

Climate Change and the Course of Global History

A Rough Journey

"Think of this as travel writing of the highest order. A rough journey for mankind becomes a stimulating armchair adventure for the reader. This is big history, framed by big ideas but anchored in the very recent explosion of knowledge about climate through the ages and about our history and prehistory. Brooke skillfully navigates the interpretive hazards of proxy paleoclimate data. In Brooke's persuasive account, our evolution to modernity is not absolutely determined by climate and disease, but it has been substantially influenced by them. Our new knowledge shows that quite often these influences abruptly change course, and Brooke shows that much of our history is a consequence of societies scrambling to adjust."

—Mark A. Cane, G. Unger Vetlesen Professor of Earth and Climate Sciences,
Lamont-Doherty Earth Observatory of Columbia University

"John L. Brooke skillfully joins a vast scientific literature to the historiography of virtually every major region to argue that climatic shifts always have been the primary agency determining the pace and direction of human development. He thus offers an unprecedentedly coordinated global chronology as well as a nuanced, distinctly original understanding of the relation between endogenous and exogenous forces. A jaw-dropping tour de force."

—Victor Lieberman, Raoul Wallenberg Distinguished University Professor of History,
University of Michigan

John L. Brooke presents the first global study by a historian to fully integrate the earth system approach of the new climate science with the material history of humanity, demonstrating how geological, environmental, and climatic history have shaped the pattern and trajectory of biological and human evolution. *Climate Change and the Course of Global History* provides a path-breaking model for historians of the environment, the world, and the human condition.

John L. Brooke is Humanities Distinguished Professor of History at Ohio State University, where he also directs the Center for Historical Research. His most recent book is *Columbia Rising: Civil Life on the Upper Hudson from the Revolution to the Age of Jackson* (2010), which won the Best Book Prize from the Society of the Historians of the Early American Republic.

Cover image: © handed / iStockphoto.com

Cover design by Joseph Piliero.

CAMBRIDGE
UNIVERSITY PRESS
www.cambridge.org

ISBN 978-0-521-69218-2



9 780521 692182 >

Contents

<i>List of Figures and Tables</i>	page xiii
<i>Acknowledgments</i>	xv
<i>List of Abbreviations</i>	xix
Introduction: Growth, Punctuation, and Human Well-Being	i
PART I EVOLUTION AND EARTH SYSTEMS	15
1 Geological Time: The Court Jester on the Platform of Life	25
<i>Tectonics, Asteroids, Plumes, Punctuation, Gaia: Revolutions in Earth Science</i>	26
<i>Evolution: From Neo-Darwinism to Complex Emergence</i>	29
<i>A Punctuated Earth Systems Synthesis</i>	36
<i>Origins: The Hadean and the Archean</i>	37
<i>The Archean/Paleo-Proterozoic Crisis</i>	38
<i>The Neoproterozoic Crisis and the Cambrian: A Snowball Earth?</i>	42
<i>Phanerozoic Super-Cycles – and Biotic Extinctions and Escalations</i>	44
<i>Mass Extinctions</i>	49
2 Human Emergence	55
<i>Into the Cenozoic Icehouse</i>	56
<i>The Court Jester in the Cenozoic: Debate and Three Kinds of Evidence</i>	58
<i>Miocene Apes and the Early Hominins</i>	62
<i>Orbital Cycles: From the 23K World to the 41K World</i>	66
<i>The 41K World and the Genus Homo</i>	70
<i>The 100K World: Homo Heidelbergensis, Archaic Homo Sapiens</i>	77
<i>Modern Humans in the 100K World</i>	83
<i>The Modern Origins Debate and a Renewed Understanding of Mortality</i>	97

	<i>Gould and Eldridge's Punctuation Meets Boserup's Intensification: Toward a New Understanding of the Upper Paleolithic</i>	104
	PART II DOMESTICATION, AGRICULTURE, AND THE RISE OF THE STATE	109
3	Agricultural Revolutions	121
	Energy	123
	<i>Changing Climates: The End of the Pleistocene</i>	130
	<i>New Climate Science, New Archaeological Science</i>	134
	<i>Human Adaptation at the Bølling-Allerød Warming: The Mesolithic</i>	136
	<i>The Younger Dryas and the Early Holocene: Cereal Domestication in the Northern Mid-Latitudes</i>	144
	<i>Early Holocene Warming and Tropical Domestications</i>	152
	<i>Into the Mid-Holocene: Final Domestications and First Dispersals</i>	154
4	The Mid-Holocene, the Late Neolithic, and the Urban-State Revolution	165
	<i>The Emergence of Modern Global Climates: The Mid-Holocene Transition</i>	166
	<i>The Mid-Holocene Crisis and the Rise of the State</i>	183
	<i>Neolithic Intensification: The Secondary Products Revolution</i>	191
	<i>China and Mesopotamia in the Neolithic–Bronze Age Transition</i>	194
5	Human Well-Being from the Paleolithic to the Rise of the State	213
	<i>Human Health in the Paleolithic</i>	213
	<i>The Neolithic Demographic Transition</i>	216
	<i>Civilizational Stresses in the Neolithic</i>	220
	<i>Fertility and Mortality in the Neolithic</i>	225
	<i>Fertility, Mortality, and the Origins of Complex Societies: The Case of Southwest Asia</i>	229
	PART III ANCIENT AND MEDIEVAL AGRARIAN SOCIETIES	243
6	Stasis and Growth in the Epoch of Agrarian Empires	261
	<i>Getting Ahead, Running in Place, Falling Behind</i>	261
	<i>Population Growth and Dark Ages</i>	269
	<i>Endogenous Degradations?</i>	272
	<i>Late Holocene Climate Reversals</i>	276
	<i>Disease and Epidemics</i>	279
	<i>Energy: Innovation, Labor, and Slavery</i>	281
	<i>Punctuations</i>	285

7	Optimum and Crisis in Early Civilizations, 3000–500 BC	288
	<i>The Old World Bronze Age: Expansions and Crises, 3000–1000 BC</i>	288
	<i>The Preclassical Crisis and the Age of Iron, 1200–300 BC</i>	300
	<i>A Global View on Optimum and Crisis</i>	306
	<i>Human Health in the Bronze Age Optimum and the Iron Age/Preclassical Crisis</i>	312
8	A Global Antiquity, 500 BC–AD 542	317
	<i>The Problem of Growth in Antiquity</i>	317
	<i>China, Iron, and Rotary Power</i>	318
	<i>Global Antiquity: Numbers and Climate</i>	322
	<i>The Rise of Rome</i>	328
	<i>The Fall of Rome?</i>	339
9	The Global Dark and Middle Ages, AD 542–1350	350
	<i>Climate Reversals in the Tropics and the North</i>	351
	<i>The Dark Ages, AD 400–900</i>	351
	<i>The Medieval Climate Anomaly, AD 900–1275</i>	358
	<i>Population and Health in the Old World Dark and Middle Ages</i>	360
	<i>Growth and Crisis in the Medieval World, 1000–1350</i>	362
	<i>Southern Asia</i>	363
	<i>North America</i>	364
	<i>China and Mongolia</i>	367
	<i>Into the Little Ice Age</i>	370
	<i>Europe</i>	372
	<i>The Little Ice Age and the Black Death</i>	380
	PART IV INTO THE MODERN CONDITION	393
10	Climate, Demography, Economy, and Polity in the Late Medieval–Early Modern World, 1350–1700	413
	<i>Population in and beyond the Third Age of Epidemics, 1300–1800</i>	414
	<i>The Question of Growth and Divergence</i>	417
	<i>The Aftermath of the Third Age of Epidemics</i>	423
	<i>Emerging European Empires, New World Depopulation</i>	429
	<i>The Little Ice Age, New World Depopulation, and the Origins of the African Slave Trade</i>	438
	<i>The Little Ice Age and Early Modern Eurasia</i>	444
	<i>Early Modern England in the Age of Empire, the Little Ice Age, and the Seventeenth-Century Crisis</i>	451
	<i>The Seventeenth-Century English Energy Revolution</i>	459
11	Global Transformations: Atlantic Origins, 1700–1870	467
	<i>The End of the Little Ice Age and the Beginning of Modern Population Growth, 1700–1860s</i>	468

	<i>The Beginnings of the Modern Anthropocene</i>	476
	<i>Industrial Revolutions</i>	479
	<i>The First Industrial Revolution</i>	483
	<i>Emissions and Atmosphere, 1800–1880</i>	495
12	<i>Launching Modern Growth: 1870 to 1945</i>	500
	<i>Urbanization, a New Political Economy, and the Second Industrial Revolution</i>	500
	<i>Atlantic Cities and the First Wave: Environmental Crisis and Social Reform</i>	502
	<i>The Second Industrial Revolution</i>	509
	<i>The Demographic Revolution, 1800–1945</i>	513
	<i>1914–1945: A World in Crisis, Growth on Hold</i>	518
	<i>Environmental Impacts, 1870–1945: The Second Wave</i>	524
13	<i>Growth beyond Limits: 1945 to Present</i>	529
	<i>The Demographic Revolution, Part II: 1945 to Present</i>	530
	<i>The Age of High Growth and a Third Industrial Revolution?</i>	
	<i>The World Economy, 1945 to Present</i>	534
	<i>Environmental Impacts, 1945 to Present: Confronting the Third Wave</i>	543
	<i>The Modern Anthropocene</i>	553
	<i>Coda: A Rough Journey into an Uncertain Future</i>	559
	<i>Malthus Vindicated?</i>	560
	<i>Deniers, Pessimists, and Pragmatists</i>	570
	<i>Data Bibliography: Full Citations for Data Used in Figures and Tables</i>	581
	<i>Index</i>	593