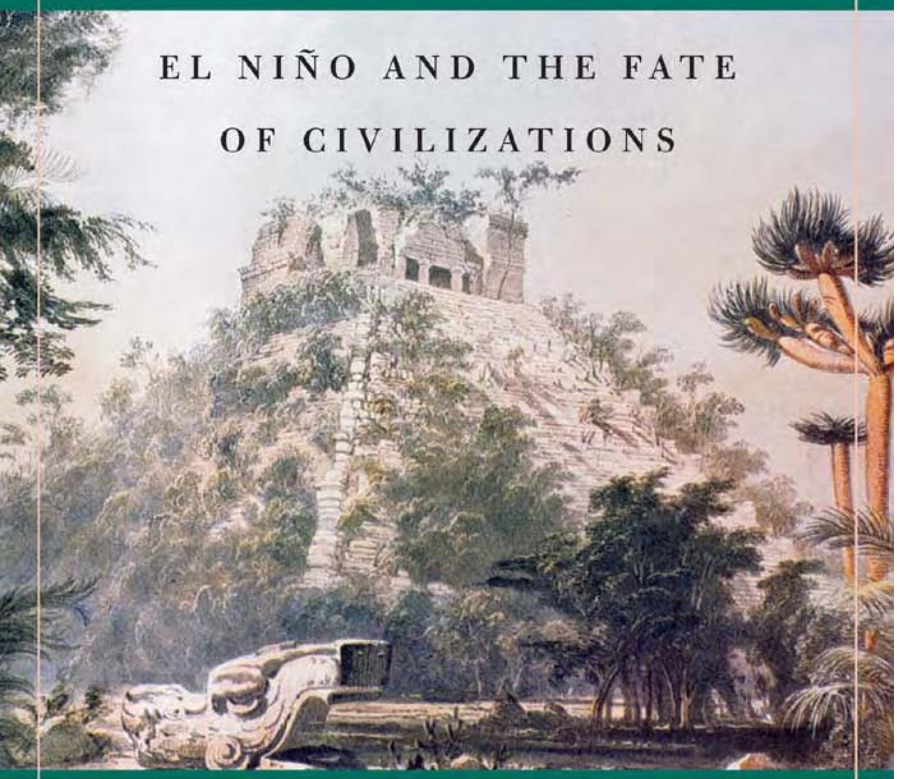
FLOODS, FAMINES, AND EMPERORS

EL NIÑO AND THE FATE OF CIVILIZATIONS



BRIAN FAGAN

TENTH ANNIVERSARY EDITION

Floods, Famines, and Emperors

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Floods, Famines, *and* Emperors

El Niño and the Fate of Civilizations

Revised Edition

Brian Fagan

A Member of the Perseus Books Group
New York

Published by Basic Books,
A Member of the Perseus Books Group

Library of Congress Cataloging-in-Publication Data

Fagan, Brian M.
Floods, famines, and emperors : El Niño and the fate of civilizations / Brian Fagan. — Rev. ed.
p. cm.
Includes bibliographical references and index.
ISBN 978-0-465-00530-7 (alk. paper)
1. El Niño Current. 2. Climatic changes—Social aspects—History. 3. Climate and civilization. 4. Human beings—Effect of climate on—History. I. Title.
GC296.8.E4F34 2008
363.34'92—dc22
2008035558

10 9 8 7 6 5 4 3 2 1

For Lesley

When I see you coming my heart beats

harder and I reach for your hand . . .

Or if you prefer: light blue touch paper—and stand clear

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Contents

PART THREE
CLIMATE CHANGE AND
THE STREAM OF TIME

Author's Note

All measurements in this book are given in metric units. Dates are given in years before the present or in years A.D./B.C., following the most commonly used convention. All radiocarbon dates after 6000 B.C. have been calibrated with tree-ring chronologies.

Nonsailors should note that wind directions are described, following common maritime convention, by the direction they are coming from. A westerly or west wind blows from the west, and northeast trade winds from the northeast. It is surprising how many people are unaware of this common usage! Ocean currents, however, are described by the direction they are flowing toward. Thus, a westerly wind and a westerly current flow in opposite directions.

Place-names are spelled according to the most common usages. Archaeological sites are spelled as they appear most commonly in the academic literature.

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Preface

The whole earth is the sepulcher of famous men; and their story is not graven only on stone over their native earth, but lives on far away, without visible symbol, woven into the stuff of other men's lives. For you now it remains to rival what they have done.

—Thucydides, "The Funeral Oration of Pericles"

The damage wrought in California in 1997–1998 was not as severe as the winter storms of 1995 and 1997, but it was bad enough. We learned about the impending great El Niño long before it arrived. Satellites and computer models showed us a rapidly swelling blob of warm water—always red, like a pustule—in the western Pacific moving eastward along the equator. We were mesmerized by this expanding lesion on the earth and bombarded with predictions of approaching doom. *Time, Newsweek,* and newspapers around the world ran features on coming droughts, floods, and severe storms. The World Wide Web buzzed with dire warnings; California politicians orchestrated carefully stage-managed conferences to discuss preparations for disaster relief. It was the year *El Niño* became a household word and a social phenomenon. "Blame it on El Niño" became a nightclub joke in California.

The apocalypse came late to the West Coast. Day after day we basked in crisp autumn sunshine, the Pacific like glass, winds calm, the temperature neither too hot nor too

cold. We began to laugh at the scientists' forecasts of record rainfall and record ocean temperatures. The fall rains came on time and were beautifully spaced. Thanksgiving and Christmas passed with clear skies and gentle breezes. Stories of hundred-year rains in Peru, of floods that swept away entire streets of the city of Trujillo, were received with smug detachment. El Niño, we told one another, had given us a miss.

Then the January and February rains arrived. Roiling southeasterly storms descended on the California coast. Hurricane-force gusts battered San Francisco Bay and closed the Golden Gate to commercial shipping. Just south of the city, the cliffs at Pacifica melted, sweeping houses to their doom. The Russian River rose so far above flood stage that parts of the small town of Guerneville were evacuated. Mud slides cascaded down on hillside cabins and homes at the hamlet of Rio Nido. Families lost everything in minutes.

Storm after storm blew onto the waterlogged coast. A ferocious downpour in the mountains behind Ventura in southern California sent a flash flood rushing down the river west of the city. Within minutes the floodwaters rose over the main link between Los Angeles and San Francisco, drowning cars and blocking Freeway 101 for eighteen hours. Hundreds of motorists spent the night in their cars waiting for the waters to recede. The same flood swept away the Southern Pacific railroad trestle immediately downstream. Ten days passed before coastal rail service resumed.

California had always paid a high price for unpredictable El Niños. Fourteen years earlier, when another strong El Niño also brought strong winds and intense rainfall (as did a weaker event in 1993), floodwaters and landslides caused nearly one billion dollars worth of damage between Orange County and San Diego. The saturated earth buckled side-

walks and broke concrete swimming pools like eggshells. Tornadoes and waterspouts twisted across the coast, and eight people died.

The 1998 El Niño, the greatest in living memory, brought record rains to the California coast: nearly 1,270 millimeters in Santa Barbara, almost three times its yearly average. But because federal, state, and local governments had spent millions clearing flood-control channels, stockpiling sandbags, and taking other precautions, the damage was less than anticipated. It was the first time the authorities had the benefit of accurate long-range weather forecasts that predicted the onslaught. Computer models and satellite images tracked the great El Niño from birth to death. Although thousands more of us lived in low-lying coastal zones, we escaped catastrophic damage because we were at least partially ready. Everyone with access to a TV set was well aware of the impending storms.

Elsewhere in the tropical world, the 1997–1998 event caused well over ten billion dollars in damage. Severe droughts hit Australia and Southeast Asia. Millions of hectares of rain forest went up in smoke in Indonesia and Mexico. More than 1.8 million people in northeastern Brazil received famine relief. As in every climatic disaster, the poor suffered most, especially those living in marginal environments and in countries without the resources to prepare for drought or flood or to pay for relief and reconstruction.

Ten years have passed since the last great El Niño, and no one knows when the next one will develop. But history tells us that it is certain to arrive, probably sooner rather than later.

Spanish colonists in Peru of four centuries ago were the first to write about El Niños. They called them *años de abundancia,*

years of plenty and heavy rainfall. Ocean water temperatures rose sharply. Exotic tropical fish appeared off the coast. Vegetation bloomed in the normally arid desert. All this bounty came about because a warm countercurrent, called El Niño, "the Christmas Child," occasionally flowed southward along the Pacific coast, bringing torrential rains and exotic sea life. El Niño still brings heavy rains to Peru, and tropical fish to the nearby sea, but people now dread its ravages. Population growth has turned small farming villages into mushrooming cities where slums and shantytowns crowd onto river floodplains. A strong El Niño now sweeps away bridges, houses, and roads and kills hundreds of people, leaving hunger in its wake. The coastal economy takes heavy losses as anchovy catches plummet and fresh guano production slows dramatically. All of us, and especially the poor, are vulnerable to the Christmas Child and other short-term climatic changes as never before.

An El Niño happens when a huge "plate" of warm water accumulates in the central Pacific and moves east, slackening or reversing the northeast trade winds and bringing warm, humid air to the west coast of South America. Normal weather patterns are reversed: the deserts west of the Andes can receive their entire average annual rainfall in a day, while the rain forests of Southeast Asia and Borneo turn as dry as tinder. For years scientists thought El Niño was just a local phenomenon limited to the Peruvian coast. But in the 1960s, UCLA scientist Jacob Bjerknes linked El Niño with atmospheric and wind circulations throughout the tropical Pacific. Bjerknes showed that El Niños were global events that triggered severe droughts, floods, and other climatic anomalies throughout the tropics.

Until recently, scientists studying ancient civilizations and those specializing in El Niño rarely spoke to one another. Now they work closely together, for they realize that this once-obscure Peruvian countercurrent is a small part of an enormous global climatic system that has affected humans in every corner of the world.

We have always known that climatic anomalies—droughts, floods, temperature extremes—could put civilizations under stress. We knew the Egyptians suffered from periodic droughts, the Moche of Peru from catastrophic rains, and the Ancestral Pueblo of the American Southwest from highly localized rainfall. Such vicissitudes were seen as purely local and random phenomena, which counted for little when explaining how civilizations rose or fell. If a drought or floods happened to coincide with the collapse of a dynasty or an entire civilization, this was thought to be more a matter of bad luck than anything else. Scholarly attention focused on general ecological factors and on complex social forces such as divine kingship, increasingly centralized government, and growing social inequality.

Since Bjerknes showed that El Niño was a consistently recurring phenomenon whose effects extended around the entire world, scientific perspectives have changed. We began to see that the climatic engine that produces El Niño interacts with other major climate-producing systems as part of a huge global weather machine. Each year increasingly sophisticated computer models reveal new secrets about the world weather system and about El Niño's links with other parts of this chaotic and ever changing climatic engine. We are ever closer to learning how different states of the global machine produce predictable weather conditions on local, regional,

and global scales. The study of the workings of El Niño is a microcosm of how scientists are painstakingly learning how to predict global weather.

Part One of this book describes how El Niño was first identified and the progress scientists have made in defining its role in the global weather machine. For the first time, we can infer, albeit crudely, the existence of climatic anomalies in one part of the world if we know of simultaneous (but not necessarily similar) anomalies half a world away. Thus, when a strong El Niño in the tropical Pacific produces heavy rainfall in coastal Peru, we can, with reasonable accuracy, predict a simultaneous drought in northeastern Brazil and very dry conditions in Southeast Asia.

This is a hugely important development for our understanding of world history. It means that for the first time, we have the scientific data and tools to discern, in something more than crude outline, the climatic history of human civilization. We now know that short-term climatic anomalies were not mere coincidences or aberrations. There is a strong correlation between unusual climatic shifts and exceptional historical events. For example, the fall of the Old Kingdom in ancient Egypt coincided with severe droughts that ravaged the Nile Valley in 2180 B.C.; those droughts, in turn, were triggered ultimately by interactions between the atmosphere and the ocean on the other side of the world.

Part Two of this book revolves around an increasingly important central question: How do climatic events affect the course of civilization? How do droughts, famines, and floods affect a people's faith in the institutions of their society and the legitimacy of their rulers? The newly revealed evidence of history suggests that such fluctuations present a severe—and

sometimes the ultimate—test. What determines whether a society passes that test, or fails?

There are only a limited number of ways societies can respond to accumulated climatic stress: movement or social collaboration; muddling their way from crisis to crisis; decisive, centralized leadership on the part of a few individuals; or developing innovations that increase the carrying capacity of the land. The alternative to all these options is collapse. The chapters in Part Two explore different variations and combinations of these four responses. For millennia, countless Stone Age peoples of remote prehistory relied on mobility and well-developed social networks for survival (Chapter 5), as the San foragers of southern Africa's Kalahari Desert do to this day. In other instances, decisive leadership paid off. The Egyptians of 2100 B.C. survived savage droughts and the collapse of central government because local leaders with close ties to the land fed their people, then remodeled divine kingship's ancient doctrines of royal infallibility to make the kings shepherds of the people in charge of an organized oasis (Chapter 6).

Other civilizations were less adaptable because their thinking was too rigid for their environments. Fifteen hundred years ago, Moche warrior-priests in the coastal river valleys of arid northern Peru poured hydrological and irrigation expertise into their field systems (Chapter 7). Their power came from both military power and a compelling religious ideology, which did factor in El Niño events. But their glittering civilization collapsed in the face of drought and then in the inevitable El Niño floods. Ideology and force were powerless against the relentless onslaught of the natural world. The Maya of lowland Central America developed a

brilliant civilization more than two thousand years ago, a patchwork of forest states that vied with one another for power and prestige (Chapter 8). Maya lords ruled over lowland rain forest with fragile soils and unpredictable rainfall. As population densities rose, the rigid-minded rulers escalated their demands on the commoners farming a devastated environment. Then an El Niño–driven drought cycle delivered a savage punch and knocked out a civilization already stressed to the limit.

The Egyptians, Moche, and Maya show us that the viable options are really just two: move away or innovate—improve the yield from the land or pack up and settle elsewhere. In Chapter 9, I describe the Ancestral Pueblo of the Southwest, who had no illusions about their arid environment. They developed a remarkable expertise at farming in dry environments and did not hesitate to disperse into more scattered settlements when drought cycles caused crop yields to plummet. Their descendants flourish in the Southwest today.

In Part Three, I show how the same relationships between carrying capacity, population, and the legitimacy of rulers and governments still operate today. Just like animals, all humans, whether a foraging group in the Arctic, a farming community in central Africa, or an industrial city in Brazil, live by the rules of a fundamental equation that balances population density with the carrying capacity of the land. Unlike animals, we human beings can get around the limitations of carrying capacity by increasing food supplies through technology, be it the ivory-tipped seal-hunting harpoon of a Stone Age hunter, the farmer's plow, or pest-resistant corn developed through genetic engineering. But however much we may bend this fundamental equation, we cannot escape it. Short-term climatic anomalies, whether of

a few centuries or a single year, test whether we are adhering to its realities. Many times we have not, as when millions died in nineteenth-century India's monsoon failures (Chapter 10). Sometimes human innovation has triumphed, as it did with the introduction of the humble potato to European agriculture in the seventeenth century. It has become fashionable in some circles to believe that human innovation will always triumph, and that population, with its inevitable needs for food, space, and waste disposal, may therefore expand indefinitely. If this were true, it would mean that humanity has entered a new and unprecedented era. However, archaeologists of the future may find this belief in infinitely bountiful technology as quaint and touching as a magical faith in divine kings.

Meanwhile, the equation of carrying capacity and population has assumed global proportions. The African Sahel (Chapter 11) offers a graphic portrait of what happens when a severe drought strikes semiarid lands crowded with too many people and cattle. The people of the Sahel cannot move, nor do they have the capital and technology to support four times their ancient population on the same arid grasslands. They are profoundly vulnerable to starvation and to minor climatic anomalies. Even if food exists nearby, political circumstances often prevent its distribution.

The great El Niños of 1982–1983 and 1997–1998 gave us a measure of the devastation that such events can wreak across the world (Chapter 12). The material destruction, by itself, does not pose great danger to humanity. But the archaeological record shows that in societies already strained by unwise management of the environment, an El Niño adds stress upon stress, sometimes to the breaking point. In such circumstances, hunger, destruction, and dislocation can

undermine the people's faith in the legitimacy of their leaders and in the foundations of their society. Overpopulation and its consequences, global warming, or rapid climate change alone will not destroy our civilization. But the combination of the three makes us vulnerable to the forces of climate as never before.

These words, written just under a decade ago, ring even more true today in a world where anthropogenic global warming is now accepted as scientific reality. El Niños have taken somewhat of a break since the epochal event of 1998–1999. Cool, La Niña–like conditions, the opposite polarity of El Niño, have prevailed for much of the time, which also bring droughts and other climatic hazards in their train. Our preoccupation with global warming has, perhaps, pushed thoughts of great El Niños to the backs of our minds, but we forget them at our peril. This is one of the reasons that a new chapter in this revised edition describes the terrible events that resulted from the major El Niño of 1877–1878. That event killed millions of tropical farmers in a world where subsistence-farming populations were far smaller than today and many fewer people lived on agriculturally marginal lands. We have much to learn from the mismanagement and shortsighted political conditions made in the very different late nineteenth century. But if there is one thing that El Niños teach us, it is that history provides us with insights into what may lie ahead.

Acknowledgments

This book originated in a spirited conversation about El Niño with a group of coffee-drinking friends, who had no idea what they were launching me into. I am grateful to Noah Ben Shea, Steve Cook, and Shelly Lowenkopf for helping me have the idea and for their constant, always helpful, and often irreverent comments on my literary endeavors. My greatest debt is to William Frucht of Basic Books, who encouraged me from the beginning and exercised superlative editorial skills on the manuscript against near-impossible deadlines. Lisa Cipolla helped with the research for many chapters and was a wonderful sounding board. Many other scholars gave advice, critiqued individual chapters, supplied references, tore apart my ideas, and took me seriously when I asked stupid questions. My thanks to Mark Aldenderfer, John Arachi, Jeffrey Dean, Carol Ellick, Michael Glantz, David Hodell, William Kaiser, Doug Kennett, Chap Kusimba, Richard Leventhal, Rod Macintosh, George Michaels, Jeffrey Quilter, Peter Rowley-Conwy, Dan Sandweiss, Vernon Scarborough, Chris Scarre, Stuart Smith, Chip Stanish, Gwinn Vivian, and John Zweiker. Jack Scott and Steve Brown drew the maps and plans with their usual sensitive skill. Susan Rabiner, agent extraordinaire, helped me formulate my idea and encouraged me at every stage. Last, thanks to Lesley and Anastasia, who endured not only El Niño but the writing and revision of a book about it. Small wonder Lesley sometimes calls my books doorstops!

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PART ONE

The Christmas Child

Olympus, where,
they say, the gods' eternal mansion stands unmoved,
never rocked by galewinds, never drenched by rains,
nor do the drifting snows assail it, no, the clear air
stretches away without a cloud, and a great radiance
plays across that world where the blithe gods
live all their days in bliss.

—Homer, *The Odyssey*