable rate of the decrease of the burned areas of 1.28×10^4 km^2/year, a decrease produced despite the increase of temperatures. This can be seen in Figure 27.7.

According to the indicated study, the significant decline of wildfires in North America and Europe was caused by increased soil moisture due to a combination of increased rainfall and CO_2 fertilization. In turn, the increased rainfall was produced by higher temperatures, which allowed a higher concentration of water vapor in the atmosphere, so more rain occurred. And an increasing effect of CO_2 fertilization leads to stomata with smaller openings, which reduced stomatal conductance and water loss through perspiration. The plants needed less water, which left more moisture in the soil. Hence, a reduction in intense heatwaves, wildfires, and droughts are benefits of climate change.

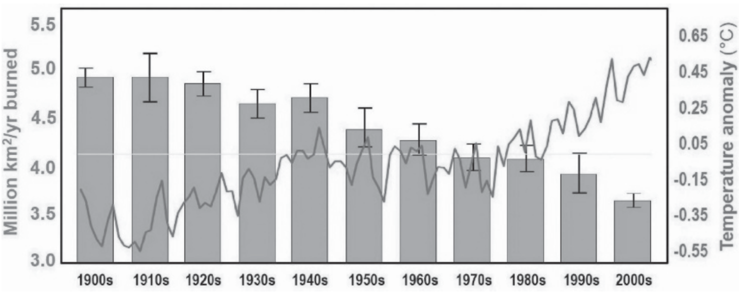

Figure 27.7. Areas burned in wildfires and temperature variation.[16,17,23]

A zoom-in of the last 30 years (1990–2020) suggests a relative general decrease in the number of fires, starting around 2006, with some spikes in areas burned in 2006, 2015, and 2017, and is shown in Figure 27.8.

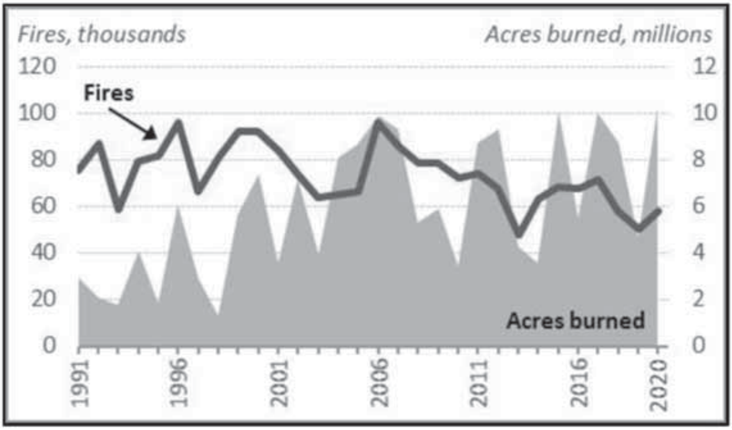

Figure 27.8. Wildfire statistics, 1990–2020. Data reflect wildland fires and acres burned nationwide, including wildland fires on federal and nonfederal lands.[24]

The global decline in global burned areas was documented by Andela et al. (2017) using satellite data. Despite the current global warming climate, there was a reduction of the global burned area by around 25% over the period between 1998 and 2015. It was surmised that agricultural expansion and intensification most likely contributed to the decline, the largest being recorded in savannas and grasslands.[21]

What else do politicians and eco-activists propose? Carbon tax!

One of the radical measures in the fight against anthropogenic climate change is the tax on an economic entity's carbon emissions. Very dear to many politicians and eco-activist organizations, the carbon tax is seen as an effective measure in the arsenal of coercive means of economic agents to force them to pay for CO_2 "pollution." But the situation on the political-ecological tables is not supported by ideologically unregimented scientists.

In 2018, a group of researchers at the International Institute for Applied Systems Analysis published in *Nature Climate Change* the first study comparing eight different models of climate effects on agriculture with the costs and effects of mitigation policies. They analyze the impacts on food security and hunger risks.[18]

By 2050, the models suggest that climate change could be responsible for starving an additional 24 to 50 million people. However, the authors argue, if agriculture is subject to carbon taxes or if a comprehensive cap-and-trade emission system is applied to all economic sectors, the rise in food prices will be so great that between 78 and 170 million will face the risks of starvation. Some areas are much more vulnerable than others, particularly sub-Saharan Africa and India.

Trying to help 50 million people by endangering another 170 million seems to be a terrible policy.

Unfortunately, this story is not something new. Over the past few decades, similar stories have been produced by climate policies that have created more disasters than benefits in their attempts to control climate change.

For example, a madness of ethanol produced from corn and other biofuels only began 10–12 years ago. Politicians and eco-activists alike hailed the idea as a welcome divorce from fossil fuels. Remember what President George W. Bush said in 2006: “America is addicted to oil . . .” Ethanol-producing ones have replaced food-producing crops. The outcome? A sharp rise in food prices has pushed at least 30 million people into poverty, and another 30 million have been starved, according to data provided by UK charity Action Aid.

Conclusions

In his speech from which I extracted the motto of the article, Mr. Guterres launches another fumigant:

> Climate change is the defining problem of our time and we are at a defining moment … Scientists have been telling us for decades. Again, and again. But too many leaders refused to listen.

As far as I know, only one leader, President Donald J. Trump, refused to listen to the climate sirens’ song. Maybe United Nations Secretary-General is aware of others. I know that after the signing of the Paris Agreement in 2015, very few countries came close to the voluntarily accepted targets for reducing CO_2 emissions.

On December 3, 2018 in Katowice, Poland, a new round of evaluation of the promises signed three years ago in Paris took place. Probably, the delegates gathered there considered that, at best, the application of the Agreement will achieve 1% of what would be needed to keep the temperature rise below 2°C. But that will cost between $1 trillion and $2 trillion annually. This is money that could be spent on better nutrition, health, and education.[19]

On February 26, 2021, it was made public that “Global action is ‘very far’ from what’s needed to avert climate chaos”[25]:

> New climate targets submitted by countries to the United Nations **would reduce emissions by less than 1 percent**, according to the latest tally, made public Friday by the world body [emphasis added].
>
> The head of the United Nations climate agency, Patricia Espinosa, said the figures compiled by her office showed that “current levels of climate ambition are very far from putting us on a pathway that will meet our Paris Agreement goals.”[25]

The road to reach the conditions signed in 2015 in Paris Agreement is longer and tougher than expected.

CHAPTER 28

"OVERHEATED" CLIMATE MODELS AND THEIR FANTASTIC PREDICTIONS

In 2099, Iceland will have the richest inhabitants in the world, Mongolia will become an economic superpower, and Romania and the United States will have similar GDP per capita.

In recent years, estimates of climate patterns of rising temperatures due to global warming have been coupled with projections of economic models to estimate the magnitude of the challenges and the economic costs associated with them. Thus, a kind of climate economy or economic climatology occurred, whose studies seek to clarify how changes in the environment, predicted by climate models, will impact human collectivities through their anticipated effects on the economy, health, or infrastructure.

If the climate part of these hybrid studies is strong enough (after all, it is accepted by the consensus of the 97% of experts who agree with anthropogenic global warming!)[1], the economic part is often ridiculous. Projections of the imminent and inherent costs of climate change have started to be based on statistical analyses of the effects of temperature variations, creating correlations between current temperatures and outcomes such as economic growth or mortality. Next, the correlations obtained on a small scale are extrapolated to more extended periods, with much higher global warming than the one initially used. This results in a proportionately greater response to climate effects and the costs that society will have to pay to mitigate significant future impacts. In other words, climate catastrophe is compounded by economic disaster.

For those interested, I compiled some instructive examples in a note.[2]

The article I will analyze below is entitled "Global non-linear effect of temperature on economic production" and is authored by three professors—Marshall Burke, Solomon Hsiang, and Edward Miguel—from the renowned Stanford University and the University of California, Berkeley. It was published on November 15, 2015, in the journal *Nature*.[3]

Using data from 166 countries over 20 years (1980–2010), the authors compared variations in the average temperature in a country with variations in the same years of economic growth (GDP per capita). They also built a climate–economic model (I will call it the "Burke model") based on a single nonlinear equation, which correlates the two variables.

Analyzing the correlations obtained, the authors discovered that in countries with an average temperature below 13°C (approximately the average temperature in New York City, Milan, Beijing, and Wellington), economic growth was more sustained in warmer years. If countries experienced average temperatures above 13°C, they achieved economic growth in the colder years. Therefore, the ideal temperature for growth is 13°C. The closer you are to this temperature, the better. The farther you are from 13°C, the harder it will be to achieve economic growth. As climate patterns show an annual increase in global temperatures, it turns out that economic growth will also suffer a yearly decline.

Once this correlation between temperature–labor productivity and economic growth was found, the Burke model was applied to future humanity, much warmer than in 2010. The anticipated period, with the corresponding warming, was considered until 2099.

According to the Burke model, the main consequence of global warming will be **a dramatic decrease, by 23%, of the average global income** (GDP/capita). The forecast reduction is an order of magnitude larger than any other previous estimate. For example, the Obama Administration estimated in 2010 that the decrease in global revenues will be in the order of 1%–4%. It should come as no surprise that this gloomy prediction has received widespread media attention and publicity. That the article was published exactly one month before signing the Paris Climate Agreement (December 15, 2015) may be a coincidence. Maybe not. However, if the Paris signatories read it, I don't think they would have missed the warning written in the Abstract:

> … unmitigated warming is expected to reshape the global economy by reducing average global incomes roughly 23% by 2100 and widening global income inequality, relative to scenarios without climate change.

But the Burke model is as amazing as it is absurd.

Mongolian climate change

Using the data provided by the authors, I represented some of the values produced by the Burke model for 2099.

According to Figure 28.1, while the world's economy will shrink sharply due to global warming, countries with cold climates will reach an unimaginable level of wealth.

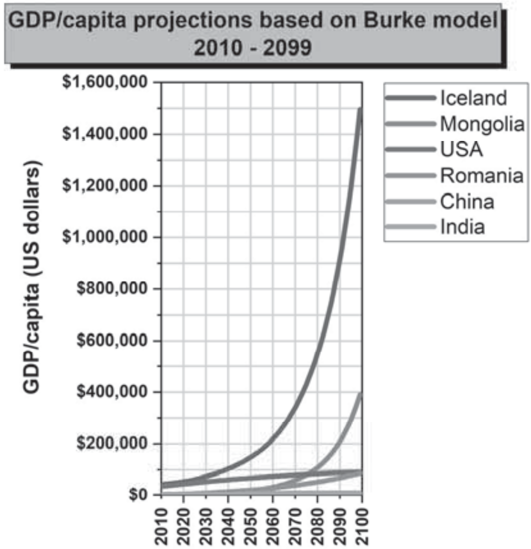

Figure 28.1. GDP/capita projections, following climate change from 2010 to 2099.[4]

Thus, with a GDP of $1,500,000 USD, the richest people in the world will be living in Iceland, a country with 300,000 people, less than those from a Brooklyn neighborhood. Icelanders will earn more than double than any other country except Finland ($860,000).

On the other hand, the world's poorest country in 2099 will be India, with a GDP/capita of only $1,657. China will also be on the poverty line, with a GDP per capita of $10,362.

Another significant aspect of the Burke model is that, finally, due to global warming, Romanians will reach a level of individual wealth similar to that of the Americans. Romania in 2099, with $86,216, will rank 31st in the world, rising from its current 70th place; USA (2099), with $90,429, will occupy the 28th place!

But by far, the most spectacular prediction of the Burke model is the emergence of a new world economic superpower: Mongolia! From the current 118th place in the world economic hierarchy, with a current income of $861 per inhabitant, Mongolia will become the 7th country in the world in terms of GDP per inhabitant. With a GDP per capita of $390,000 due to global warming in 2099, the Mongols will be more than four times richer than the Americans. I'm talking about Mongolia, the country with about three million inhabitants, of which approximately 40% are nomads, and horse and camel breeders. Global warming, well incorporated into Burke's "overheated" model, will probably produce wonders never seen before.

Another striking example is that of the state of Israel, as seen in Figure 28.2.

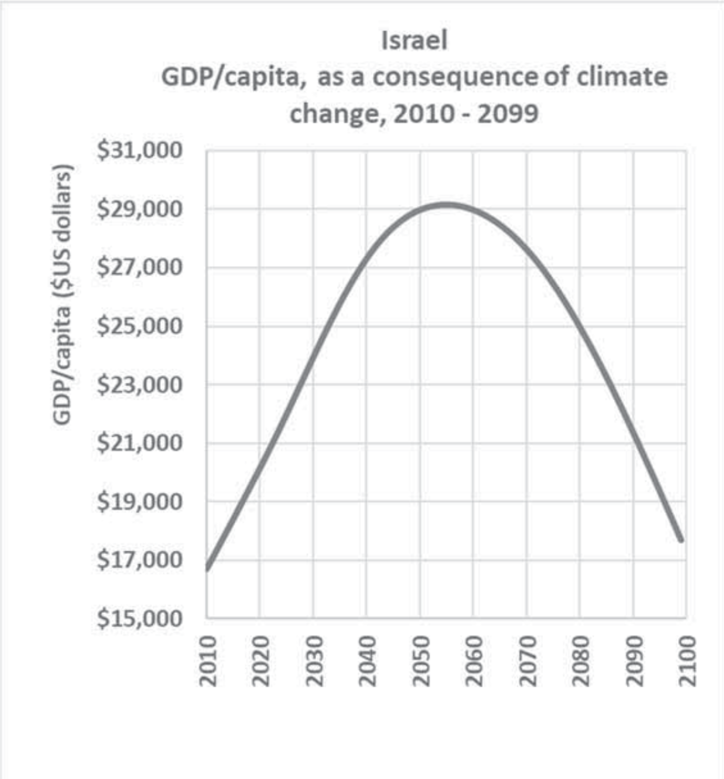

Figure 28.2. GDP/capita evolution in Israel as a result of climate change from 2010 to 2099.[4]

This is Israel, a country that made the desert flourish through revolutionary water and irrigation management techniques, a country that had a surplus of water during intense droughts in the area, which some consider a cause of the civil war in Syria.[6] The Burke model predicts that the citizens of Israel will reach a maximum of their wealth around 2055, after which their income in 2099 will be similar to that of 2010, i.e., it will decrease by more than 2% per year.

If we report the values of total GDP, provided by the Burke model, the following situation occurs, as seen in Figure 28.3.

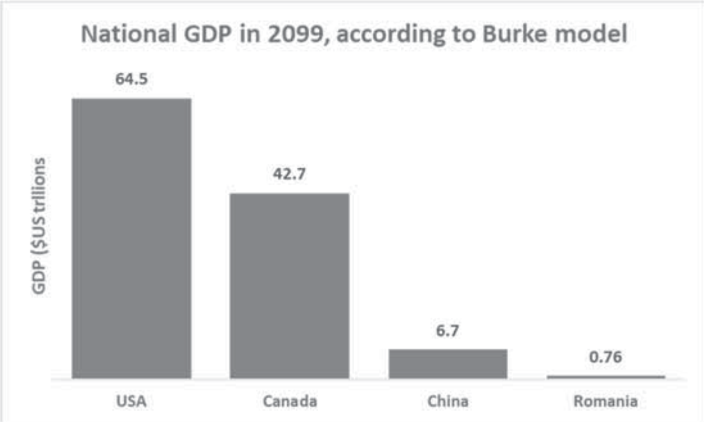

Figure 28.3. National GDP for selected countries.[5]

These predictions seriously shake common sense. Despite the relatively low per capita income, the United States will continue to be the world’s number one power because the current population will double, reaching over 713 million. Based on the same shocking presumption that populations are growing faster in colder countries, Canada, with more than 81 million people, will be ranked second in the world’s economic powers for the first time in its history. What’s more, Canada’s economy will be more than seven times larger than China’s because (you guessed it!) global warming will ruthlessly reduce the number of Chinese women and men, from 1.4 billion in 2018 to only 644 million in 2099, which means halving! Miraculously, India will maintain a population of 1.1 billion in 2099, even if it is the poorest on the planet.

As for Romania, the Burke model authors do not have much good news. In 2099, the national GDP will be $760 billion because the same global warming will cause a decrease in the population from 19.5 million in 2018 to only 8.8 million in 2099.

Burke’s model bizarreries don’t end with the ones described above. Definitely, the results for Iceland and Mongolia are aberrations, and someone grumpier could reply: well, what if the two examples are hard derailed from the natural line of socio-economic logic? Do they change the quality of the "overheated" model? Yes, it changes everything. Because we either believe in the assumption that gradual changes in global temperature affect economic growth according to the function invented by Burke et al. (2015), or we do not think so.

If a statistical model makes predictions that can be easily falsified, we are dealing with a flawed model, regardless of who the authors are or where they published their findings.

With such an overheated climate–economic model, the world will fully share the Mongolian sentiment of climate change.

What's wrong with the Burke model?

In short, three sophisms undermine the credibility and value of this climate–economic approach:

(1) The authors consider that the same answers, highlighted in case of minor variations (i.e., fractions of a degree Celsius) and random historical temperatures, will amplify into proportional manifestations in case of future climate changes, becoming major (several degrees Celsius) and permanent.
(2) The authors consider that human society in the next eight decades will either remain unchanged or will not try any adaptation to mitigate or counteract the future effects imposed by climate change.
(3) The authors construct an alternative universe, which does not currently exist. Their analyses do not consider the effects of adaptation to climate change, driven by increasing national wealth and technological advances, and providing solutions to many climate problems. Biophysical, behavioral, and social adaptations are also possible.[7]

How does Marshall Burke respond to the criticism already made? Accused of confusing "weather" (short-term temperature studies) with "climate" (long-term studies with multiple variables), his PhD thesis being in agricultural economics, Marshall proudly ignores answering questions about the quality or plausibility of his forecasts. Instead, he is keeping his critics accountable on his blog:

> … just claiming that responses derived from studying 'weather' are a bad guide to understanding 'climate' is not that satisfactory. Show us how long-run responses are going to be different.[8]

Conclusions

What looks dangerous to me in the current climate reductionism is that its practitioners are giving away the planet's future to climate modelers' epistemic community. Then, using proximities, they transfer their conclusions to social, economic, and political analysts. The consequences of these co-productions climate modeling (i.e., social interactions, economic consequences, and environmental policies) can often be asymmetric, with impacts on various societies' vulnerability and resilience that are difficult to estimate.

On the other hand, what worries me about the new climate–economic models is their rapid rise in American decision makers' administrative offices. The United States Government Accountability Office (GOA) and the United States Environmental Protection Agency (EPA) have been working for several years reviewing information about climate change's potential economic effects and the associated risks and challenges to the federal government.[9]

The studies considered by the federal agencies mentioned above have used, like the Burke model, variable doses of unjustified alarmism produced by the extrapolation of temperature–socio-economic effects correlations. Adding economic catastrophe to climate catastrophe does not help at all; on the contrary.

For example, the study produced by Hsiang et al. (2014) (Hsiang is the second author of the "Burke model" in 2015) estimates that by 2100, the cost in the United States caused because of climate change effects will reach $228–$945 billion per year. At least 71% of this amount is estimated by considering individual temperature studies.

The study published by the EPA in 2015 estimates that the costs associated with climate change in the United States will range between $1.3 trillion and $1.8 trillion annually by the end of this century. At least 89% of the estimated amount is due to temperature studies of the Burke model type.

But when climate–economic studies and modeling defy common sense, make aberrant estimates, and slip dangerously on the slope of unwarranted alarmism, the integrity of science suffers.

Did the decision makers, who signed the Paris Climate Agreement, become aware of the "spells" of the "overheated" Burke model, published just one month before the official ceremony, in one of the world's leading scientific journals, with authors employed by famous American universities? *Just asking …*

Chapter 29

A Paradox: When Renewable Energy Becomes Cheaper, Electricity Becomes More Expensive!

After President Donald Trump decided to withdraw the United States from the Paris Climate Agreement on June 1, 2017, the liberal media rushed to publish news after news after news about the price dropping of renewable energy, mainly solar and wind. Here are some examples:

- "'Spectacular' drop in renewable energy costs leads to record global boost," *The Guardian*, June 6, 2018.[1]
- "Clean Energy is About to Become Cheaper Than Coal," *MIT Technology Review*, June 15, 2017.[2]
- "The Green Energy Revolution Will Happen Without Trump," *The New York Times*, June 20, 2017.[3]
- "America's 'Renaissance' to Gains for Renewables: Global Energy Trends," *The New York Times*, November 13, 2017.[4]
- "Why a Big Utility Is Embracing Wind and Solar," *The New York Times*, February 6, 2018.[5]

The intentions of the distinguished *New York Times* journalists (and many of their colleagues of the same political orientation) seem clear enough to me.

On the one hand, President Trump was painted negatively as "uneducated" who, unlike former President Obama, did not want to consider the consensus of the 97% of experts who agree with global warming.[6]

On the other hand, a rosy picture is presented to the public about how much the prices of solar panels and wind turbines have fallen lately.

Based on such information, people rightly expect electricity prices to fall accordingly. But the reality is precisely the opposite: electricity has become more expensive, not cheaper! Of course, the readers of the publications mentioned above did not have the opportunity to read the explanations of this paradoxical situation.

Indeed, solar and wind energy prices *fell* sharply between 2009 and 2017: by 75% for solar panels and 50% for wind turbines.[7]

But electricity prices *have risen* by:

- 51% in Germany between 2006 and 2018, as seen in Figure 29.1.[8] Since 2000, Berlin has subsidized renewable energy (wind and solar) by USD $222 billion.[9]
- 30% in California between 2011 and 2019, as seen in Figure 29.2. Renewable energy produces 20% of total electricity.[10]
- more than 100% in Denmark, since 1995, when large-scale wind energy development took place.[11]
- 63% in Australia,[12] between 2007 and 2017, when the government spent USD $8.5 billion to increase the contribution of renewable energy by 147%.[13]

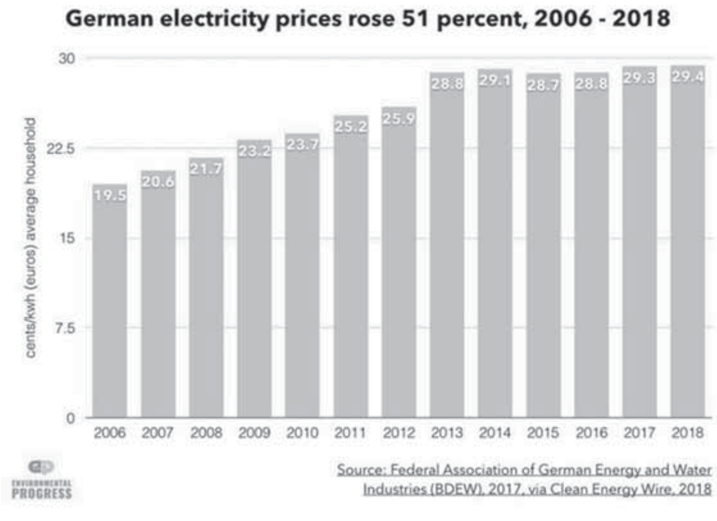

Figure 29.1. Electricity prices in Germany increased by 51% between 2006 and 2018.[8]

Figure 29.2. Electricity prices in California increased by 30% (six times more than in the rest of the US) during the development of its solar energy, 2011–2019.[10]

A major exception to the general trend of rising electricity prices in America is Texas, the epicenter of the shale revolution and the place where hydraulic fracturing is triumphantly applied on a large scale. Between 2008 and 2017, natural gas prices fell by 70%[14], and consumer electricity prices fell by 14%.[15] What results from these opposite trends? If wind and solar energy production has become so much cheaper, why have the prices of electricity produced increased instead of falling?

Michael Shellenberger, a well-known environmentalist and California gubernatorial candidate in the November 2018 election, tested two possible answers:[16]

1. The price decrease of electricity produced by the sun and wind is counteracted by the price increase of other energy sources, such as coal, natural gas, and nuclear. Thus, any gains were eliminated, producing a general increase in the price of electricity.

This hypothesis does not stand up to a confrontation with reality.

In 2016, due to the shale revolution, the natural gas price in the United States was the lowest it had been in the last 20 years. In total, gas prices fell by 72% between 2009 and 2016.[17] During the same period, the price of Russian gas at the German border fell by almost 50%.[18]

2. The paradox in the chapter's title may be caused by the *closure of some nuclear power plants*, resulting in high electricity prices.

This assumption is based on the fact that the states that massively produce nuclear energy, such as France, Sweden, South Korea, and Illinois in the United States, have some of the lowest electricity prices. For example, in France, a kWh costs 24.63 cents, 43% less than in Germany, and electricity in Illinois is 42% cheaper than in California.

Since 2010, Germany has abandoned five nuclear power plants and four reactors at other operating plants producing 10,980 MW. California has shut down a single nuclear facility with an installed capacity of 2,140 MW.

And this hypothesis does not stand the test of energy reality. The prices of coal and natural gas—which replaced uranium—remain relatively low, so they could not be the ones contributing to higher electricity prices.

Then, what's going on? Aren't the two renewable energies, despite their cheapening, paradoxically producing an increase in the cost of electricity they generate?

A possible answer was suggested by German economist Lion Hirth in 2013.[19] Analyzing solar and wind energy dynamics, Hirth estimated that there would be significant decreases in their economic value as they become an increasingly important part of the energy mix. What is the cause? Solar and wind energy are eminently variable,[20] which substantially affects their market value, which decreases with increasing market penetration rates.

Simply put, both the sun and the wind produce too much energy when people do not need it and too little when needed.

In 2016, I presented this situation, calling it "the duck neck effect" and using California as an example.[21] The addition of variable amounts of solar energy to the grid creates problems, especially when electricity demand is relatively low and renewable energy production is high. When the sun sets and most people return home, turn on the lights, and turn on various appliances, there is a rapid increase in electricity demand. Solar energy is no longer sufficient, and then a "duck neck" requires maintaining idle a large group of energy resources with a high degree of flexibility that can be switched quasi-instantly.

Returning to Hirth, he estimated that the economic value of wind energy in the European grid would decrease by 40% when the penetration rate reached 30% of the total electricity produced, while the value of solar energy will decline by 50% when it represents only 15% of the electric mix, as seen in Figure 29.3.

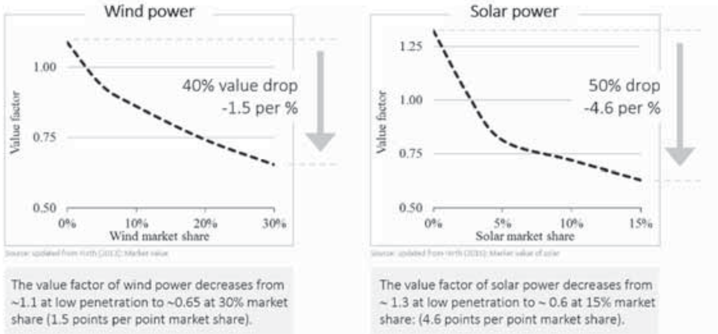

Figure 29.3. Decreasing the economic value of wind and solar energy as their share in the energy mix increases (modified from Hirth, 2013[19]).

The Hirth model's confirmation came in 2017 when the percentages of wind and solar energy reached 53% in Denmark, 26% in Germany, and 23% in California. The two countries rank first and second for the most expensive electricity in Europe (30.5 cents/kWh).[22]

And Californians, as seen in Figure 29.2, pay six times more for the electricity bill than the rest of the American states, which is almost half (16 cents/kWh) of the electricity bills of the "champions" of Europe. However, journalists from *The Los Angeles Times* (as if following in the footsteps of their colleagues from *The New York Times*) reported in 2017 an increase in electricity prices without connecting it with the rise in renewable energies.[23] Economist James Bushnell of the University of California, Berkeley, has sharply criticized this overlook:

> The story of how California's electricity system has reached its current state is a long one, but the dominant factor in electricity policy has been, without question, the emphasis on the development of renewable sources of electricity.[24]

Another remarkable aspect of the title paradox should be noted. In those American states where wind and sun experience a substantial penetration, electricity prices would have risen much more if a significant reduction of natural gas produced by hydraulic fracturing had not co-occurred.

As I mentioned above, since 2000, Germany has subsidized renewable energy with USD $222 billion.[25] But when the Berlin government decided in 2012 to reduce solar subsidies, the industry plummeted. Since then, almost every major German solar panel manufacturer has gone under since new capacity has fallen by 90% and new investment by 92%. About 80,000 workers, 70% of the total solar workforce, were laid off.

Germany’s experience is spreading throughout Europe as a stark reminder. When subsidies decrease or disappear, investments in wind turbines and solar panels also take a downturn, as do jobs in these industries.

Conclusions

The famous American journalist H. L. Mencken nicknamed “The Baltimore Sage” intuited a paradoxical situation: *any complex problem has a clear, simple, and … wrong solution!* The issue of anthropogenic global warming has a clear and straightforward answer that all fossil fuels must be replaced immediately with renewable energy. What could be simpler and clearer than that? But, as I tried to prove above, the proposed solution also has a major flaw: it leads to higher electricity prices, even if renewable energies become cheaper every day.

But even the last sentence is not 100% correct. In the real world of business and commerce, renewables’ cost becomes prohibitive in the absence of state subsidies. One of the wealthiest people in America, Warren Buffet, explained in 2014 what the deal is with subsidies:

> In the wind energy industry, we receive subsidies if we build a lot of wind farms. This is the only reason we build them. Without subsidies, it would make no sense.[26]

Does anyone remember President Obama and the $535 million he gave to Solyndra, California, in 2009 to produce solar panels? In just two years, the company misused the President’s money (plus another $ 25.1 million from the state of California) and went bankrupt without producing anything for the American people. The liberal press preferred to overlook that President Obama donated over half a billion dollars to his friends in Solyndra to buy more votes.[27]

In the imaginary world of environmental activists and politicians, renewable energies are not only reasonable in price, but they are also inevitable. The difference between real and imaginary costs is called *wishful thinking*. This feeling is induced not only by certain media but also by some academic exercises, which put a stamp of authority on ideologues’ beliefs.

I want to conclude by returning to the role of journalists who report on the fall in the prices of solar panels or wind turbines without mentioning at the same time the adverse effect of higher electricity prices.

With or without intention, these journalists do a disservice to public opinion and politicians with decision-making power, creating a false picture of the two energies and generating vain hopes that everything will be all right. I do not think that these journalists are energetically illiterate, but are somewhat biased. When there is an opportunity to criticize fossil fuels or people who ignore climate experts' consensus, the same journalists find the typographic space necessary to blacken it with everything gloomy, sinister, or pessimistic. In other words, a certain part of the mass media intentionally ignores professional ethics, singing the favorite song of political correctness: *renewable energy = good, fossil fuels = bad*.

Perhaps those journalists would not mind going through a study published in May 2018 by three Portuguese researchers, "Have fossil fuels been substituted by renewables? An empirical assessment for 10 European countries."[28] The study illustrates the difficulties faced by energy managers in ten European countries, forced to counteract the intermittent nature of wind and sun by installing new capacities based on fossil fuels, mainly natural gas. As the global economy trades to 100% electrification, gas-fired power plants, permanent, ready to operate at any time, will continue to grow. That is, in the long run, there will be an increase in fossil fuels burned to produce electricity.

Perhaps those journalists would not mind the study of researchers at Rochester Institute of Technology and Carnegie Mellon University, entitled "Bulk energy storage increases United States electricity system emissions."[29] They might recognize (probably) that energy storage in batteries, pumped water, compressed air, and molten salt, hides a dirty secret. Today's CO_2 emissions are higher than if there had been no energy storage in the United States. Another study, "The impacts of storing solar energy in the home to reduce reliance on the utility," published in 2017, analyzes solar energy storage in Texas homes.[30] All parameters being equal, residential storage increases annual energy consumption by 324–591 kWh per household and annual greenhouse gas emissions per household by 153–303 kg CO_2, 0.03–0.20 kg SO_2, and 0.04–0.26 kg NO_2. In other words, storing energy in the house does not automatically reduce energy consumption or pollutant emissions.

A renewable technology, much praised and giving ecological hopes, must be reviewed without "green glasses," and must be based on concrete unmade-up journalistic data.

Finally, perhaps those journalists would not mind reading a report published in November 2017 by *Environmental Progress*.[31] In this article, authors who are environmentalists (!) analyzed the evolution of energy carbon intensity (i.e., CO_2 emitted per unit of energy consumed) in 68 countries since 1965. Contrary to expectations, they did not find any correlation between renewable energy additions and carbon's energy intensity. Despite numerous installations of solar panels and wind turbines, the carbon intensity remained unchanged. And then, I wonder, why are some still fighting with “green” fists in their “green” chests for the immediate replacement of fossil fuels with something that, in reality, does not serve their political correctness of *fossil fuels = bad* and *renewable energy = good*?

With such opinion influencers as the above journalists, society’s polarization is ensured in the long run.

CHAPTER 30

CHICKEN LITTLE SYNDROME

In American folklore, there is a very popular fairy tale among children called *Chicken Little*. It's about a hen, named *Chicken Little* or *Henny Penny*, who had an acorn fall on its head. Terrified and panicked, the hen began to squirm, saying, "The sky is falling! The sky is falling!"

Frightened, *Chicken Little* rushed to announce the terrible news to the local king. On the way, it found its winged friends, Cocky Locky, Ducky Lucky, Drakey Lakey, Goosey Loosey, Gander Lander, and Turkey Lurkey, to whom it conveyed, with fear in its soul, that the sky would fall on them and the end of the world would come. But at one turn, they met Foxy Loxy, who immediately reassured them, saying, "Come in, my dears, into my lair, and you will be saved." The rest is history.

Starting from the fairy tale's symbolism, *Chicken Little* syndrome came to mean mass hysteria, paranoia, or the generation of a false belief in an imminent disaster. Carriers of the syndrome use ad nauseam an alarmist repertoire, dominated by desperate cries such as "It's the end of the world! It is too late! The apocalypse is coming upon us!"

History knows many epidemics caused by *Chicken Little* syndrome. Besides climate alarmism, the most disastrous manifestation of the syndrome is probably the witch trials in medieval Europe. After the Inquisition eradicated genuine heretics, such as the Cathars and Waldensians in the 1400s, most witches were accused of producing bad weather. In 1484, Pope Innocent VIII acknowledged that witches "shattered the crops of the earth, the grapes of the vine, the fruit of the trees, [destroyed] orchards, meadows, pastures, corn, wheat, and all other grains."[1] As Europe sank into the Little Ice Age, more and more areas were facing disastrous harvests, rising food prices and, finally, intense famine. The consequence was that witches have become scapegoats.

The following examples selected from the media of the time, illustrate climate alarmism and hysteria in a much more recent period.

Chicken Little and global cooling

The New York Times, February 24, 1895: "Geologists believe the world could freeze again."

April 15, 1912: "The *Titanic Transatlantic* collides catastrophically with an iceberg at a latitude of 41.7°N. The destination port, New York, is on the parallel of 40.7°N. Maybe that's why, whenever an iceberg breaks somewhere, our hen has a panic attack."

The New York Times, October 7, 1912: "Prof. Schmidt warns us that a new ice age is approaching."

Los Angeles Times, October 7, 1912: "The Fifth Ice Age is on its way. The human race will have to fight for its survival against the cold."

Chicago Tribune, August 9, 1923: "Scientists say Arctic ice will destroy Canada."

Washington Post, August 10, 1923: "The ice age is coming."

Los Angeles Times, April 6, 1924: "If these things are true, it is obvious that we are heading for an ice age."

Chicken Little and global warming

After the impending ice age, around the 1930s, temperatures began to rise. *Chicken Little* did its job again, but changed its position 180°:

Los Angeles Times, March 11, 1929: "Most geologists believe that the world is warming and will continue to get warmer."

Chicago Daily Tribune, November 6, 1939: "Chicago ranks first among thousands of cities [around the world] that have been affected by a mysterious trend toward a warmer climate over the past two decades."

The New York Times, August 10, 1952: "The world has begun to heat up in the last half century."

Chicken Little and global cooling (again)

But from the early 1940s through the 1970s, temperatures dropped so much that *Chicken Little* began to cluck again that "Global cooling is upon us!" and "Global cooling is upon us!" Here are some of Chicken Little's alarmed friends seen in the media:

Science News, November 15, 1969: "How long the current trend of cooling continues is one of the most important problems of our civilization."

Washington Post, January 11, 1970: "Cold winters herald the arrival of a new glaciation."

***Science Digest*, 1973**: “At this point we can no longer enjoy a comfortable distance of thousands of years to prepare for the next glaciation . . . Once the frost begins, it will be too late.”

The New York Times, December 29, 1974: “Current climate change is causing mass deaths through starvation and probably anarchy and violence.”

Christian Science Monitor, 1974: “The North Atlantic cools almost as fast as an ocean can cool.”

Time Magazine, June 1974: “A New Ice Age? When meteorologists measure global average temperatures, they find that the atmosphere has been colder over the past three decades and the weather anomalies they are studying could be the beginning of another glaciation.”

Newsweek, 28 April 1975: “The decline in food production [as a result of climate change] could begin very soon, probably in just decades to come. [. . .] The main fact [is that] the Earth’s climate seems to be cooling.”

The New York Times, May 21, 1975: “Sooner or later, large-scale major cooling [is] considered inevitable. The signs that it has already begun are obvious.”

Science News, March 1, 1975: “Once again, this transition could induce only a small change in global temperature—2 or 3 degrees—but the impact on civilization will be catastrophic. The cooling that began in 1940 was large enough and consistent enough to be reversed soon.”

On the cover on this magazine, the title reads “Is the Ice Age Coming?” and, for the first time, Manhattan is presented under the relentless assault of glaciers. In 2004, the movie *The Day After Tomorrow* capitalized on this apocalyptic image.

New Scientist, 1975: “The threat of a new ice age must stand by nuclear war as a possible source of death and enormous misery for mankind.”

Even the prestigious National Academy of Sciences agreed with this view. In 1975, the American Academy warned that there was “a non-trivial possibility that serious global cooling could affect the Earth for the next 100 years.”

Lowell Ponte, 1976, “Cooling: Has the next ice age already begun? Can we survive it?”

The cooling has already killed hundreds of thousands of people in poor nations . . . If it continues, and no strong measures are taken to deal with it, the cooling will cause world famine, world chaos, and probably world war, and this could all come by the year 2000.”[2]

Chicken Little and global warming (again)

But it wasn't long before the *Chicken Little* and the other winged hens found another cause for devastating panic. "Global warming would kill us all! Global warming will kill us all!" This fear, as in any panic more or less justified, produces anxiety, and it reached record heights in the media:

The New York Times, August 22, 1981: "Global warming, with an almost unprecedented magnitude, is predicted."

The Independent, January 17, 2006: "The collapse of civilization is the likely result if fossil fuel use increases."

Washington Post, January 18, 2006: "Rising temperatures could literally change the fundamentals of life on the planet."

Sunday Times, February 19, 2006: "Once an ice cap begins to disintegrate, it can reach a critical point, beyond which melting becomes explosively fast."

The film *An Inconvenient Truth* was released on March 24, 2006. Al Gore predicted rising ocean levels, melting ice caps, higher temperatures, and more hurricanes.

Time Magazine, March 26, 2006: "Polar caps are melting faster than ever . . . More and more . . . Earth is devastated by drought . . . Rising ocean levels are flooding low-lying communities . . . Anyway, the Earth is in critical point of balance. The climate is collapsing and global warming is to blame."

Time Magazine, April 3, 2006: "Global Warming: Be worried. Be very worried."

Reader's Digest, June 12, 2006: "We have never faced such a global crisis in the past."[3]

The post-2006 examples about climate alarmism are too many and too well known to mention them here.

So, if we count well, in about 125 years, *Chicken Little* has warned us, in its characteristic style, about four climate changes, one more catastrophic than the others. And, again, if we accept its logic, we should now expect a new global cooling! Isn't that right, *Chicken Little*?

I would also note that a major liberal publication, *The New York Times*, reported on all four post-1895 climate changes saying, once global cooling came, then global warming, then global cooling, and now we are bombarded with global warming. Based on climate articles published from 1895 to the present, *The New York Times* fully deserves the *Chicken Little* Award!

What *Chicken Little* and its panicked friends never discuss is that the geologic past of our planet, long before the appearance of man, h recorded a succession of extreme climates that are unparalleled today. These include colder and warmer temperatures, higher and lower CO_2 concentrations, larger or smaller volumes of ice, and higher or lower ocean levels.

Chicken Little and friends never discuss that global warming is not a phenomenon characteristic only of the earth, where it would have produced predominantly by anthropogenic CO_2 emissions. Glaciations and interglaciations also occur on Mars, a planet without a consistent atmosphere (it is about 100 times thinner than the terrestrial one) and without people to generate CO_2.[4] Habibullo Abdussamatov, director of the space research laboratory at the Astronomical Observatory in Pulkovo, Russia, stated in 2007 that climate change on Mars is the result of solar activity and Milankovitch cycles.[5]

How is the *Chicken Little* syndrome currently manifested and treated?

Concerns about the persistent and inflammatory rhetoric of global warming have created a thriving market for “eco-therapists” who specialize in treating “eco-anxiety.” For example, on February 16, 2008, *The New York Times* reported that “more than 120 therapists from Alaska to Uruguay are listed as practitioners” in the field of eco-psychology, offering “strategies for eco-anxiety in private sessions, or lead discussion groups for the conservation-minded.”[6]

Like Prescott College, Arizona, and Lewis and Clark College in Portland, Oregon, some schools have set up special courses in eco-therapy and eco-psychology to help patients suffering from eco-anxiety.[7] One patient, Sarah Edwards, declared on April 17, 2008, on *Fox News*, that she suffers from the gasoline she burns in the car, the paper towels she throws in the trash, the garbage on the beach, and the water pollution. In short, Sarah suffers from eco-anxiety. Manifested by “fear, grief, anger, confusion, and depression,” eco-anxiety “caused her ‘neck and shoulder pain, fibromyalgia, and fatigue.’ ”[8]

The issue of eco-anxiety is more severe than it seems at first glance. An independent United Kingdom news source reported that eco-anxiety is to blame for various symptoms, such as bulimia, alcoholism, and depression.[9] An article on this topic was published in January 2018 in the journal *Psychology Today*, “Coming to terms with ecoanxiety: growing an awareness of climate change.”[10] According to the author, The International Psychoanalytical Association considers climate change to be “the greatest global health threat of the 21st century, closely followed by nuclear war.” [sic!]

Maybe some of you are trying a smile by reading the lines above. All of this could be comical if there weren't some deeply troubled people by the *Chicken Little* alarms. They truly feel guilty about their contributions to global warming.

A tragic case involved a family from Argentina. In March 2010, Francisco Lotero, 56, and Miriam Coletti, 23, shot their children before killing themselves. In a suicide note, the killing parents indicated their reason: fear of global warming. Their 2-year-old son died instantly, but their 7-month-old daughter miraculously survived after being shot in the chest.[11]

Another tragic case occurred more recently in Brooklyn, New York. On April 14, 2018, lawyer David Buckel (60 years old) died after setting himself on fire in Prospect Park.

Two notes, written by Buckel, describe his act as a "suicide protest" designed to "draw attention to the need to take action" against climate change and the use of fossil fuels. In a note labeled "For the Police," Buckel wrote that he sprayed himself with "fossil fuel" before setting himself on fire to suggest a metaphor for destroying the planet.[12]

Chicken Little syndrome and confirmation bias

Chicken Little syndrome is related to *confirmation bias*, a classic situation described as follows: Once we have formed or suggested an opinion (e.g., hydraulic fracturing will poison drinking water or global warming, only the anthropogenic one will kill us), all future activities will focus on seeking and accepting only the information that justifies our opinion. At the same time, we will reject or ignore information that casts a shadow of doubt on the opinion we have formed. Like those suffering from *Chicken Little* syndrome, the followers of confirmation bias do not perceive all circumstances objectively. They chose only those parts that make them feel good because they can then confirm their prejudices. There is thus the risk of becoming prisoners of one's assumptions or illusions.

Voltaire warned us long ago that "Illusion is the first of all pleasures." It follows that by sweetening ourselves with our illusions, we "drug" ourselves with them and deceive ourselves about reality. Our critical spirit is numb in the face of reality. We close one eye or both when it comes to gathering strong evidence or to think independently of the tribe to which we belong. In these situations, our baloney detector remains stuck at the position indicated by the political correctness.

The uncontrolled use of climate models offers the last example that illustrates *Chicken Little* syndrome's typical character and confirmation bias. For an outsider, the crucial innovation in the global warming controversy is the obvious dependence on model predictions. They are no longer judged by how well they reproduce real-world data, but by how well they respond to confirmation bias. Once the global warming policy is implemented, acceptable climate models are only those that provide data to justify that policy, data that, although computer generated, are taken as an unavoidable reality. Any other model, which would contradict official policy, has a low chance of being evaluated, popularized, or supported without fear of ideological retaliation. That’s why skeptics of global warming are usually older scientists who have little to lose if they whistle in the church of political correctness.

Climate change is the geometric place where *Chicken Little* and confirmation bias meet.

Conclusions

More and more people today are gathering information from social networks. Reading scientific articles is more difficult because researchers’ jargon is often difficult to understand and often because of the exorbitant prices that journals charge to access articles of interest. Under these conditions, the proliferation of truncated, altered, manipulative news for various reasons becomes *le mot du jour* among social groups. Filtering genuine news vs. fake news is often difficult to solve. A possible risk can rise from this, as I will describe here.

You read a news story posted on a social network and initially, you doubt it, thinking, “well, it can’t be that bad!” But after you’ve finished reading the comments on the article, you may change your mind, now thinking, “oh, my God, the world will end in the next second!” If you have experienced such situations, it means peer pressure performed well and you became infected with *Chicken Little* syndrome. You are not the only one, unfortunately. We, humans, have a psychological inclination to get the virus and act as such. For example, somewhere an unhappy but isolated incident takes place and our imagination goes crazy on untrodden paths, looking for all sorts of possible explanations. *Chicken Little* has a habit of turning the mosquito into an elephant or turning small misunderstandings into the apocalypse.

And the use of a dual language is on the *menu du jour*. When frosts and snow intensify and spread over long periods, the media offers us all sorts of exotic labels, such as polar vortex, bomb cyclone, and trans-Siberian express. These names say something about meteorology and nothing about climate. But when temperatures rise during the summer, the language changes suddenly. It’s no longer just about the weather but is about global warming and climate change, usually imminent and catastrophic.

Our life is too short to waste it with such exaggerations, alarmism, paranoia, catastrophic conclusions, mass hysteria, etc. If you ever notice an acorn falling on your head, don’t panic and think for a second, “does the sky really fall on me, or am I sitting under an oak tree?”

And if someone else wants to scare you with “the sky is falling on us!” exclamation, look carefully at his head, too. If you do not see an oak there, take a step back or to one side and leave it with the Lord.

Chapter 31

The Sixth Extinction of Life on Earth? About the Magic Power of Numbers

Life on this planet has an expiration date.

Lee Billings

In June 2015, national and international media circulated a piece of sensational news. It was that the earth had entered a new phase of mass extinction.[1] The basis of the news is the publication of an article titled "Accelerated modern human-induced species losses: Entering the sixth mass extinction."[2]

Statements like, "Life on earth is in danger," "The earth has entered a new stage of extinction, and humans could be among the first victims," and "The earth is on the verge of extinction in the sixth mass extinction and the blame is on ours" bombarded unspecialized public opinion with sensational titles, easily misleading scared people and predisposing them to various manipulations (religious, political, social, etc.).

As someone who studied the relations between climate change and periods of extinction of life on our planet for many years, I developed a special interest in this topic.[3] Therefore, when I read all sorts of "apocalyptic" news, I felt the urge to step into the public arena and express my point of view on such kind of news by detailing aspects that lie beyond the limited content of an article heavily promoted by the media.

In paleontology, mass extinctions are defined as those periods when the earth loses over 75% of all its species in a relatively short time. Of the four billion species believed to have lived on earth in the last 3.5 billion years, about 99% have disappeared.[4] It follows that extinctions are a common phenomenon on our planet that are balanced by speciation.

In the history of geology, five events have been identified that are considered, based on the above definition, as "*mass extinctions*":[5]

1. The Ordovician event: ~ 443 Ma (millions of years ago).
   Probable cause: rapid freezing. Ocean levels dropped by more than 100 meters, devastating shallow marine ecosystems. After less than 1 million years, the second phase of extinction took place, when glaciers melted, ocean levels rose, and living things that could not adapt to the new ecological conditions were destroyed. About 86% of the species are extinct.

2. The Devonian event: ~ 359 Ma.
   Probable cause: a global glaciation (followed by global warming). About 75% of species became extinct.

3. The Permian Event: ~ 251 Ma. The biggest extinction of all five. It caused the extinction of about 95% of all existing species.
   Probable cause: Huge volcanic eruptions in Siberia. They produced vast amounts of ash, which triggered a short period of intense global warming. Ocean water was also acidified by CO_2 and H_2S.

4. The Triassic Event: ~ 200 Ma.
   Probable cause: Another intense volcanic activity. This time it was in the Magmatic Province of the Central Atlantic, and it increased CO_2 concentrations and temperatures. About 80% of species became extinct.

5. The Cretaceous event: ~ 65 Ma.
   Probable cause: The collision of our planet with an asteroid. It sank in the Gulf of Mexico in an area called Chicxulub in the north of the Yucatan Peninsula. Before the impact, intense volcanic activity in the Deccan area of India had significantly weakened existing habitats. About 76% of species became extinct.

The catastrophic extinction of dinosaurs 65 million years ago created a biological niche that was eventually filled by mammals, whose last representatives are the genus *Homo* with the only existing species, *Homo sapiens*. In other words, we humans owe our presence on this earth to misfortune (for dinosaurs) and luck (to us).

The decisive role of climate change is involved in at least the first two mass extinctions. The sequence of glaciation–interglaciation cycles is mainly controlled by three astronomical factors, identified by the Serbian mathematician Milutin Milanković in 1930: the eccentricity of the orbit of rotation around the sun, the inclination of the axis of rotation, and the precession of the equinoxes.[6]

An example of a correlation between the Milanković cycles and the extinction of some mammalian species was published in 2006 by a group of European researchers.[7] Studying the evolution of rodent species in central Spain over a relatively long period (about 22 million years), the authors came to a disturbing conclusion that mammals have a fixed lifespan on this planet, enjoying an existence of about 2.5 million years before extinction. The study also indicated that the studied species show appearances and disappearances at relatively regular intervals of 1.0 and 2.5 million years. The duration and timing of these periods correspond to two of Milanković cycles, eccentricity, and inclination.

The link between climate and species extinction is consistent with the "reversal pulse" hypothesis proposed in 1985 by paleontologist Elisabeth Vrba of Yale University.[8] Her arguments explain species' survival periods by assuming that species remain stable until environmental changes trigger rapid pulses of extinction and speciation.

If the 2.5-million-year period of mammalian existence on this planet is correct, then a disturbing question arises. The oldest member of the genus *Homo*, our ancestor *Homo habilis*, lived 2.8 million years ago. Is our species somehow doomed to imminent extinction? Is our time up?

The sixth mass extinction has been suggested by biologists, based on the extinction of species in recent centuries and millennia. And the study by Caballos et al. (2015) starts from the fact that, in the twentieth century, the species' extinction rate was up to 100 times higher than it would have been if there was no human impact. For example, the authors write that instead of nine vertebrate extinctions, which would have occurred under normal geological circumstances since 1900, they identified "another 468 extinctions among mammals, birds, reptiles, amphibians, and fish."

There are three possible causes of this ongoing extinction, as suggested by the authors: the loss of species habitat, their overexploitation for economic purposes, and climate change.

If for the first five mass extinctions the causes were purely natural, in the case of the sixth similar event, anthropogenic factors appear. Although terrestrial, a single species became a top predator for the oceans, producing a drastic decrease in fish and whale populations.

The importance of anthropogenic impact on the biosphere cannot be ignored. Some studies estimate that our species alone is responsible for 20–40% of the earth's primary productivity. This productivity is fueled by hyperfertilization produced by the extraction of nitrogen from the air and phosphates from the subsoil. Thus, over-harvests are obtained, which feed with great efficiency, the farm animals that we eat. The scale at which this operation takes place is one of the main causes of the current extinction of other organisms.[9]

If we could weigh all the vertebrates currently living on earth, the mass of over seven billion people would be 30%, and the animals they consume (i.e., pigs, cows, sheep) would be over 67%.[10] All wild animals now weigh less than 3% of the total mass of terrestrial vertebrates. In other words, the zoomass of wild vertebrates is now surprisingly small compared to the biomass of domestic animals.

In the twentieth century, the human species obtained other tools to influence the biosphere. For example, they discovered technological engineering, which creates new species of animals to meet food needs. Often, the new species created are invasive, causing regression and, finally, the extinction of some native species.

Indirectly, our species also influences the current climatic conditions. The extraction and consumption of energy stored by photosynthesis in coal, oil, and natural gas can lead to increased concentrations of greenhouse gases (e.g., CO_2, CH_4) in the atmosphere and hence, global temperatures rise and the climate changes. By the way, it must be said that nature also fully contributes to the increase of CO_2 concentrations through volcanic eruptions, the expansion of the ocean floor, the decomposition of carbonate rocks, and more.

There is even a proposal that the period begun in 1850 be called the *Anthropocene* to signify the importance of the human species as a geological factor and its influence on the biosphere and climate. The term has not been officially adopted and some scientists do not recognize it.[11]

Returning to the conclusions of the sensationalist article, according to which we humans have already entered the sixth extinction and we are responsible for it, I want to calm any panic attacks. The published study, by revealing extinction rates up to 100 times higher than in the past, brings elements to improve our species extinction database, but it does not yet confirm the sixth mass extinction in terms of rapidly accelerating the current extinction rate. One can, however, speak of a major biodiversity crisis. The current extinctions of some species are dramatic and severe, but I repeat, they do not yet qualify to be classified as the sixth mass extinction. We need much more time (maybe two centuries) to get solid, irrefutable confirmation of the rates that justify a mass extinction.

Sixth Extinction = Revelation? About the magical power of numbers on imagination and emotions

In 2017, some of the authors of the first article discussed here published a continuation of their prophecies under the title “Biological annihilation via the ongoing sixth mass extinction signaled by vertebrate population losses and declines.”[12] This time, I noticed an escalation of rhetoric right in the title, where the first words speak, no more, no less, about a biological annihilation, making the sixth mass extinction no longer a prophecy of the future, but a palpable reality.

I also noticed that both articles about the imminent, relentless, and unstoppable sixth mass extinction have, as the second author, Paul R. Ehrlich. Readers of some of my previous articles[11] probably remember what an interesting character Professor Ehrlich is. He is a prophet who has proved to be a liar several times, a valiant successor to the eco-prophet and founder of modern environmentalism William Vogt. Vogt is the author of a terrible book called *Population Bomb*, published in 1968, which opens with an apocalyptic prophecy that “The battle to feed mankind is over.” After which, the eco-apocalyptic author warns us: “In the 1970s, hundreds of millions of people will starve to death. We need population control because it is the only solution.” In other words, when I deal with articles co-authored by Paul Ehrlich, my baloney detector signals that I must be extremely cautious with an environmental prankster whose repeated predictions are just as much outrageous stupidities due to their toxic content of false prophecies.

And yet, the 2017 article unexpectedly caught my attention, due to either Ehrlich or the other two co-authors. It is about that escalation of prophetic rhetoric mentioned above. If in 2015 we were warned only about the loss of biodiversity, in 2017, Ehrlich and his colleagues pressed the pedal of harsh language, talking not about the gradual decline of life, but about “biological annihilation” or the “frightening assault on the foundations of human civilization.”

After that, my attention was drawn to two numerical details. First, we find that about half of all mammals studied (177 species) suffered massive losses between 1900 and 2015. We are then told that about a third of all terrestrial vertebrate species (27,600) suffer a sharp decline and loss of local populations of considerable magnitude. Well, some will ask what that is all about.

One possible explanation is that the authors of the 2017 article intuited the magical power of numbers on our imagination and emotions. Unlike simple verbal statements (e.g., “it’s worse than before, some species go extinct faster than others"), numbers have (a supposed) power to shock, taking us out of our daily apathy and numbness to face a catastrophic moment in the existence of life on earth.[13] And, in the underground, the two numbers highlighted above (half, third) also benefit from the indisputable authority of their use in the Book of Revelation, the final book of the New Testament, which is a cosmic eschatological drama describing in vivid colors the end of the foundations of human civilization.

Chapter 8 opens with the mention of a temporal *half*:
"And when he opened the seventh seal, there was silence in heaven about the space of **half** an hour" [14] [emphasis added].

Next, Revelation uses *one-third* as numerical detail to describe:

– the destruction of the earth (verse 7): "A **third** of the earth was burnt up, a **third** of the trees was burnt up, and the green grass was burnt up."
– the destruction of the sea (verse 8): "A **third** of the sea was turned into blood."
– the destruction of sea creatures (verse 9): "A **third** of the living creatures in the sea died."
– the destruction of rivers (verse 10): "a great star . . . fell from the sky on **a third** of the rivers and on the springs of water."
– the poisoning of drinking water (verse 11): "A **third** of the waters turned bitter, and many people died from the waters that had become bitter."
– destruction of the sun, moon, and stars (verse 12): "A **third** of the sun was struck, a **third** of the moon, and a **third** of the stars, so that a **third** of them turned dark. A **third** of the day was without light, and also a **third** of the night."

In the next chapter, 9:15, the fate of humankind is also described with the help of the numeral 1/3:

> "And the four Angels . . . were released to kill a **third** of mankind."

Is it possible to connect a third of the extinctions in the mentioned article and the third of the extinctions in the Apocalypse?

First, biblical numerology is notorious for the multitude of interpretations to which it has been subjected for millennia. There are, therefore, various exegetical explanations for the meaning of a ***third*** expression. As with other chapters in Revelation, four theories (historical, preterist, futuristic, and symbolic-spiritual) can be used to discern the meaning of a ***third***. For example, it can be accepted that a third is a quantitative measure, meant to convince us that only a limited part will suffer irreversible losses and that the future will reserve more trouble. Or maybe the destruction has increased to a third after in Chapter 6:8 we are told that the earth will be destroyed by over a fourth by the rider of the pale horse. Some interpreters suggest that, because two-thirds remain untouched, there is hope that all of humanity will not be annihilated. This would mean that the Lord's creation will be partially saved, and we should do more to act in this direction.

Second, it should be noted that initially, *apokalyptein* meant the revelation, or the unraveling of mysteries, not the catastrophic end of life and earth as it is now considered. From this point of view, Revelation's prophecies must be considered along with the Old Testament prophecies of Enoch and Daniel as revelations of divine secrets made to mortal humanity, often focusing on the theme of future salvation.

Finally, apocalyptic prophecies can be discussed in conjunction with those of extinction (if one wishes) to activate a moral function adjacent to pessimistic rhetoric that presents the latest figures of extinction. Perhaps this was the underground intention of the authors of the 2017 article. The ethical goal would be, in this case, the awakening "from the dead sleep" of numb consciences and feelings, apathetic to the dramas of endangered species.

Let us not forget a later phrase in Revelation (11:18), when God will destroy "those who destroy the earth," a clear eco-theological warning to those who cause irreversible damage to His creation.

Revelation is a call to hope based on faith, not optimism.

Conclusions

The magical power of the numbers in Revelation goes beyond their simple mathematical significance. Numerical representations of living creatures, of various earthly elements, and of the sky above us acquire deep resonances and incite meditation. Therefore, our imagination cannot remain insensitive to the fascination that the symbolic use of numbers in Revelation exerts. Symbols penetrate deeper than words, and the symbols in this book have contributed significantly to shaping Christians' imagination.

If the numbers describing the biological annihilation of living things on earth enjoy the same privileges, perhaps the sixth extinction will be drastically slowed down.

Chapter 32

The Replication Crisis, Biased Publication, and Canonization of Fake Facts in Scientific Studies

. . . The dram of evil
Doth all the noble substance of a doubt
To his own scandal.

Shakespeare
Hamlet, Act I, Scene 4

When, in August 2015, the journal *Science* published an article titled "Estimating the reproducibility of psychological science," Pandora's Box opened.[1] When a group of researchers tried to replicate the results of psychology experiments published in 100 peer-reviewed articles, they found that only 35 could be replicated.

Like a snowball, the replication crisis first rolled on the front page of the influential *The New York Times* with the alarming headline of "Many Psychology Findings Not as Strong as Claimed, Study Says." It also included a dire alarm. "Their conclusions . . . have confirmed the worst fears of scientists who have long worried that the field needed a strong correction."[2]

Then, within hours of this publication, the most famous American right-wing commentator, Rush Limbaugh, addressed the 13 million listeners of his daily program.

> You can certainly assume that the vast majority of everything you read—if you read, in the journal Science, in Psychology Today—is completely false … From nutrition to psychology to climate change to global warming to hydraulic fracturing, which has been exposed here demonstrates that science is no different from politics. Science is completely determined by money. Scientific results can be bought. And with the scientific results, either in the social sciences, or in climate science, or in medical science …, when you can buy the desired result, we no longer have science; we have a corrupt policy.

> And it is safe to say that the vast majority of what passes for politics, science, anything, in our system today has been corrupted to some degree. And that's why I think something like Trump is happening.[3]

The show aired on August 28, 2015, when Donald J. Trump was just one of 26 presidential candidates.

The 2015 revelations about the **crisis of replicating** peer-reviewed observations, measurements, and scientific experiments are just the tip of the iceberg. A shortlist of scientific frauds can start, for example, from 2005 and can continue to this day.[4] In addition to psychology, the replication crisis also includes articles published in biomedicine, economics, pharmacy, artificial intelligence, ecology, climate change, and more.

For example, in 2011, a group of researchers from the German company Bayer wrote in *Nature Reviews Drug Discovery* that 75% of the peer-reviewed literature used to discover new drugs is unreliable because it contains fake facts. And in 2013, a biotechnology company, Amgen, reported that it could replicate only 6 of the 53 major cancer studies.

The impossibility of replication affects, according to some authors, about 50% of all scientific literature. It has also been estimated that publishing false or exaggerated conclusions is partly responsible for wasting up to 85% of total research resources. For example, a 2015 study found that in the United States alone, approximately $28 billion is spent annually on non-reproducible biomedical research.[5]

Replication allows science to self-correct. Results that cannot be replicated are worse than fairy tales. With fairy tales, we at least know that we are dealing with fiction.

Despite their fundamental importance for establishing the credibility of science and the efficient spending of resources, studies dedicated to replication are rarely funded and, as a rule, not very well seen by those wishing to advance in a scientific career.

Biased publishing is a widespread practice that favors the appearance of articles with "positive" results. Even if the researchers performed several different tests of a scientific hypothesis, only the "positive" results that confirmed the hypothesis described in the article are sent for publication. The "negative" results, though methodologically legit, do not create too much interest for publications (because "what is the purpose to show how we struggled to find the right solution and many attempts performed, and how much time and money it took to get "positive" results?"), and this therefore influences the impartial distribution of scientific research. If the number of published "negative" results were large enough, then, by comparison, it would be easier to detect those fake facts that become unjustly recorded as facts.

An extensive study found that between 1990 and 2007, over 80% of the 4,600 articles studied reported “positive” results, this number exceeding 90% in the case of disciplines such as psychology and ecology.[6] Moreover, the percentage of publications reporting “negative” results has been steadily declining. The main reason is that amid fierce competition for funding and citations, young (and less young) researchers are not attracted to the idea of publishing “negative” results, including the databases that produced them.

The biased publication of only “positive” results produces a **canonizing** effect where some results are widely accepted that cannot be easily retested or re-examined in light of their initial hypotheses. The status of these researchers is high on a pedestal, and they can no longer stand contradictions and future tests, which would question the canon, have minimal chances of publication and media coverage.

The phenomenon of canonization creates disasters when, instead of legitimate results, it applies to fake facts, mainly those that cannot be replicated.

For example, between 2011 and 2015, the canonization of *some* results produced by *some* researchers from Cornell University and Duke University in the United States generated an antifracking hysteria at national and international levels, including in Romania. Suddenly, after the release of the propaganda film *Gasland*, the press, television, blogosphere, public discussion platforms, politicians, and ordinary citizens discovered that *some* scientists, who had been silent like fish in water from 1947 to 2011, have made some apocalyptic discoveries about the disasters that hydraulic fracturing would cause. These include water poisoning, radiation, earthquakes, air pollution, birth defects, animal and bird deaths, and others. A new canon, almost indestructible, was created.

Another example of the detrimental effect of canonizing fake facts is that “most researchers believe in anthropogenic global warming.” Based on only four articles that, surprisingly, found the same percentage, the **97% canon**, aka the canon of anthropogenic climate change, has come to dominate—as in the case of hydraulic fracturing— the mass media, international bodies, the Pope of Rome, the blogosphere, politicians, and simple taxpayers. The 97% canon has become more publicized and idolized than that of hydraulic fracturing. It is a sacred, inviolable space of political correctness. Any opinion contrary to the canon is immediately categorized as a serious dissent, and the perpetrator becomes a scientific or climate denier, synonymous with those who deny the Holocaust.

If there were no publication bias, it would be possible to read more articles such as those discussed here, which dismantle *sine ira et studio*, all those fake facts that formed the basis of the 97% canon.[7]

Strictly related to this canon, I consider another example to be suggestive.[8] It was presented by John R. Christy, a professor of atmospheric science at the University of Alabama and Alabama State Climatologist, to the United States House Committee on Science, Space & Technology on March 29, 2017.

Professor Christy, a lead author, collaborating author, and referent of the IPCC Reports, presented in Congress evidence that there is a significant difference between the published and well-publicized IPCC climate models and the measured observations, as seen in Figure 32.1. That is, climate models cannot replicate reality. The acceleration of tropospheric warming, predicted by 102 models, is not supported by observational data. Another discovery made by Professor Christy is even more shocking: the difference between models and reality is caused by the additional introduction of anthropogenic greenhouse gases!

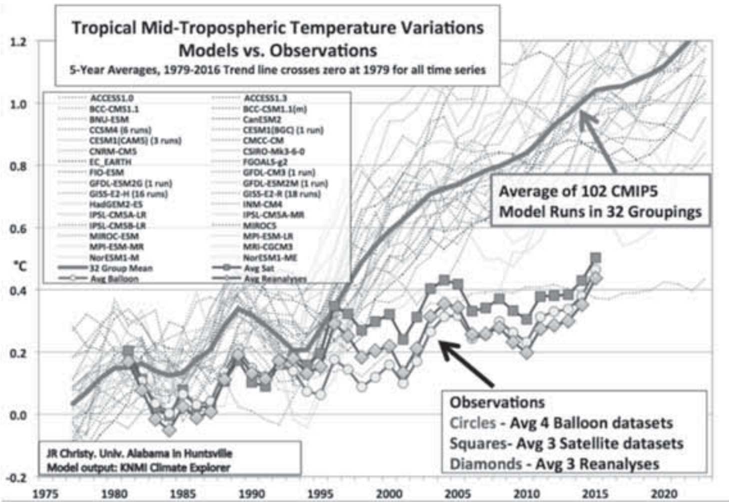

Figure 32.1. Five-year averaged values of the annual mean (1979–2016) tropical bulk mid-troposphere temperatures as depicted by the average of 102 IPCC CMIP5 climate models (red) in 32 institutional groups (dotted lines). The 1979–2016 linear trend of an all-time series intersects at zero in 1979. Observations are displayed with symbols: green circles—average of four balloon datasets, blue squares—three satellite datasets, and purple diamonds—three reanalyses. Since 1996, there has been a significant difference between the models containing anthropogenic greenhouse gases and the three sets of observations.[8]

But if we consider only natural gases with a greenhouse effect, the difference between models and reality disappears. The conclusion is simple. The anthropogenic greenhouse gases introduced in the models are canonized fake facts, which fail the reality test.

Another environmental canon, heavily publicized against alternative explanations, deplores the fate of islands that will soon be swallowed by ocean waters whose levels will have risen because of people and their habits of burning fossil fuels relentlessly. But in a moment of journalistic objectivity, *Nature* magazine published an article in February 2018 that debunked this canon:

> We present analysis of shoreline change in all 101 islands in the Pacific atoll nation of Tuvalu. Using remotely sensed data, change is analysed over the past four decades, a period when local sea level has risen at twice the global average (~3.90 ± 0.4 mm/yr). Results highlight a net increase in land area in Tuvalu of 73.5 ha (2.9%), despite sea-level rise, and land area increase in eight of nine atolls.[9]

Of course, the Tuvalu authorities, who played a leading role on the Paris Climate Agreement stage, did not like this type of scientific research, which they immediately declared "bad, irresponsible science." And of course, Rush Limbaugh couldn't help but make a point, saying that the "new research is yet another proof that climate change is fake."

A final example illustrates the birth of another ecological canon, modernized to include *le mot du jour*, anthropogenic global warming.

The Great Barrier Reef (GBR) holds iconic status for environmentalists and has therefore attracted their attention as well as that of the governments of Queensland and Australia for over 55 years.[10] Authorities have already spent A$375 million between 2008 and 2013 and are preparing to spend another A$575 million between 2015 and 2020.

Campaigns in the 1960s initially focused on preventing coral mining because of calcium carbonate production. Then it was discovered that coral mortality is caused by an incredibly voracious starfish, the crown-of-thorns starfish. Another concern for the conservation of the GBR arose in the 1990s when fertilizers used in agriculture and transported by rivers to the ocean, promoted the multiplication and development of killer starfish larvae. When, in 1998 and then in 2002, coral bleaching was observed, the causes were water temperature and pH, plus cyclones' frequency and intensity. Environmentalists have decided that the latter causes fall under the generous umbrella of climate change, aka anthropogenic global warming. The GBR global warming canon was created without replicable scientific scruples and survives even today in the media and government policies.

As in the example above with Tuvalu islands, the reality is that, except for a few small corners on the edge of the reefs affected by port works, living corals live on all approximately 3,000 GBR reefs. In other words, the claim that the GBR is under increased threat due to anthropogenic global warming is strongly exaggerated.

Is it possible to impose a quality control of the sciences that legitimize major political decisions?

In 2019, the National Academy of Sciences published a book called *Reproducibility and Replicability in Science* which, among other issues, underlined a major expectation society has from science and scientists:

> We rely on science to reveal what is knowable of nature, and typically, that knowledge has some level of uncertainty attached to it. Repeated findings of comparable results tend to confirm the veracity of an original scientific conclusion, and, by the same token, repeated failures to confirm throw the original conclusions into doubt. When a scientific study becomes the basis of policy or has a direct or indirect impact on human well-being, scientific reliability becomes more than an academic question.[11]

As illustrated above, the replication crisis is a major cause of eroding the popular confidence in the applied sciences that is used to introduce national and international policies. And when it comes to spending hundreds of billions, even trillions of dollars on solutions required by various canons, the control and quality assurance of research underpinning canons must concern both scientists and politicians.

After the manuscripts are sent for publication, two quality controls take place after publication. They are the peer-review process, as well as comments with the author's reply. This is occasionally published by some magazines.

The peer-review process

Considered by many as a golden standard of checking the quality of research, the peer-review process has strengths and weaknesses. This basic idea of this process is that the referent is an entirely objective person and a flawless professional, and his report is an excellent filter to ensure the publication of error-free, readable material. But the reality is far from ideal, and I make this statement from my position as Associate Editor for over 15 years of the journal *Marine and Petroleum Geology*. Unfortunately, there are anonymous references who butcher a manuscript for some gain. They either take the original information from the manuscript for personal use or share the manuscript's contents with others. Therefore, we should not be surprised by the outburst of a frustrated author:

> . . . But we know that the system of peer review is biased, unjust, unaccountable, incomplete, easily fixed, often insulting, usually ignorant, occasionally foolish, and frequently wrong.[12]

Authors who feel cheated have no other resources at hand than to resubmit the manuscript to another publication, even if the delay in the publication could be fatal to them, because their chances of employment or funding could be reduced. What else can an author do to redress an injustice they think a referent has done to them? Nothing important. They can write an email to the Associate Editor only to be reminded that his decision, based on two to three external reports, cannot be appealed.

The author's comment-reply process

Sometimes some magazines host a comment (usually critical) article about a previously published article. The author has the right to a reply published immediately below the comment. Theoretically, it is an ad hoc quality control, based on the desire of those attentive readers who have the time and training to read the article carefully and write the comment. Such a process becomes difficult and expensive if large databases are to be analyzed and long-lasting experiments are to be replicated.

Unfortunately, most comments are ignored in the literature or produce other effects. I published such a critical comment about an article of a famous author in hydrogeology, and I provoked adverse reactions from several directions.[13] For a young author, this process is not appealing because it attracts personal animosity and career risks, making them think twice before sending the critical comment for publication.

In short, this quality control of published articles does not have enough strength to become popular among researchers. There are, on the contrary, various motivations to sit quietly, not whistling in the wind.

Conclusions

The harsh reality of the replication crisis, accompanied by the bias of publishing predominantly "positive" results and the canonization of fake facts, is that it has multiple detrimental effects which need to be carefully examined and removed.

Firstly, there are the moral costs.

I am considering the dramatic decrease, with various consequences, of the popular confidence in the objectivity and veracity of applied scientific research in several fields, such as psychology, economics, biomedicine, pharmacy, ecology, climate change, and others. The lack of replication of some results, coupled with an accentuated tendency to publish predominantly "positive" results, creates a real danger for the canonization of some false facts and immediately raises the question: "is science degenerate or can it still be self-correcting?" As early as 1964 the Nobel Laureate in Medicine—Sir Peter Medawar—launched a guillotine question, which still makes waves today: "Is the scientific paper a fraud?"[14]

When the Academician's Research Center in India published the journal *Immunology and Vaccines* when the "famous academician" Borat Sagdiyev from Kazakhstan was sitting on the Editorial Board, what else can we believe about science?[15]

In 2015, Rush Limbaugh told his 13 million listeners that science is no different from politics, because both are corrupt due to money. The results of scientific studies can be bought for various purposes, which means that "something is rotten in Denmark." That is why I used the metaphor of Prince Hamlet as a motto, who lamented those people full of "Their virtues else–be they as pure as grace, /As infinite as man may undergo," but in which "The dram of evil/Doth all the noble substance of a doubt/To his own scandal." In science, "the dram of evil" is the crisis of replication, biased publication, and the canons of fraudulent data and misinterpretations.

Second, it is about the socio-economic costs.

We have already mentioned the large sums, between hundreds of millions and tens of billions of dollars, wasted on nonreplicable experiments and which, through perverse feedback, generate additional demands from public money. Those researchers do not forget to add a key sentence at the end of their articles: "more research is needed." And the more apocalyptic their results are ("The climate Armageddon is nearby! The planet is in mortal danger due to climate change!"), the greater the pressure on the public and progressive politicians. "Let's give them funds to research without interruption. Otherwise, the end of the world will come!"

From a social point of view scientific mistakes and the canonization of fake facts in a field of global interest—such as climate change—also take a strictly political form, introducing a Marxist Trojan horse into the city.

In a 2010 interview, Dr. Ottmar Edenhofer, a well-known German researcher and IPCC leader, made clear the goals of his organization—holder of the 2007 Nobel Peace Prize—along with former United States Vice President Al Gore. He said:

> One must say clearly that we redistribute de facto the world's wealth by climate policy . . . One has to free oneself from the illusion that international climate policy is environmental policy. This has almost nothing to do with environmental policy anymore, with problems such as deforestation or the ozone hole.[16]

The IPCC's political position on climate change was also reiterated by Christiana Figueres, Executive Secretary of the United Nations Framework Convention on Climate Change. A few months before the Paris Climate Conference in December 2015, she emphasized that the Climate Agreement is not about climate science or climate change, but about something else:

> This is the first time in the history of mankind that we are setting ourselves the task of intentionally, within a defined period of time, to change the economic development model [of capitalism] that has been reigning for at least 150 years, since the industrial revolution.[17]

The introduction of Marxist Trojan horses in our cities dressed in patches of climate change and sustainability is a more insidious and persistent action than it appears at first sight. I read about it in one of the most prestigious scientific journals, *Nature Sustainability*. On February 1, 2018, under a very generous title, "A good life for all on a limited planet," the authors make a "scientific" plea for the confiscation and redistribution of wealth, the development of socialism, and the destruction of democracy in those countries that do not want to surrender their wealth voluntarily. Soon, the old Marxist slogan will change to "Ecologists from all countries, unite!"[18]

Thirdly, it is about the scientific education of many of us.

Even if the sources of information simply exploded after the invention of the internet, virtual discussion platforms, and social networks, I am astonished by the proliferation of ignorant volunteers and their continuous manipulation through biased publishing and canons built on fake facts. Under the auspices of the media and with many governments' complicit consent, coercive measures are being promoted for entire societies.

What can happen next, Albert Camus warned us: One day, the plague "would rouse up its rats again and send them forth to die in a happy city."

Chapter 33

About Agnotology with Two Case Studies: Hydraulic Fracturing and the Consensus of the 97% Experts who Agree with Anthropogenic Global Warming

Science is trust in the ignorance of experts.

Richard Feynman (1969)

All great truths begin as blasphemies.

George Bernard Shaw (1919)

Agnotology is the study of the cultural manufacturing of ignorance or doubt, primarily through the publication and dissemination of erroneous or misleading scientific data.

The term was originally introduced by Professor Richard N. Proctor at Stanford University in a book published in 2008. He introduced it by identifying three types of ignorance:

– **Type I. Genuine ignorance**, caused by lack of basic knowledge, supposed to be known in the end, if possible.
– **Type II. Selective ignorance**, produced by the deliberate choice to remain ignorant. The individual considers something to be true without evidence or, when the evidence exists, considers it, but in the opposite direction.
– **Type III. Intentional ignorance**, produced by a conscious attempt to mislead through the circulation of wrong information, scientific or otherwise.[1]

Regarding these three types, Proctor states that "ignorance has many interesting surrogates and overlaps, in a myriad of aspects, with secrecy, stupidity, apathy, censorship, misinformation, faith, and forgetfulness, all of which are strongly intertwined with science."

As an educator of many generations of students in both Romania and the United States, I consider it my responsibility to teach future specialists: what is recognized as scientific truth and how to establish that truth; what the areas are where scientific knowledge is lacking and why they are not present yet; what are the uncertainties and limitations inherent in the process of accumulating scientific knowledge; why the unilateral presentation of controversial topics stifles debates, drastically diminishing critical thinking and scientific knowledge, etc.

The three types of ignorance can be successfully used as educational and docimology tools in the teaching of geosciences and other disciplines, and there is already a series of articles detailing their use.[2] I will present in this chapter only two case studies involving agnotology.

Hydraulic fracturing (fracking)

Invented in 1947 in Oklahoma and applied industrially since 1949, hydraulic fracturing was a technological invention designed to increase oil and gas production. Over the next 60-plus years, more than 1.1 million boreholes were fractured in the United States alone.[3] And throughout this long period of time, despite the impressive number of treatments applied, hydraulic fracturing was known only to an extremely limited number of people, mainly the wells' drilling staff. In essence, we are dealing with Type I ignorance, which is acceptable, because no one needs to be aware of all the technologies in the world used at one time.

But everything changed overnight in 2010, when the propaganda film *Gasland* was released, nominated the following year for the Oscar for best documentary. What happened next were textbook examples to illustrate Types II and III of ignorance.

I explained in detail how the film's director, Josh Fox, intentionally used false information about the origin of the gas that caught fire in the tap water in citizen Mark Markham's kitchen.[4] Creating a visual and psychological shock was enough to trigger a hysterical fear among ignorant people of Type I. Manipulating public opinion for propaganda purposes by peddling false information, prefabricated fake news, is a typical illustration of Type III ignorance.

But what surprised me in the case of *Gasland* was the explosive manifestation of Type II ignorance. Until watching the pseudo-documentary film, people who had not heard or read a single word about hydraulic fracturing believed themselves overnight that they were “experts” in criticizing this technology. I watched with amazement the critical impetuousness of various professional figures, who had nothing to do with fracking, suddenly turn into pseudo-experts, entitled to redden the blogosphere with antifracture blame.

After analyzing articles published by “citizen-experts” on several public platforms, I realized that the main source of antifracking “expertise” is the internet, represented by the three famous “universities”: Google, Wikipedia, and YouTube. But I must stress once again that free and open access to various information is not a guarantee of becoming an expert.

Psychologist David Dunning cautions that the internet helps to spread ignorance because it is a place where everyone has the chance to be their own expert. This situation causes some to fall prey to the strong interests of those who deliberately want to spread Type III ignorance. While some smart people will take advantage of all the information available now just a click away, many will be misled by a false sense of expertise. The Dunning-Kruger effect also applies to Type II ignorant people. They resist constructive criticism from actual experts and stubbornly think they are smarter than they really are, even if their arguments are fragile.

The mirage of internet-based expert knowledge creates impostors and motivates seemingly healthy people to ignore their actual status, being agitated pygmies among elephants, and rush to write or post about things they don’t fully know in depth, thus creating a clutter of information, which breaks at the slightest contact with true knowledge.

By definition, a Type II ignorant person is also someone who refuses to accept evidence that would contradict the opinion that they have already formed. I offer only one example: one of the arguments against using hydraulic fracturing in Romania or elsewhere was that it would affect heavily populated areas. Or, in America, said Type II ignorant people, fracturing is possible because it occurs in desert areas! When I presented data on thousands of fractured boreholes in the Dallas-Fort Worth area, including a photograph of a drilling platform working at night in the center of the second city, I asked readers and those who watched me on TV: Do you think the metropolitan area Dallas-Fort Worth, with a population of 7.1 million, is an American desert? Answer: A sudden, deafening silence, no excuse for stubbornly sustained nonsense and further regurgitation of the same lie.[5]

The combination of the two types of ignorance (II and III) in the case of hydraulic fracturing via *Gasland* created a poisonous and explosive mixture at the same time. Thus, the fear of technology over 60 years old was induced in the collective mind of Europe and some states. The American fracktivists used misinformation from *Gasland* to manipulate public opinion and mobilize part of the population to participate in street demonstrations and other forms of resistance against it, sometimes violent.

According to recent research, the emotional shock tactics used by fracktivists allied with other social movements have helped them dampen, albeit temporarily, hopes for the safety of fracturing gas or oil, with an overemphasis on the alleged risks of hydraulic fracturing.[6]

Oil and gas production from hydraulic fracturing added almost 1% to United States GDP each year from 2008 to 2013, making it responsible for about 40% of total GDP growth during this period.[7] And a 2015 study by the Harvard Business School and Boston Consulting Group estimated that oil and gas production by fracturing contributed $430 billion, or nearly 2.5 percent of GDP in 2014 alone, or about $1,400 for each American in a single calendar year.[8]

The fact that the shale revolution is triumphant and, through the abundance of energy produced, has created a national renaissance that has overthrown world geopolitics, strengthening American power,[9] is the most severe lesson taught to Type II and III ignorant people (but they are not sure they want to learn it).

The consensus of the 97% of experts who agree with anthropogenic global warming

In almost any discussion of recent climate change, if you try to articulate a small skeptical sentence, you are immediately roasted with a terrible argument: But there is a **consensus**! 97% of experts agree that climate change is, in fact, global warming because of people! Even President Obama told us on Twitter in 2016 that “97 percent of climate scientists agree: Climate change is real and man-made.” [10]

There are two types of arguments against this position.

Philosophical arguments

About 2,300 years ago, Aristotle compiled a list of 13 common sophisms that he presented in the text “Sophistical refutations” in his book *Organon*. Many of the sophisms identified by Aristotle are still valid today and are applicable to the debate on anthropogenic global warming:

– *Argumentum ad populum*, or the consensus fallacy
– *Argumentum ad verecundiam*, or recourse to authority

- *Argumentum ad ignoratiam,* or argument from ignorance
- *Ignoratio elenchi,* or fallacy of irrelevant conclusion, or "red herring"
- *Argumentum ad misericordiam,* or inappropriate mercy (appeal to pity)
- *Post hoc ergo propter hoc,* or the argument of a false cause
- *A dicto simpliciter ad dictum secundum quid,* or the fallacy of the accident or rapid generalization
- *Argumentum ad hominem,* or the attack on the person
- *Argumentum ad baculum,* or the argument of force.[12]

Although each of these sophisms has real merits for discussing the 97% consensus, I will detail only the first two for reasons of text economy.

Argumentum ad populum (or the consensus fallacy): A statement must be true because many or most people believe it. Or, in short, "If many think so, it means so."

Environmentalists say it is about the consensus of scientists and scientific societies. Here we are dealing with *argumentum ad verecundiam,* or recourse to authority.

Ibn Al-Haytham (Alhazen), the eleventh century philosopher of science, considered to be the father of the scientific method, wrote that "he who seeks the truth (i.e., the scientist) does not put any belief in consensus, however venerable it may be . . ." And the English biologist Thomas Henry Huxley (Darwin's "bulldog") wrote in 1866: "He who enhances natural knowledge absolutely refuses the authority of knowledge as such . . . For him, scepticism is the greatest duty, and blind faith is an unpardonable sin."

Experts may be unanimously incorrect, as was the case with the 100 German authors who opposed Einstein's theory of relativity in 1931. They were incorrect because the regime required them to enslave their scientific objectivity to the regime's racial policies.[11]

Think of the thousands of years when scientific consensus (probably more than 97%!) imposed that the earth was the center of the universe and that the sun revolved around the earth. It took only one brilliant mind, that of Copernicus, for that consensus to disappear.

One of the chapter's mottos reproduces the statement of George Bernard Shaw, who draws our attention to the fact that "All great truths begin as blasphemies." We must not forget that "science is settled" was used many times in history, and we see that the experts were wrong those times.

When Louis Agassiz tried to explain to the European geological community that the continent was covered by at least one glaciation, the consensus of experts at the time, including the famous Charles Darwin, did not believe it.[13] Disappointed by Type II ignorance, Agassiz chose to immigrate to the United States, where he remained until the end of his life as a professor at Harvard University. Today, the consensus of experts accepts the existence of multiple episodes of glaciation–interglaciation events.

Decades later, German meteorologist Alfred Wegener published several geological and paleontological proofs that in the past, the continents were united into a supercontinent, which he named Pangea, that was surrounded by a superocean, which he called it Panthalassa. Moreover, he suggested that the continents' breaking and current position can be explained by a movement that he called continental drift. What did the consensus of experts in Europe and the United States say after listening to Wegener and reading his book? "There is no such thing . . ." Again, a classic example of Type II ignorance. Today, scientific consensus values continental drift as an essential part of plate tectonics.

In 1847, Ignaz Philipp Semmelweis suggested that hand washing would drastically reduce newborn mortality, making him a pioneer of antiseptic procedures. The scientific consensus of the time ignored him, ridiculed him ("What do you mean? Let this Jew teach us that we must wash our hands before attending a birth?") and treated him with contempt until Semmelweis lost his job as an obstetrician in Vienna. Louis Pasteur, Joseph Lister, and an understanding of germs had to appear for the new consensus to assert Semmelweis's validity.

In science, invoking a consensus is not a good idea because, in this way, we indirectly recognize that science is not solid enough. We never say that there is a consensus of experts who accept that $E = mc^2$. We never say that there is a consensus of experts who accept that the earth is round and not flat.

The consensus is not part of the scientific method. We are dealing with a post-modernist presumption that the truth can be deduced by measuring a consensus of experts. Richard Feynman, whom I quoted in the first motto, was a promoter of science seen as constructive skepticism. The motto goes on like this: "When someone says that 'science teaches us this and that' he is using the word incorrectly. Science does not teach us; experience teaches us."

Science is not based on and does not advance by consensus; it only works well in politics. "Science is not a belief system (like 'I believe in global warming')" (Legates et al., 2015). Science is based on the repeatability of facts and the testing of hypotheses. According to Karl Popper, the criterion for delimiting between science and pseudoscience is falsifiability:

"Insofar as a scientific statement refers to reality, it must be falsifiable; and insofar as it is not falsifiable, it does not speak of reality." Think about falsifying climate change. Would that be possible? If so, how?[14]

Statistical arguments

Four articles presented the 97% consensus of experts who believe in anthropogenic global warming.[15] In this chapter, I will limit myself to presenting only the last one (Cook et al., 2013), which triggered President Obama and other politicians' reactions. The rest of the articles suffer from similar statistical problems.

Cook et al. (2013) used three interchangeable definitions of consensus:[16]

- **Unquantified definition**: Consensus means that people produce global warming.
- **Standard definition**: Human activity is most likely the cause of most current warming (anthropogenic global warming).
- **Definition of catastrophic**: Human intensification of the greenhouse effect will be dangerous enough to become catastrophic.

None of these definitions is precise enough and quantified enough to be falsifiable in the Popper sense. And due to their interchangeability, it is not clear which definition the authors tested. Worse, it is easy to see that the three definitions are mutually exclusive.

After a subjective examination of the abstracts of 11,944 peer-reviewed articles, which contained the expressions "global climate change" or "global warming," Cook et al. (2013) concluded that 97.1% of those who expressed an opinion are acceptors of the hypothesis defined by them in the introduction of the article (i.e., the standard definition).

However, according to Table 33.1, 7,930 (66.16% of the total) abstracts do not express any position. That is, only 33.84% of all analyzed summaries form the basis of the 97% consensus. Also, the analysis of data used by Clark et al. (2013) shows that they categorized only 64 abstracts, or 0.53% of the total, for expressing an explicit, quantified endorsement, which is the standard definition of consensus. Upon further verification, it turned out that, in reality, only 41 of the 64 abstracts, or 0.34% of the total 11,985, approved that definition.

Table 33.1. Data showing the breakdown of the abstracts reviewed by Cook et al. (2013) by the level of endorsement of the climate consensus (from Legates et al., 2015).

Endorsement level	**Type of abstract**	**Abstracts**	**% of all abstracts**	**% of all abstracts expressing an opinion**
1	Explicit, quantified endorsement (standard definition of consensus)	64	0.54	1.59
	Actually endorsing the standard definition upon inspection	*41*	*0.34*	*1.01*
2	Explicit, unquantified endorsement	922	7.72	22.97
3	Implicit endorsement	2,910	24.36	72.50
4a	No position	7,930	66.39	
4b	Expression of uncertainty	40	0.33	1.00
5	Implicit rejection	54	0.45	1.35
6	Explicit, unquantified rejection	15	0.13	0.37
7	Explicit, quantified rejection	9	0.08	0.22
	TOTAL	**11,944**	**100**	**100**

Even prominent climatologists in the field of climate change admit that there is no consensus. Phil Jones, the former director of the Climatic Research Unit at the University of East Anglia, was asked by a BBC reporter if the climate change debate was over, and he said: "I don't think the vast majority of climatologists believe that. This is not my point of view."[17]

A devastating critique of the Cook et al. (2013) paper was made by Professor Mike Hulme, founder of the Tyndall Centre for Climate Change Research, Professor of Human Geography at Cambridge University, and former Professor of Climate and Culture at King's College London and Professor of Climate Change at the School of Environmental Sciences at the University of East Anglia:

> The "97% consensus" article is poorly conceived, poorly designed and poorly executed. It obscures the complexities of the climate issue and it is a sign of the desperately poor level of public and policy debate in this country that the energy minister should cite it. It offers a similar depiction of the world into categories of "right" and "wrong" to that adopted in Anderegg et al.'s 2010 equally poor study in PNAS: dividing publishing climate scientists into "believers" and "non-believers". It seems to me that these people are still living (or wishing to live) in the pre-2009 world of climate change discourse. Haven't they noticed that public understanding of the climate issue has moved on?
>
> The Cook et al. study is hopelessly confused as well as being largely irrelevant to the complex questions that are raised by the idea of (human-caused) climate change. As to being confused, in one place the paper claims to be exploring "the level of scientific consensus that human activity is very likely causing most of the current GW" and yet the headline conclusion is based on rating abstracts according to whether "humans are causing global warming." These are two entirely different judgements. The irrelevance is because none of the most contentious policy responses to climate change are resolved *even if* we accept that 97.1% of climate scientists believe that "human activity is very likely causing most of the current GW" (which of course is not what the study has shown).[18]

In 2017, six climate experts published another substantial critique of the 97% consensus, warning in the most serious way that a climate science consensus campaign could have the opposite effect of what ecological propaganda wants:

> . . . repeated efforts to shore up the scientific consensus on minimalist claims, such as "humans cause global warming", are distractions from more urgent matters of knowledge, values, policy framing and public engagement. Such efforts to force policy progress through communicating scientific consensus misunderstand the relationship between scientific knowledge, the public, and policymakers.[19]

If there is more interest, a list of "97 articles refuting the '97% Consensus'" can be found here.[20]

The conclusion of Cook et al. (2013) was, "Among [the 4014] articles that expressed a position on anthropogenic global warming, an overwhelming percentage (97.1%) accept the scientific consensus on anthropogenic global warming." It is erroneous and, consequently, contingent on Type III ignorance. There are all the premises to argue that the much-invoked consensus on anthropogenic global warming is artificial and deliberately constructed.

Cui prodest?

In academia, climate change research means a lot of money in the form of large grants, from which university administrations also receive substantial amounts in the form of indirect spending. For researchers, those grants mean an easier and simpler path to new publications, tenure, promotion, and, of course, new grants.

Today, research funding plays a crucial role in the academic life of profile institutes, and most researchers and funding agencies have little interest in funding projects that go against the current paradigm, challenging existing beliefs, especially if the expected results will challenge political correctness.

The current trend is to fund those projects that take a catastrophic stance, and the money from the government and environmental groups is not small. For example, the United States government alone spent nearly $80 billion on climate policies from 1989 to 2008. And global carbon trading reached $180 billion in 2011.

Studying climate change is the golden goose that lays many eggs, and no one wants to kill it.

Conclusions

An editorial published in *Scientific American* once again discussed the role of scientists in universities. They should be encouraged to discuss and debate publicly, on blogs and web platforms, any topic of public interest (e.g., fracking and climate change). When universities discourage scientists from taking a public stand, society suffers.[21]

If hydraulic fracturing has disappeared (almost) from the radar of public debates, climate change continues to polarize large segments of the population of the United States and many other countries.

Talking about climate change from only one perspective, that people are the *only* cause of global warming by 0.8°C in the last 200 years according to the consensus of 97% of experts, is an unproductive, biased, and narrowminded enterprise. In my opinion, only an open mind is fully prepared to absorb the true knowledge.

Professors who tackle only one point of view in their courses without elaborating and insisting on the many facets of climate change, past, present, and future, only encourage lazy thinking, lack of intellectual curiosity, and the emergence of a one-dimensional person. These students learned to believe only what is taught to them, to accept without remorse an authoritarian leader, and to later become people who demonize the skeptics, considering them uninformed, ignorant, or lacking objectivity, when they are ignorant Type II. For comparison, Lysenkoism in the Soviet Union from 1930 to 1960 is the classic example that illustrates the triumph of an evil utopia where opposing ideas are discouraged and disregarded.

Recognizing the educational and docimology value of agnotology can help detect Type II and Type III ignorance. Both academia and wider categories of people, sincerely and honestly interested in participating in public debates of highly polarized ideas or issues, will benefit from identifying pseudo internet experts (ignorant Type II) and attempts to manipulate traffic misinformation programmed to mislead (Type III ignorance).

It is unfortunate that some governments, environmental lobbyists, academics, politicians, most liberals, and the liberal media have given so much time and attention to the so-called 97% consensus, which is essentially misinformation deliberately manufactured. That is, it is inscribed via agnotology in Type III ignorance.

If further proof of the inefficiency of consensus in science is needed, I would add the warning given by Francis Bacon in 1605 in *The Advancement of Learning*:

> If a man begins with certainty, he will end in doubt; but if he is content to begin with doubts, he will end in certainty.

CHAPTER 34

GASLIGHTING AND THE POWER OF MANIPULATION

But I saw you with my own eyes!
Well, who are you gonna believe?
Me or your own eyes?

Chico Marx
Duck Soup, 1933

In 2014, my first article published on the platform Contributors.ro was "*Gasland* or the power of manipulation."[1] For the first time in Romanian mass media, I identified and debunked the pseudodocumentary *Gasland*'s main manipulative technique scene, or the shock sequence with water running from the kitchen faucet and lit with a lighter. After the film was hacked and appeared free and translated into dozens of languages on YouTube, *Gasland* unleashed a global hysteria: tens of thousands of people, brainwashed by a propaganda lie, demonstrated en masse, hit the asphalt of the streets with pets, engaging in violent confrontations with law enforcement. Now, after six years, none of the apocalyptic predictions of the use of hydraulic fracturing have come true: water in wells has not been poisoned, natural radioactivity has not increased, the few earthquakes in Oklahoma are not catastrophic, surface water reserves are not depleted, etc.

Instead, hydraulic fracturing marked the first technological revolution of the twenty-first century, a revolution that made the United States the world's largest oil and gas producer. The shale revolution led to lower fuel prices in oil and gas, and according to a study published in October 2019, Americans saved $200 billion, or about $2,500 per four-member family annually.[2] By making gas cheaper than coal, hydraulic fracturing has allowed a significant transition in electricity production from coal-fired to gas-fired power plants. This is the main reason why the United States has seen the largest reduction in carbon emissions in the world in the last decade, although President Trump withdrew his country from the Paris

Climate Agreement, a decision that was reversed in January 2021 by the current Democratic administration.[3]

Gasland and the hysteria it caused remained a shameful stain for some, a bad dream for others, and a typical example of how easy it can be for some people to be manipulated by master puppets.

Here, I would like to present another type of manipulation: gaslighting, which, coincidentally, originates from a film whose name is also related to the fateful gas from *Gasland*.

In 1944, viewers could watch the movie *Gaslight*. In the movie, a couple (apparently) in love move into a house that the wife had inherited. But immediately after the move, the woman's life (admirably played by Ingrid Bergman, who, two years earlier, had played in *Casablanca*) undergoes a radical change: her loving husband begins to mentally abuse her, trying hard, through blatant lies, to break her from the outside world, to destroy her inner balance, and to shake her self-confidence. To create an "alternative reality," the man staged the production of suspicious noises in the house and the unjustified flickering of the gas lamp. Frightened, the woman tried to discuss with her husband the strange situations she experienced every night. But, every time, the man accused her of being delusional, of having lost her mind, and of falling prey to emotions that he can still control. His ultimate goal, we learn from the film, is to hospitalize his healthy wife in a hospital for mental illness and to appropriate precious jewelry, which had belonged to his wife's aunt.

Taking the central idea of the 1944 film, gaslighting is a form of psychological abuse in which a person or group makes someone question their health, perception of reality, and memories. People who experience gaslighting often feel confused, anxious, depressed, and unable to trust themselves.[4]

Gaslighting is also a manipulation tactic in which the manipulator(s) will cause the victim(s) to question and doubt the reality they perceive: "Is it me, or it is you who makes me think it's me." Abundant examples prove that gaslighting works beyond expectations, a lot better than anyone would think. In principle, everyone can become a victim of gaslighting and can be affected or controlled slowly, without realizing how much they have been brainwashed.[5]

Sarkis (2017) describes several techniques/tactics used by gaslighting manipulators from which I selected and completed the following:[6]

The utterance of blatant lies uttered without any embarrassment

Why are these lies so powerful and dangerous? Because they set a precedent. And, following a quote from Joseph Goebbels, "if you tell a lie big enough and keep repeating it, people will eventually come to believe it."

Denying things said, even though you have evidence that they actually said them

The technique used here is similar to the one illustrated by the chapter's motto: "But I saw you with my own eyes! And who will you believe? Me or your own eyes?" This tactic makes you start to question the very reality you perceive personally, causing you to think "maybe they never said that . . ." And the more they do this, the more you doubt your own reality and start accepting it.[5] See, for example, the relatively recent and well-spread fake news and alternative facts.

Sentimental blackmail

They know how important children are to you. And if you have children, they tell you that you shouldn't have had them because their future is dark because of global warming. Moreover, they will show you a photo of a girl holding a sign that reads: "You will die of old age. I will die of climate change."[7] On the other hand, if you have children, some even mentally ill who are skipping school to demonstrate against climate change, everything is okay because the goal excuses the means.

Moral wear using the Chinese drop

Another powerful and insidious technique employed by gaslighting manipulators is to proceed gradually over time. An exaggeration here, another beyond, followed by a lie here and another beyond, an acid comment from time to time . . . and then things start to accumulate into a hyperbole, which, uncorrected in time, turns into hysteria-generating mythology. Even the most intelligent and most self-aware people can be enmeshed by gaslighting. The efficiency of the manipulation, in this case, is measured by the analogy with the "frog in the pot of boiled water": the heat increases slowly so that the victim (the frog) never realizes, or realizes too late, what is happening to it.

Post-factum praise to increase your confusion

Those who mercilessly shamed you before, saying that you have no value, now praise you for something you just did. This is meant to add an extra feeling of unease. You may think, “Well, maybe they’re not that bad.” In reality, they are evil. Post-factum praise is nothing more than a perverse mask, a calculated attempt to keep you away from your area of intellectual comfort and, again, an attempt to question your own sense of reality. It doesn’t hurt to check what you’ve been praised for. Most probably, it is something that fulfilled the expectations of the manipulators.

Trying to line up other people against you

The master puppeteers will find those people they know will be with them without grumbling and will use them against you. You’ll hear comments, such as, “This person knows you’re wrong” or “This person knows you’re useless.” Keep in mind that this does not necessarily mean that those people made those statements. Gaslighting puppeteers are notorious and constant liars. The purpose of using this tactic is to induce a sense of insecurity so that you no longer know who to trust or who to turn to, as well as isolation. And that’s precisely their purpose because isolation offers them increased control over you.

“You’re crazy!”

A tactic taken directly from the movie *Gaslight*: “I’m telling you (or those around you) that you’re crazy.” The effect is immediate and expected. Puppeteers know that if your mental health is called into question, people will not trust you when you tell them that you are a victim of manipulation, mental abuse, intellectual harassment, etc. The mental situation of Swedish activist Greta Thunberg can be considered an exception, that is, we must believe her without hesitation.

Examples of gaslighting abound in various fields, not just in movies or family/personal relationships. Interested readers will certainly find such examples. Therefore, I will discuss only one case study of gaslighting and climate change. I will also use a rich source of gaslighting, *The New York Times.*

Gaslighting and climate change

If you have to scare people to death about climate change, an effective technique is to publish dozens, maybe hundreds of apocalyptic articles that call into question your own perceptions of reality. You see with your own eyes that it is not as the liberal press writes, but they use Chico Marx's method of "Yes, I know you saw it with your own eyes, but who are you going to believe, me or your own eyes?"

Let's consider just a few instructive examples from *The New York Times*:

- *Global cooling*
  February 24, 1895: "Geologists believe the world could freeze again."
  October 7, 1912: "Prof. Schmidt warns us that a new ice age is approaching."

- *Global warming*
  August 10, 1952: "The world has begun to heat up in the last half century."

- *Global cooling*
  December 29, 1974: "Current climate change will cause mass deaths through starvation and probably anarchy and violence."
  May 21, 1975: "Sooner or later, major large-scale cooling [is] considered inevitable. The signs that it has already begun are obvious."

- *Global warming*
  August 22, 1981: "Global warming, of almost unprecedented magnitude, is predicted."[8]
  December 4, 2019: "Climate change is accelerating, bringing humanity dangerously close to irreversible change." [9]

A "masterpiece" of climate gaslighting, intensely promoted by *The New York Times*, was published on July 23, 2020: "The great climate migration."[10]

The author, Abrahm Lustgarten, is not what is called an unbiased or impartial reporter/journalist. A declared anti-Exxon, antifossil fuel fracktivist, Lustgarten has been publishing for over a decade at *ProPublica*, a New York-based NGO that promotes investigative journalism for citizens.

The report on climate migration is full of terrifying images of hordes of poor and hungry people in South America rushing to the American border with Mexico. To find an official justification to support his article's main thesis, Lustgarten manipulated the conclusions of a report published by the World Bank in 2018 on the causes of climate migration. According to the document, almost all "climate migrants" move within their own countries, moving from villages to cities:

> The report notes that **internal climate migration** is likely to increase by 2050 and then accelerate if there are no significant reductions in greenhouse gas emissions and strong development actions.[11]

But for *The New York Times*, *ProPublica*, and Lustgarten, the reality of domestic climate immigration was not what they needed. They wanted economic immigrants, who want to leave their countries of origin and arrive in the United States illegally, to be assimilated with domestic climate immigrants. How to build an "alternative reality?" Apply a gaslighting technique. The model used by the World Bank in 2018 was modified for a fee by the geography professor Bryan Jones at Baruch College, so that, after only two years, the readers were presented another "reality":

> We focused on changes in Central America and used data on climate and economic development to examine a number of scenarios. Our model projects that migration will increase every year regardless of climate, but that the volume of migration increases substantially as the climate changes. In the most extreme climate scenarios, more than 30 million migrants would head to the US border in the next 30 years.[12]

…To the border with the USA, that is to the north, where it is less warm, I hope it is understood, isn't it?

Playing a shell game in which internal climate migration becomes "magically" external climate migration to North America, is another proof of gaslighting manipulation used by the liberal media and which, unfortunately, manages to fool many people, some in good faith. "It is not true what you read with your own eyes in 2018, it is true what I tell you in 2020 . . ."

Conclusions

Gasland and *Gaslighting* have the manipulative nature and the name of methane gas in common. But the comparisons stop there.

Gasland-type manipulation has lived its life and now lies in the dustbin of history.

Gaslighting-type manipulation has a longer history and rumors of its death are gently inflated. Incorporating multiple tactics and techniques, gaslighting is both a powerful and dangerous phenomenon, sometimes long-lasting, as in the case of climate change.

Finally, I just want to remind those who are still lucid and unprejudiced, a grim warning from Friedrich Nietzsche:

> He who fights with monsters might take care lest he thereby becomes a monster. And if you gaze for long into an abyss, the abyss gazes also into you.

Chapter 35

Two Recent Climate Manipulations: The Polar Bear that Starves to Death and Walruses that Commit "Suicide" because of Global Warming

We are living, fortunately or unfortunately, in the age of viral videos and pictures and fake news. Without a solid general education and a mind free from prejudice, it is relatively easy for some of our peers to fall prey to professional manipulators. And the effects of such activities, such as visceral emotions, media hysteria, the consumption of personal energies for wrong or inefficient solutions, and more are harmful manifestations of the hegemony of social networks in contemporary society.

To successfully shock and manipulate naive and less informed public opinion, part of the media resort to what I called in 2014 a **shock sequence**, or a video whose purpose is not honest, objective information, but the induction of acute feelings and visceral emotions of horror, indignation, immediate revolt, with guaranteed media impact (i.e., "clicks").

Who doesn't remember the planetary hysteria created by the shock sequence of lighting the tap water on fire in a Colorado farmer's kitchen, immortalized to Josh Fox's shame in the fake documentary *Gasland*? The immensity of this manipulation resulted, for example—in Romania at least—in physical and verbal acts of violence, endless demonstrations, rallies to expose the imperialists from Chevron who want to poison the people's wells, and so on.

In 2014, my first article published in Contributors.ro, "Gasland or the power of manipulation," was a rigorous debunking of manipulating the public opinion of those less educated and a will to turn a deaf ear to various environmental sirens.[1] Unfortunately, that "documentary" was showered with a rain of awards, including the *2011 Academy Award for Best Documentary Feature*, which gave it an undeserved aura of credibility.

Although the fracktivist hysteria in Romania and the rest of the world has now become history, I think we must not forget the lesson of manipulation in *Gasland*, especially as social networks have meanwhile increased their membership, and fake news is spreading at exponential speeds. The reader can find more details in the precedent chapter of this book, “Gaslighting and the power of manipulation.”

Here are two more recent examples.

The polar bear that starves to death because of global warming

On December 5, 2017, photographer and environmental activist Paul Nicklen posted a video about a dying polar bear on his Facebook page, forgetting to mention that the organization he belongs to, www.SeaLegacy.org, advocates for fundraising and ideas designed to save polar bears from death due to anthropogenic global warming.[2] In a short time, the post was shared 30,000 times and garnered over 1,500 comments. One year later, the video reached 2.5 million people.[3]

On December 7, 2017, Sarah Gibbens of *National Geographic* made a pathetic commercial for the video, which she described as “Heart-wrenching video shows starving polar bear on iceless land,” adding, as a subtitle, “Lack of ice makes the task much more difficult for bear to find food.”[4] What Sarah Gibbens forgot to mention is that filming probably took place at the end of the summer, a time when Baffin Island and its surroundings are ice-free.

On December 11, 2017, under Matt Stevens’s signature, *The New York Times* published a lengthy article about the video propaganda surrounding the polar bear starving to death. Right from the title, we are told that we will see something that “will rip our hearts out of our chests.”[5]

Meanwhile, the rumor media has picked up speed. Social networks have become inflamed with outrage, and millions of people have bitten the bait of anthropogenic global warming and signed messages of ecological anger. It is “inexcusable,” “what can we do,” “it is a ‘tragedy,” and more are what people think. Even Canada’s Minister for the Environment and Climate Change at the time, Catherine McKenna, wrote in a tweet: “THIS IS how climate change looks.”[6]

Then, on December 12, 2017, the media bubble burst as fast as it swelled.[7]

Experts have strong arguments that the bear did not starve due to melting ice, not because of anthropogenic global warming. No convulsions accompanying death by starvation had been observed. The bear was most likely injured, sick (e.g., with a form of bone cancer) or old (the fur around the neck was ragged), or a combination of these three causes.

Data collected by Canadian federal authorities between 2010 and 2018 show that, out of nineteen polar bear subpopulations, seven declined in 2010, but then only two likely declined in 2014, and only three likely declined in three areas in 2018. In 2010, the polar bear subpopulations increased in three areas, increased in one area in 2018, and likely increased in two areas (2014) and one area (2018), as shown in Figure 35.1.[8] The dynamics of the polar bear population shows undoubtedly that there is not an overall trend.

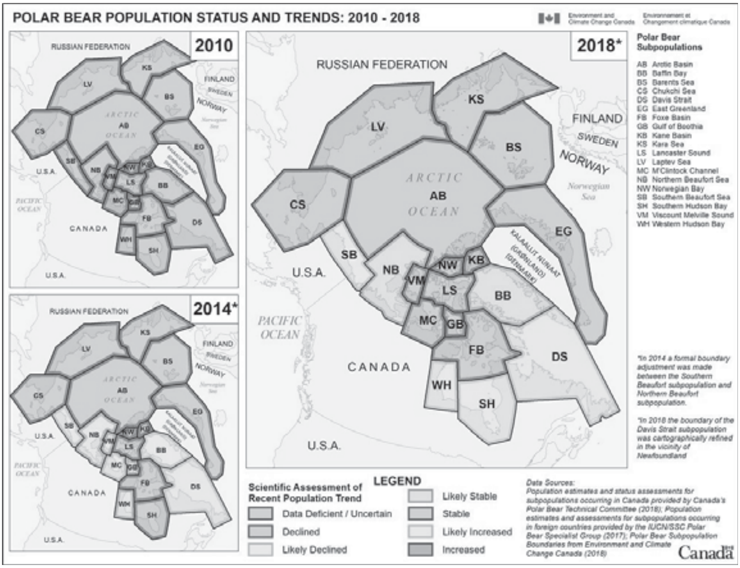

Figure 35.1. Maps of polar bear subpopulations in Canada between 2010 and 2018.[9]

Although ice decline is a possible cause for a smaller number of losses in some polar bear populations, other factors should be considered, as well. For example, hunting was responsible for the deaths of 53,500 polar bears between 1963 and 2016, with an average of 991 deaths per year.[10] The number of hunted polar bears is twice as large as the total number of polar bears living today, which is around 26,000.[11]

Being the apex of the Arctic food chain, polar bears have no natural predators. That is why most die of old age or disease. If a moose, a reindeer, or a walrus grow old, there will always be a predator who will turn them into a delicious lunch without giving environmental photographers the chance to immortalize their common end. On the other hand, the polar bear will move from the phase of a young and healthy animal to the phase of biological decay without the risk of being devoured by another animal.

On the other hand, I find it exaggerated and taken out of context for a dying bear to be considered the "representative face of climate change," as the Canadian minister and many who watched the video claim. Applying this logic, what could account for the multitude of healthy bears in Canada? Global cooling? If in December 2017, for the first time in the last decade, it snowed in Florida and South Texas (i.e., Houston, Corpus Christi) to a layer of 18 cm, do we have to make videos, post them quickly on the internet, and then claim that those unexpected snows are the "representative faces of global cooling?"

The myth of polar bears as the canaries in a coal mine started to propagate since the release of Al Gore's movie *An Inconvenient Truth* (2006). But the reality was and is different.

In 2012, Professor Susan J. Crockford, the University of Toronto, penned an article titled "Polar bears – outstanding climate change survivors," in which she writes:

> We tend to hear nothing but alarming messages about the current status and future welfare of Polar Bears from animal advocates of all kinds, including lobby groups and activist scientists. Many of these tales of imminent doom, however, have important facts left out, glossed over or misrepresented – and much of the uncertainty in the underlying research has been downplayed. It is still not known for certain when Polar Bears evolved but there is no question that, in the many millennia they have existed as a separate species, they have survived very significant changes in climate. Polar Bears successfully adapted to times when there was both much less, and much more, Arctic sea ice than exists today. Polar bears obviously have strategies for surviving dramatic changes in sea ice conditions – we just don't know yet what all of them are.[12]

The truth is that the polar bear species has never been and is not seriously threatened even today by climate change. In reality, polar bears are remarkable champions of survival during the last glaciation (130,000–115,000 years ago). Polar bears also survived the first millennia of the current interglaciation, when the Arctic ice surface was sharply reduced and when there were even long periods of ice-free summer in the center of the Arctic Ocean.

In the mid-1960s, their number was about 12,000. In 2019, this number exceeded 26,000. When conservationists in the Polar Bear Specialist Group began studying polar bear populations in the mid-1960s, they clearly identified that their biggest threat was not anthropogenic global warming but non-discriminatory and unregulated hunting. After the hunts were brought under the control of the official authorities (to the displeasure of some local tribes), the number of polar bears consistently increased, with numbers in 2019 being more than double those in the 1960s.

In July 2020, a study published in *Nature* acknowledged that:

> Estimating when different subpopulations will likely begin to decline has not been possible to date because data linking ice availability to demographic performance are unavailable for most subpopulations and unobtainable a priori for the projected but yet-to-be-observed low ice extremes.[13]

In conclusion, the real threat to polar bears is not climate change but people who hunt them indiscriminately. Because of this, photogenic polar bears are no longer the canary symbol of the climate mine.

Netflix, Sir David Attenborough, and the walruses' "suicide"

If the polar bears lost their status as canaries in the climate mine, what else should replace them?

The propaganda machine needed a replacement. And because the symbol of climate change must always be present, Netflix aired a new series in April 2019, *Our Planet*.[14]

For the voice of the eight episodes, Netflix hired Sir David Attenborough, the most credible celebrity in the United Kingdom in 2006.

Episode 2 (*Frozen Worlds)* proposes, through the unmistakable voice of the narrator, that walruses from northern Siberia become the new emblem of climate change. Sir Attenborough and director Sophie Lanfear (literally, with tears on her cheeks!) lamented the new victim of global warming, of anthropogenic origin, of course, that is seen in Figure 35.2.

What happened?

In September 2017, about 250 walruses from the Chukotka Autonomous Okrug (Cape Schmidt area) of Siberia, after climbing an 80 m high rock above the ocean in northern Siberia, threw themselves off the cliff in an apparent suicide.

Through the voice of the unmistakable Sir Attenborough, we learn what the cause of the sinister walrus disaster is:

> The far north-eastern coast of Russia. This is the largest gathering of walrus on the planet. Over a hundred thousand have hauled out on one single beach. They do so out of desperation, not out of choice.

Figure 35.2. Capture from the series "Our Planet," Episode 2, of the moment when a first walrus falls from an 80 m high rock.[23]

> Their natural home is out on the sea ice. But the ice has retreated away to the north, and this [suicidal cliff] is the closest place to the feeding grounds where they can find rest …
>
> Some manage to find space away from the crowds. They struggle up the 80-metre cliffs. An extraordinary challenge for a one-tonne animal used to sea ice. At least up here, there is space to rest. The walruses' eyesight out of water is poor. But they can sense the others down below. As they get hungry, they need to return to the sea. In their desperation to do so, hundreds fall from heights they should never have scaled.
>
> These mass gatherings of walrus are now happening almost every year. So the lives of walruses, like those of polar bears and seals, are changing. All are living at the frontier of climate change, and all are suffering as a consequence.

After the cinematographer's voice says that there are 200–300 dead walruses on a beach of about 800 m, the director Sophie Lanfear, with tears on her cheeks, mourns the fate of the "suicidal" animals: "This is the sad reality of climate change . . . It's just so heart breaking."

What else can be said in the face of such a tragedy, filmed live and distributed on the most popular online movie network, Netflix? A shock sequence, similar to that of *Gasland* or the starved polar bear due to global warming, deserves, of course, the critics' appreciation. And if *Gasland* was only nominated for the 2011 Oscar Awards for Best Documentary, *Our*

Planet had already received two major awards in 2019: *The Primetime Creative Arts Emmy Award for Outstanding Documentary or Nonfiction Series*, a distinction given to director Sophie Lanfear, and the *Primetime Emmy Award for Outstanding Narrator*, given to Sir David Attenborough.

When the media bubble starts bursting . . .

Because there are also real experts in the field of Arctic animals (e.g., polar bears, walruses, and seals), immediately after the broadcast of that episode, attempts were made to draw attention to the fact that the story of the walrus suicide due to global warming was not very solid. Of course, those attempts did not enjoy media attention on the same scale as Sophie Lanfear's or Sir David Attenborough's Emmy-winning speeches.

First, contrary to popular belief, not even *lemmings* commit mass suicide, jumping off rocks when they feel that their numbers have become too large.[15] Why would walruses, animals weighing over 1000 kg, do it? One cause would be the presence of polar bears, their only enemies in the area, which would have panicked the animals, forcing them to jump in suicide from 80 m. But the film's director and cinematographer strongly denied that they had noticed any bears near the suicide rock when they filmed. So, what could be the reason for the mass suicide of the 200–300 walruses? And most importantly, why did they climb that rock? The director's (Emmy Award winner) response is surprisingly simple (and partly untrue):

"Because this is the sad reality of climate change . . . They'd be on the ice right now if they could be."

Second, Attenborough's assertion that walruses climbed the suicide rock because the beach was overcrowded is contradicted by the actual filming, which shows a relatively empty beach. Why then would the 200–300 animals be forced to climb to avoid congestion?

Here, the propaganda bubble was broken for the first time. The director confessed that she combined, without telling the audience, two sequences filmed in two completely different locations: one, with an overcrowded beach of 100,000 walruses, but without mass suicides; the second, the suicide rock, where the number of animals was much smaller than in the first location. By a simple hocus-pocus at the editing table, it turned out that the reason for the suicide was the excessive number of individuals on the beach who would have forced the "suicides" to find a place 80 m high.

Third, the director and narrator claim that there is a link between climate change and walrus climbing/suicide, but this is false because such tragedies officially occurred even when the ice's thickness and extent were not an issue. For example, three years in a row, in 1994, 1995, and 1996, walrus committed suicidal behavior, with dozens of males dying at the foot of rocks in southwest Alaska.[16]

The final demystification of the shock sequence in *Our Planet* came unexpectedly from another series with a similar theme, also made by the BBC. It was called *Seven Worlds, One Planet* and it was Episode 2, broadcast on November 3, 2019. This series was also narrated by Sir David Attenborough.[17]

The BBC producers used the same material filmed by Netflix, but without some cuts at the editing table. The similarity between the two series is evident in Figures 35.2 and 35.3, which describe the same tragic scene of the suicide of walruses at Cape Schmidt, Siberia.

Figure 35.3. Identical images showing the moment of the deadfall of a walrus in the series **Seven Worlds, One Planet**, BBC (left) and the series **Our Planet**, Netflix (right).

However, the BBC series also included images filmed with a drone over the suicide rock, in which (surprise!), some polar bears are seen near the walrus group, as seen in Figure 35.4.

Meanwhile, there has been overwhelming evidence of climate manipulation designed and executed by Netflix.

On May 17, 2020, Evgeniy Basov, a Russian photographer studying Pacific walruses, posted on YouTube a short film entitled *Walrus and White Bears from Chukotka (Моржи и белые медведи Чукотки)*.[19] From the movie, you can see that the rock shown on Netflix, called Schmidt's Head, is the same one used by the Netflix series cinematographer. Analyzing the new images, the BBC confirmed that this was the same event that appeared on both their movie and the Netflix episode.

Figure 35.4. Capture from the BBC series **Seven Worlds, One Planet**, in which three polar bears can be distinguished near the rock populated by suicidal walruses. On November 19, 2020, new footage revealed that Netflix faked walrus climate deaths[18]

Based on the sequences present in the BBC series and those posted by Basov, it turns out that the polar bears panicked the walruses, which jumped off the rock without being provoked. Basov is friends with Anatolii Kochnev, Netflix's scientific advisor, and appears to have been invited to watch commercial footage. In 2017, he also published a long photographic report about the situation of walruses in the Chukotka area, which provided many exciting details about the life and behavior of large mammals with long tusks.[20]

Like the original Netflix footage, the scene of the collapse of the rock, filmed by Basov, is hard to watch for the faint of heart. A brutal but absolutely natural situation is presented, or a meeting between prey and predator. The presence of walruses on land in mid-summer is a natural phenomenon, even when there is ice on the ocean. Polar bears know where their food is. As seen in Basov's film, the bears devour the corpses of walruses on the beach, some of which fell from the rocks, others that were trampled by the other animals who panicked when the bears appeared. It is known that polar bears follow such herds until they stumble, leaving the weak or careless crushed behind them. The rocks are not essential for this polar bear hunting strategy, but they are particularly effective.

If there is still a need for further proof that polar bears, not climate change, are causing a deadly panic in walrus herds to procure the food they need, here is a news item published on October 19, 2017 (a month after Netflix footage was filmed) in the newspaper *The Siberian Times*:

> Village besieged by polar bears while hundreds of terrorized walruses fall from 38 meters and die.
>
> Around 20 beasts have surrounded Ryrkaypiy, with one bear cub trying to get into a house through the window. The polar bears were attracted by 5,000 walruses that appeared this year at a special protection zone in Chukotka.
>
> Now the walruses are gone, but about 20 polar bears remain practically next to the village. Many of the frightened flippered marine mammals fell off cliffs at Kozhevnikova Cape as they sought to flee the invaders. Several hundred fell to their deaths, and the polar bears then ate the carcasses.[21]

Conclusions

Josh Fox, *Gasland*'s screenwriter and director, terrified a large mass of gullible people, without the necessary education, that hydraulic fracturing causes the contamination of drinking water with methane gas. The kitchen tap water flame from that Colorado farmer was sequenced by fracktivists to trigger hysteria, sometimes violently, in the world. A classic example of false propaganda manipulation.

Paul Nicklen, a Canadian biologist and photographer who is an active member of the environmental organization *The Sea Legacy*, also manipulated millions of people with the video of a dying polar bear he called the "representative face of climate change," a direct accusation of anthropogenic global warming. I have not denied and even now, I do not dispute the reality of climate change. It has been, it is, and it will be present in the destiny of the planet earth for many years, even after the extinction of the human species.

Walruses are not threatened with extinction by climate change. The manipulation of a tragic event, such as the one filmed by Netflix in Chukotka, is another sign of despair on the part of some media outlets trying to sell snake oil. If polar bears are no longer profitable as a symbol because their numbers have not declined enough in recent decades, if student Greta is not doing too well, this attempt to now promote walruses as a symbol of "evil" people, who emit CO_2 regardless of the thickness and extent of the Arctic ice, is laughable.

In 2017, the United States Fish & Wildlife Service published some very important news[22] for those who do not want to buy snake oil from Netflix: "After a comprehensive review, the service establishes that Pacific walruses do not require the protection of endangered species law." The press release for this is displayed in Figure 35.5.

U.S. Fish & Wildlife Service

Conserving the Nature of America

Search

FWS Home Newsroom Home Offices

Back

PRESS RELEASE

After Comprehensive Review, Service Determines Pacific Walrus Does Not Require Endangered Species Act Protection

October 4, 2017

Contact:
Division of Public Affairs
External Affairs
Telephone: 703-358-2220
Website: https://www.fws.gov/external-affairs/public-affairs/

The U.S. Fish and Wildlife Service has found that the Pacific walrus does not require protection as threatened or endangered under the Endangered Species Act (ESA). The finding follows a comprehensive review and analysis of the best available scientific information concerning the species, as well as local and traditional ecological knowledge of Alaska Native peoples.

The Pacific walrus is found throughout the continental shelf waters of the Bering and Chukchi seas and occasionally in the East Siberian Sea and Beaufort Sea. In its review, the Service paid particular attention to the impact to the species of the ongoing loss of sea ice in the walrus's range.

While walruses use sea ice for a variety of activities, including breeding, birthing, resting and avoiding predators, they have shown an ability to adapt to sea ice loss that was not foreseen when the Service last assessed the species in 2011. Given these behavioral changes, the Service determined that it could not predict, with confidence, future behavioral responses of the species beyond 2060. Accordingly, that date was used as the limit for determining whether the walrus was likely to become endangered within the "foreseeable future," under the ESA. Beyond that time, predicting behavioral responses becomes too speculative to be considered best available science for the purposes of a listing determination.

Figure 35.5. United States Fish & Wildlife press release about Pacific walrus status in 2017.[22]

Even though the shock sequence in the series *Our Planet* is brutal, nature in action is often the same, and it is not proof that certain species are on the verge of extinction due to climate change. Neither polar bears nor walruses are near extinction. But what the narrative promoted by Sir David Attenborough in *Our Planet* proves is that we are dealing with another disgusting manipulation, "an eco-tragedy porn," according to a British newspaper.[24]

CHAPTER 36

THE EARTH'S THERMOSTAT HAS BEEN SET TO "HABITABLE" FOR BILLIONS OF YEARS. HAVE PEOPLE MANAGED TO RUIN IT IN THE LAST 200 YEARS?

The most difficult subjects can be explained
to the most slow-witted man
if he has not formed any idea of them already;
but the simplest thing cannot be made clear
to the most intelligent man if he is firmly
persuaded did that he knows already,
without a shadow of doubt, what is laid before him.

Leo Tolstoy
The Kingdom of God is Within You (1894)

The existence of life on earth is probably the strongest argument for the uniqueness of our planet among other members of the solar system and of the known universe today. In addition to the presence of oxygen and liquid water, the perpetuation of life along geological eons also implies the existence of favorable habitat. However, the planet earth still has a unique characteristic, which a permanently changing climate that directly influences the presence and continuity of life in its biotope. In these circumstances, a fundamental question arises: How did the earth manage to remain habitable throughout its existence?

Many will be quick to answer that we were lucky, and that we are a Goldilocks planet, neither too big, nor too small, nor too far, nor too close to the sun, with an average temperature close to 15°C, which is the only good temperature for life to develop almost anywhere.

Some, however, will question the favorable nature of our terrestrial habitat for astronomical reasons. When the earth formed about 4.55 billion years ago, our external energy source was a thermonuclear power plant, called the sun, with an activity reduced by 25%–30% compared to today. That is, in the beginning, the sun was "young and weak," and the heat provided to the earth was insufficient to avoid total frost. Astronomical modeling indicates, for the first three billion years of our planet's existence, temperatures ranging between −25°C, with greenhouse gases at concentrations like today, and −40°C, without greenhouse gases.

This information in the field of astronomy is a serious embarrassment to climatologists. If the power of the sun was currently relatively lower by 25%–30%, this would mean that all the water on earth would be frozen, despite the presence of greenhouse gas emissions. And if all the oceans, seas, and lakes are frozen, their snow-covered surfaces will reflect even more incident solar radiation (*albedo* growth), thus generating even more frost in a positive feedback loop. The conclusion: The earth must have been frozen in the first two-thirds of its existence!

Contrary to the above arguments, geological research has revealed very old sedimentary rocks, indicating that most of the water on earth has remained liquid. Another piece of evidence that supports this conclusion is the continued presence of life. Primitive life forms have been dated to be at least 3.5 billion years old, and life's existence is not compatible with frozen water.

Putting all the pieces of the puzzle together, we get "the faint young sun paradox." In the beginning, the heat sent to earth was 25%–30% less than today, and yet the planet did not freeze in the first two-thirds of its existence. What kept the earth warm for the first three billion years, when temperatures were supposed to be between −25°C and −40°C? Then, when the sun increased its energy activity, what kept the earth cold, when otherwise, the temperatures would have risen too much, leading to massive losses of liquid water through evaporation?

The answer is *the planetary thermostat*, which works similarly to the ones in our homes. When autumn comes and the outside temperatures drop, the thermostat (preset to a pleasant temperature) turns on the heat. When summer comes with its suffocating temperatures, the thermostat turns on the air conditioning and cools our house.

The planetary thermostat was proposed in 1981 as a hypothetical mechanism for regulating temperature through an inactive feedback process.[1] Its role was to warm the earth when the sun was "young and faint" and cool it when solar radiation increased. In other words, after each glaciation, a warming period follows as is at present, and each warm period ends with a new glaciation.

The planetary thermostat's main component is greenhouse gases, carbon dioxide and, initially, methane. But, as I wrote above, the current concentrations of these gases would not have been enough to avoid a global freeze. It turns out that, at first, these gases must have been much more abundant in the earth's atmosphere, after which their concentrations began to decrease, thus creating the possibility of climate control by a thermostat.

The carbon exchanges between rocks and the atmosphere shown in Figure 36.1 are the key to understanding how the thermostat works. In general, the exchange rates between the various reservoirs are inversely proportional to the reservoir size: rocks and sediments have the lowest exchange rate (0.2 gigatons/year), while the atmosphere has the highest (74.6 gigatons/year). Because of these variable rates, small reservoirs (e.g., atmosphere, vegetation, soils, and the ocean surface) will recycle carbon faster than large reservoirs (rocks and abyssal parts of the oceans). It will take a few years or decades for the first, and much longer time intervals in the case of the latter.

The movement of carbon from large and deep reservoirs occurs mainly as CO_2 and is emitted by volcanic eruptions, terrestrial and submarine, and hot springs. The emitted carbon is then recycled between the other reservoirs and is finally reincorporated into the rocks, which is the final destination of all terrestrial carbon dioxide.

The planetary thermostat removes CO_2 from the atmosphere by chemical disintegration in two ways: *hydrolysis* of rocks containing silicates (e.g., granites and shales) and *dissolution* of limestone. Rainwater—the source of the incorporated carbon dioxide from the atmosphere—is weakly acidic and, by infiltration into the soil, chemically attacks and disintegrates rocks, geologically sequestering CO_2 in the form of siliceous and calcareous rocks.

The intensity with which the earth's thermostat works depends, on the one hand, on the size of the rock surfaces exposed to chemical attacks (as seen in Table 36.1 and Figure 36.2) and on the other hand, on important climatic factors like temperature, precipitation, and vegetation. For example, a warmer earth is likely to be a wetter planet, and both factors will work together to increase the degree of chemical disintegration, which will increase the sequestration of carbon dioxide in rocks, eventually reducing the initial warming, which can be achieved until the onset of the next glaciation.

Table 36.1. The largest reservoirs of carbon on earth are rocks and sediments. The (preindustrial) atmosphere holds the minimum amount of carbon.[2]

Major carbon reservoirs (gigatons)	
Sediments and rocks	66,000,000
Deep ocean	38,000
Soils	1,560
Ocean mixed layer	1,000
Vegetation	610
Atmosphere (preindustrial)	600

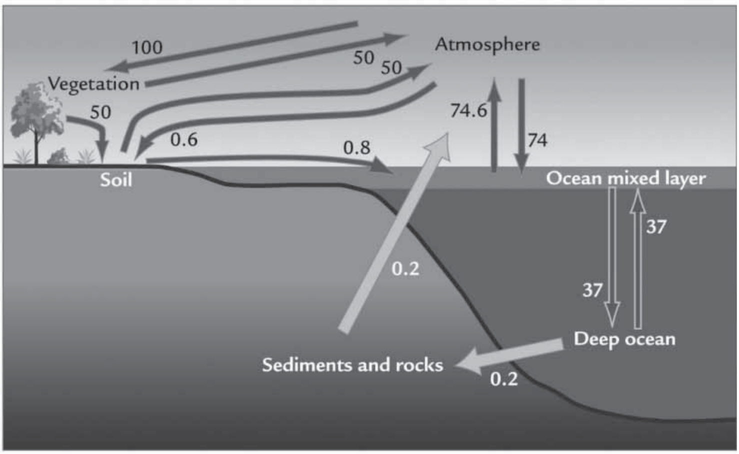

Figure 36.1. Carbon exchanges between terrestrial reservoirs and sinks. Over intervals of millions of years, carbon exchange among rocks and surface reservoirs can lead to significant changes in atmospheric CO_2 concentration.[3]

Increasing temperatures and precipitation will stimulate the development of abundant vegetation. This will increase the rate of chemical disaggregation by two to ten times compared to the typical rates of terrestrial areas where vegetation is lacking. Also, photosynthesis's extraction of atmospheric carbon correlates directly with temperature, meaning more carbon is stored in plants when temperatures are higher.

Figure 36.2. The coastal outcrop exposure in Ellis Bay on Anticosti Island, Quebec, preserves rocks stored during the Hirnantian glaciation (445 million years ago). Recent research on the rocks here confirms the functioning of the planetary thermostat.[4]

We now have all the elements of a physical mechanism—the chemical disaggregation of rocks—that plays the long-term climate thermostat role. This role comes into operation, cooling or heating the planet depending on the outside temperature, by changing the rate of removal of carbon dioxide from the atmosphere.

Is there any concrete evidence of the operation of the planetary thermostat?

The hypothesis that chemical disaggregation provides feedback that stabilizes the earth's climate was confirmed by data collected from three locations: two outcrops (Pointe Laframboise and Ellis Bay West) on Anticosti Island, Quebec, Canada, as seen in Figure 36.2, and one in Dob's Linn (near Moffat, Scotland). In the study published in June 2017 the authors used an innovative method, based on measuring the relative abundance of two lithium isotopes (Li-7 and Li-8) to demonstrate that a reduction in the rate of chemical rock disintegration is associated with climate cooling, which is precisely the behavior predicted by the planetary thermostat hypothesis.[5]

Specifically, researchers examined carbonate and shale rocks from the Hirnantian glaciation period, which was about 445 million years ago. This period was toward the end of the Ordovician period, which corresponds to the first and probably largest extinction of life in history: 85% of marine species disappeared due to cooling and the drastic drop in sea level (by about 80 meters), since the water was trapped in ice caps and mountain glaciers. Hirnantian glaciation, which produced a global cooling of −5°C, was caused either by the significant decrease in CO_2 emissions from volcanic eruptions or by the massive consumption of CO_2 by chemical disintegration.

The analyzed rock samples show that the overall chemical disintegration rate decreased four times in the relatively short glaciation period. As a result, less CO_2 from the atmosphere has been incorporated into the rocks, allowing the climate to recover and emerge from the ice age through negative feedback.

The cited study provides strong evidence supporting the planetary thermostat, set to "inhabitable," which has allowed life to flourish continuously for more than 3.5 billion years. But one question remains: what happened to the enormous amounts of CO_2 that once existed in the atmosphere and kept the earth warm, that is now habitable, so so long a time? The most likely answer can be deduced from examining the carbon reservoirs' size illustrated in Figure 36.1. Atmospheric CO_2 definitively ends its "stay" by geological sequestration in rocks.

Has the planetary thermostat ever been broken down in the past?

Probably yes, at least once. Climatologists have found evidence that the earth was very close to a total frost ("Snowball Earth"), sometime between 750 and 580 million years ago, during at least two or at most four glaciations. Testing this presumption involves confirming the position of large ice caps. Did they exist in the tropics or only in the polar regions? There are some indications of possible frozen areas at low latitudes.

The causes of the thermostat not working remain a mystery for the time being. It is assumed that all the continents were placed near the equator, where it initially rained heavily. Paradoxically, unusually heavy equatorial precipitation has accelerated chemical decay, rapidly reducing atmospheric CO_2 concentrations and cooling the planet to near freezing. Some scientists dispute the term Snowball Earth, suggesting it was instead a "Slushball Earth," or a kind of slush planet.

Have people managed to break the planetary thermostat in the last 200 years?

Almost 20% of the carbon recycled between the various terrestrial reservoirs is organic. Of this amount, only a small fraction is found sequestered in sedimentary rocks in the form of fossil fuels, such as oil, gas, coal, tar sands, and gas hydrates.

The Industrial Revolution, which began about 200 years ago, was based on and fueled by the great uses of fossil fuels that were cheap, abundant, ubiquitous, permanent, and scalable sources of electricity and heat. It led to the mechanization of all types of transport, agricultural, and industrial works, the unprecedented emergence and development of the petrochemical, plastics, synthetic fibers, medicines, agricultural fertilizers, cosmetics, and lubricants industries. In no way can we talk about economic and social progress in the last two centuries without fossil fuels' essential contribution.

From 1751 to 2010, approximately 337 Gt CO_2 have been released into the atmosphere from fossil fuel use and cement production.[6] About half of these emissions have taken place since the mid-1970s. In 2007, for example, fossil fuels produced 8.4 Gt CO_2.

About 40% of anthropogenic carbon is recycled from vegetation and oceans, and the rest contributes to increasing the greenhouse effect. The main consequences are the increase of the global temperature of the land and ocean by around 0.8°C compared to the preindustrial period when the atmosphere contained about 600 Gt CO_2, and the increase of sea level by about 0.19 m between 1901 and 2010, respectively.[7]

Returning to the question of people's relationship with the planetary thermostat, have they already broken it? Will they ruin it soon? I find the answer difficult to formulate. First of all, it is about comparing completely different carbon reservoirs in order of size. Rocks and sediments contain 66,000,000 Gt of carbon, while the atmosphere, with anthropogenic additions, contains about 1,000 Gt of carbon. Second, the time frame in which the climate thermostat has operated is much longer than the 200 years of anthropogenic greenhouse gas emissions.

In the not-too-distant future, fossil fuels will be depleted, which means that the current, transient, and climatic imbalance will adjust to the geological trend composed of the evolution of two distinct phenomena: glaciation + interglaciation.

Future climate change is estimated to be comparable in size to the largest changes in the past. The projected warming of 5°C will be similar, in absolute size, to the cooling of −5°C during the most recent glaciation of 20,000 years ago. We are currently closer by about 0.8°C (~16%) on the path to a warmer future by 5°C. After that, the climate thermostat will start to reduce the CO_2 concentration to preindustrial values and, from there, to the new glaciation.

However, on this road, there may be some events that we have not discussed in detail here, and that may influence the proper functioning of the planetary thermostat. For example, starting from the Gaia hypothesis, life itself controls earth's climate for its own good. A warmer and wetter climate with more CO_2 may produce an accelerated development of vegetation as the effect of CO_2 fertilization. And trees, grasses, and other plants play an important role in modern chemical disaggregation because they acidify groundwater by adding carbon to the soil.

An interesting hypothesis about the earth's continuous habitability for three or four billion years was formulated in 2020 by Professor Toby Tyrrell at the University of Southampton. He simulated thousands of worlds, allowing each to evolve within randomly generated climate feedbacks (e.g., geologic, biological, and atmospheric). The simulation results revealed that earth's extended habitability is due not solely to stabilizing mechanisms, but also to *chance* (e.g., asteroid impacts, solar flares, internal heat produced by radioactive decay, volcanic super-eruptions).[8]

Conclusions

The existence of the planetary thermostat was demonstrated on rock samples and, at least in the studied areas, the climate quickly stabilized. For this reason, the thermostat has been essential for maintaining a habitat conducive to the existence and flourishing of life over the last three billion years.

The recent impact of the last 200 years of anthropogenic CO_2 emissions on the proper functioning of the climate thermostat is difficult to estimate due to the incompatibility of orders of magnitude and time durations.

I wrote earlier that life on this planet has an expiration date. And this date is not determined by the burning of fossil fuels but, paradoxically, by their non-burning. The carbon cycle on earth is maintained by the geothermal energy with which the planet was endowed in its formation. The earth's internal energy moves the lithospheric plates on the asthenosphere's surface, "consumes" them by subduction, and then feeds the magmatic chambers. From there, through eruptions, carbon returns to the atmosphere. Geothermal energy is not renewable, and like fossil fuels, it will end one day. Without volcanic activity, all the carbon dioxide in the atmosphere will be permanently incorporated into the rocks. Without CO_2, photosynthesis will cease, and the food chain will break irretrievably.

C'est la vie …

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   McKinsey & Co., 2019, provides a predictive model based on the detailed compilation of data from 146 countries, 55 energy types, and 30 sectors, which it subsequently aggregates for a *bottom-up* perspective, where the aggregate product is used as the starting point for predictions.
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Index

A

Agassiz, Louis, 275
Agnotology, 270, 317, 325, 326, 342, 351, 354, 361, 363
AGW, Anthropogenic Global Warming, xxiii, 123, 124
Anastasiu, Nicolae, xxviii, xxix, 336
Animal Farm (1945), xxxii
Anna Karenina, 104
Antarctica, 31, 84, 85, 145, 149, 216, 350
Anthropocene, 113, 114, 116, 117, 118, 119, 120, 121, 255, 328, 334, 335, 336
Anticosti Island, Quebec, xxi, 305
APOC, Anglo-Persian Oil Company, xxiii, 104
Ardmore, OK, xvi, 98
Aristotle, 274, 331
Asch, Solomon, 67, 68, 69, 324, 325
Attenborough, Sir David, 293, 294, 295, 296, 300, 370

B

Bacon, Francis, 281
Baja California Peninsula, xviii, 197
Bastiat fallacy, 17, 18, 322
Betz limit problem, *5*
Biden, Joe, xv, 26, 27, 111
Billings, Lee, 251
Black Death, 88, 154
Blom, Philipp, 151, 155, 159, 162, 164, 340
Boserup, Ester, 52, 320
BP, British Petroleum, xviii, xxiii, 104, 105, 115, 180, 181, 183, 184, 186, 333, 338, 344
Braudel, Fernand, 153
Brooklyn College, xxix, 67, 122, 125
Burke, Marshall, 225, 226, 227, 228, 229, 230, 231, 232, 352, 353

C

CAGR, Compound Annual Growth Rate, xvii, xxiii, 181
California, xvi, xviii, xx, 1, 11, 60, 79, 85, 87, 131, 185, 197, 202, 226, 235, 236, 238, 239, 240, 356, 363
Camus, Albert, 21, 188, 269
Canada, xxi, 56, 67, 82, 83, 115, 178, 206, 207, 208, 217, 230, 244, 290, 291, 292, 305, 322, 368
Cazenave, Anny, xvii, 139, 338
Cenozoic, 119
Chicken Little, 243, 244, 245, 246, 247, 248, 249, 250, 356, 358, 367
Christy, John R., 91, 263, 329, 362
Ciscar, Juan-Carlos, xx, 220
Climate alarmism, 30
climate change, xx, xxii, xxv, xxvi, xxvii, xxviii, xxx, xxxi, xxxii, 1, 2, 5, 10, 15, 16, 19, 20, 21, 22, 23, 26, 28, 29, 30, 32, 33, 34, 35, 37, 38, 39, 41, 42, 43, 44, 45, 57, 61, 65, 71, 73, 75, 76, 77, 80, 89, 91, 92, 93, 94, 95, 96, 101, 110, 112, 122, 123, 124, 125, 127, 130, 135, 136, 145, 149, 150, 163, 164, 168, 188, 189, 191,

198, 200, 201, 203, 204, 208, 211, 212, 213, 220, 221, 222, 223, 225, 226, 227, 229, 231, 232, 245, 247, 248, 250, 251, 253, 254, 260, 261, 262, 264, 265, 267, 268, 273, 276, 277, 278, 279, 280, 281, 284, 285, 286, 288, 290, 292, 293, 295, 296, 298, 299, 300, 308, 316, 331, 334, 336, 338, 349, 353, 358
CMIP, Coupled Model Intercomparison Project, xx
CMIP5, Coupled Model Intercomparison Project Fifth Phase, xx, xxiii, 91, 264
CO_2 sequestration, 122
Cold waves, xix, 216, 217
Columbian Exchange, 156
confirmation bias, 248, 249
Constantinescu, Emil, xxviii, xxix, 336
Contributors.ro, xxvi, xxviii, 1, 282, 289, 336
Cook, John, xxii, 75, 78, 276, 277, 278, 279, 280, 326, 363, 366
COP, Conference of the Parties, xxiii, xxv, xxvi, 38, 337
CPI, Climate Policy Institute, xxiii, 2
Cretaceous event, 253
CRN, Climate Reference Network, xvi, xxiii, 97, 98, 99
Crockford, Susan J., 292
CRS, Congressional Research Service, xxiii, 351
CRU, Climate Research Unit, xxiii, 189
Curry, Judith, 76, 77, 78, 327

D

Dansgaard-Oeschger oscillations, 32
Deming, David, *xxix*
Democratic Socialists, 15, 17, 18, 19, 20, 96, 310, 312, 313, 317
Devonian event, 253
Don Quixote, 161
Drake, Edwin L., 12
Duck neck effect, 238
Dunning, David, 272
Dunning-Kruger effect, 272
Dziewonski, Adam, 146, 147
Eemian, period, 123
Ehrlich, Paul R., 51, 53, 61, 256, 357

E

EIA, Energy Information Administration, xviii, xxiii, 182, 184, 185, 344, 345, 355, 366
El Niño, 123
electric vehicles (EV), xv, xvii, 6, 7, 8, 9, 10, 59, 61, 173, 174, 175, 176, 177, 178
Ellis Bay, Canada, xxi, 305
EM-DAT, xv, xxiii, 39, 42
Energiewende, 105
Environmental Progress, 242
Essex, Christopher, 172, 342
European Green Deal, 1, 18, 28, 314
European Union, xxv, xxvi, 23, 28, 129, 219, 313
EV. *See* electrical vehicles
Exploring the Earth System, 122, 331, 336, 353, 359

F

Fall, Souleymane, xvi, 99
Feynman, Richard, 270, 276
Fulbright, William, 69

G

Gasland, 61, 262, 271, 272, 273, 282, 283, 288, 289, 290, 295, 299, 364, 366, 368
Gaslighting, 282, 283, 285, 286, 288, 290, 366, 367

GBR, Great Barrier Reef, xxiii, 264, 265
GDP, Gross Domestic Product, xx, xxiii, 50, 108, 109, 129, 180, 225, 226, 227, 228, 229, 230, 273, 320, 353
Geology, 34
GISS, Goddard Institute for Space Studies, xxiii, 171, 342
Global Cryosphere Watch, xviii, 196
GMSL, Global Mean Sea Level, xvii, 136, 137, 138, 139, 140, 141, 142, 144, 145, 146, 149
GMT, Global Mean Temperature, xxiii, 165, 168, 171, 172
Green New Deal, 1, 4, 11, 13, 15, 16, 17, 19, 20, 28, 29, 66, 96, 310, 312, 313, 317, 321, 331
Greenland, xvi, 31, 32, 85, 87, 115, 140, 145, 148, 149, 152, 154, 207
Greenlandian, xvi, 114, 115
Groupthink, 64, 65, 67, 68, 69, 70, 323, 324, 325

H

HadCRUT, Hadley Centre/Climatic Research Unit Temperature, xxiii, 171
Hansen, James, 131, 132, 337
Heatwaves, xix, 215
Hirnantian glaciation, xxi, 305, 306
Hirth, Lion, xx, 185, 238, 239, 345, 355
Hobbes, Thomas, 88, 151, 155, 163
Holocene, xvi, 84, 87, 88, 89, 90, 113, 114, 115, 116, 119, 120, 123, 328, 329, 334, 335
Hulme, Mike, 95, 279, 316, 330, 332, 337

I

Ice Age, 84, 85, 89, 244, 245, 336, 357
ICS, International Commission on Stratigraphy, xxiii, 114, 116
IEA, International Energy Agency, xxiii, 59, 60, 131, 182, 183, 323, 328, 337, 344
IHME, Institute for Health Metrics and Evaluations, xxiii, 320
INDC, Intended Nationally Determined Contributions, xxiii, 129
IPBES, Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Service, xxiv, 56
IPCC, Intergovernmental Panel on Climate Change, xx, xxiv, xxx, xxxi, 19, 36, 56, 74, 77, 91, 92, 95, 96, 106, 107, 124, 137, 144, 145, 189, 263, 264, 268, 313, 329, 338, 346, 362, 371

J

Janis, Irving, 65, 323, 324
Journal of Geophysical Research, 97, 331, 339, 343, 351, 370

K

Kellogg–Briand Pact, 133

L

Legates, David R., xxii, 75, 276, 278, 363, 366
Lévi-Strauss, Claude, 122
Little Ice Age, LIA, xxiv, 74, 88, 136, 151, 152, 154, 155, 156, 158, 159, 160, 161, 162, 163, 164, 207, 208, 211, 221, 243, 340
Llovel, William, xvii, 139, 338

Lomborg, Bjorn, 217, 314, 333, 334, 350, 351, 357
London, 7, 12, 37, 154, 210, 217, 279, 319, 321, 325, 330, 339, 341
Los Angeles Times, 239, 244
Lustgarten, Abrahm, 286, 287, 367

M

Malthus, Robert, 47, 48, 49, 52, 53, 55, 56, 61, 319, 321
Malthusianism, xxxii, 48, 50, 51, 52, 53, 61, 319
Malthusian trap, 49, 319
Maslow, Abraham, *xxxii*
mass extinctions, 251, 253, 254
Maunder Minimum, 163, 342
McKibben, Bill, 31, 53, 132, 321, 337
Medieval Climatic Optimum, 151, 154
Meghalayan, xvi, xvii, 113, 114, 115, 116, 119, 328, 334, 335
Mencken, H. L., 240
Milanković cycles, 32, 87, 89, 120, 152, 254, 359
Mills, Mark P., *7*, *13*, *310*
Miłosz, Czeslaw, 133
Mitrovica, Jerry X., 145, 146, 149, 339
MMTS, Maximum-Minimum Temperature Sensor, xvi, xxiv, 98
Morrison, L.V., xvii, 142, 143, 339
Munk, Walter, xvii, 136, 137, 138, 142, 144, 145, 146, 148, 150, 330, 338, 339
Murodo Snow Corridor, Tateyama, Japan, xix, 198
MWP, Medieval Warm Period, xxiv, 207

N

NARR, North American Regional Reanalysis, xvi, 99
NASA, National Aeronautics and Space Administration, xxiv, 31, 73, 76, 132, 171, 172, 214, 215, 342, 349
National Geographic, 290, 357
NATO, North Atlantic Treaty Organization, xxiv, 82, 83, 328
Nature, 31, 33, 60, 71, 72, 73, 128, 151, 189, 222, 226, 261, 264, 269, 293, 315, 316, 322, 323, 324, 327, 328, 329, 330, 337, 338, 340, 343, 346, 348, 349, 351, 352, 356, 359, 361, 362, 363, 369, 371
Nevada, *6*, *118*
New Amsterdam, 160, 206, 207, 208, 209, 210, 342, 349
New York Times, 31, 35, 132, 192, 234, 239, 244, 245, 246, 247, 260, 285, 286, 287, 290, 315, 337
NGO, Non-governmental organization, xxiv, 287
Nietzsche, Friedrich, 288
Nineteen Eighty-Four, 71
NOAA, National Oceanic and Atmospheric Administration, xvi, xix, xxiv, 76, 97, 98, 99, 171, 172, 197, 214, 338, 347
Nordhaus, William D., 80, 108, 327, 333
Northgrippian, xvi, 114, 115

O

Obama, Barack, 16, 18, 75, 77, 82, 129, 134, 226, 234, 240, 273, 276, 356
Ocasio-Cortez, Alexandria, *1*, 16, 19, *38*
Oklahoma, xvi, xxix, 98, 203, 271, 282

Ordovician event, 253
Orwell, George, xxxii, 71

P

Paris Climate Agreement, xxx, 5, 32, 38, 79, 81, 82, 96, 108, 111, 127, 128, 129, 130, 131, 132, 133, 134, 135, 223, 224, 226, 232, 234, 264, 283, 338
Parker, Geoffrey, 151, 153, 340
Permian Event, 253
Pew Research Center, xv, 23, 26, 27, 314
Phanerozoic, 119
Pielke Jr., Roger, 75, 76, 77, 326, 327
Planet of the Humans, 58, 59, 61, 62, 104, 322
Pleistocene, xvi, 84, 85, 86, 87, 89, 328
PNAS, xxiv, 73, 279, 326, 328, 338, 360
Point of no return, 31
Popper, Karl, xxxi, 125, 168, 276
Prisoner's dilemma, 79, 81, 82, 321, 327
Proctor, Richard N., 270, 271, 363
PSMSL, Permanent Service for Mean Sea Level, xxiv, 138, 139

Q

Quaternary, 115, 119, 335, 341

R

RER, Rare Earth Elements, xxiv, 8
Revelation, book of, 256, 257, 258, 326
Ridley, Matt, 53, 321, 328
Rio de Janeiro, xxv, 111
Romania, xxvi, xxvii, xxviii, xxix, 29, 64, 81, 100, 120, 225, 228, 230, 262, 271, 272, 289, 290, 327, 336
Romanian Academy, xxvii, xxviii, 336

S

Santa Barbara Basin, xvi, 85, 87
Sarkis, Stephanie Moulton, 283, 367
Schneider, Stephen, 36, 37, 316, 357
Science, 260, 328, 333, 339, 344, 348, 351, 352, 357, 360, 361, 365
Seidemann, David, *xxix*
Semmelweis, Ignaz Philipp, 275
Shakespeare, William, 151, 154, 260
Shaw, George Bernard, 270, 275
Shockley-Queisser, boundary problem, *5*
Siderian, period, 120
Simon, Julian, 53, 365
Simpson paradox, xvii, 93, 96, 168, 169, 171, 172, 330, 342
Smil, Vaclav, 117, 333, 334, 335, 360
Stephenson, F. R., xvii, 142, 143, 339

T

Tesla, 6, 11, 12, 13, 175, 178, 310, 311
The Limits to Growth, 51
The Population Bomb, 37, 51, 61
Thunberg, Greta, 5, 28, 38, 46, 66, 110, 121, 285, 334
tipping points, 31, 33, 113
Tolstoy, Leo, 104, 301
Triassic Event, 253
Trump, Donald, xv, 15, 26, 82, 83, 111, 134, 135, 162, 223, 234, 261, 283, 338, 354
Twain, Mark, 69, 200, 205

U

UN, The United Nations, xv, xxiv, xxv, xxvi, 28, 36, 91, 129, 212, 314, 322, 354, 362
UNEP, United Nations Environment Program, 36
United States, The, xv, xviii, xix, xxi, xxiv, 1, 6, 7, 12, 17, 18, 20, 23, 26, 27, 49, 50, 53, 58, 60, 72, 76, 77, 80, 82, 83, 97, 99, 100, 104, 105, 107, 111, 127, 128, 129, 130, 132, 133, 134, 135, 157, 172, 178, 182, 183, 185, 186, 200, 203, 216, 217, 219, 225, 230, 232, 234, 236, 238, 241, 261, 262, 263, 268, 271, 273, 275, 280, 281, 282, 283, 287, 299, 300, 315, 327, 339, 348, 350, 352, 353, 356, 364
USHCN, U.S. Historical Climatology Network, xxiv, 98

V

Vogt, William, 50, 51, 256
Voltaire (François-Marie Arouet), 66, 69, 249

W

Washington Post, 244, 245, 246
Wegener, Alfred, 275
WHO, World Health Organization, xxii, xxiv, 42, 43, 44, 217, 317
wildfires, xx, 220, 221
World Bank, 9, 111, 131, 287, 312, 320, 367
World Meteorological Organization, xviii, xxiv, 90, 196, 329

Y

Younger Dryas, 84, 85