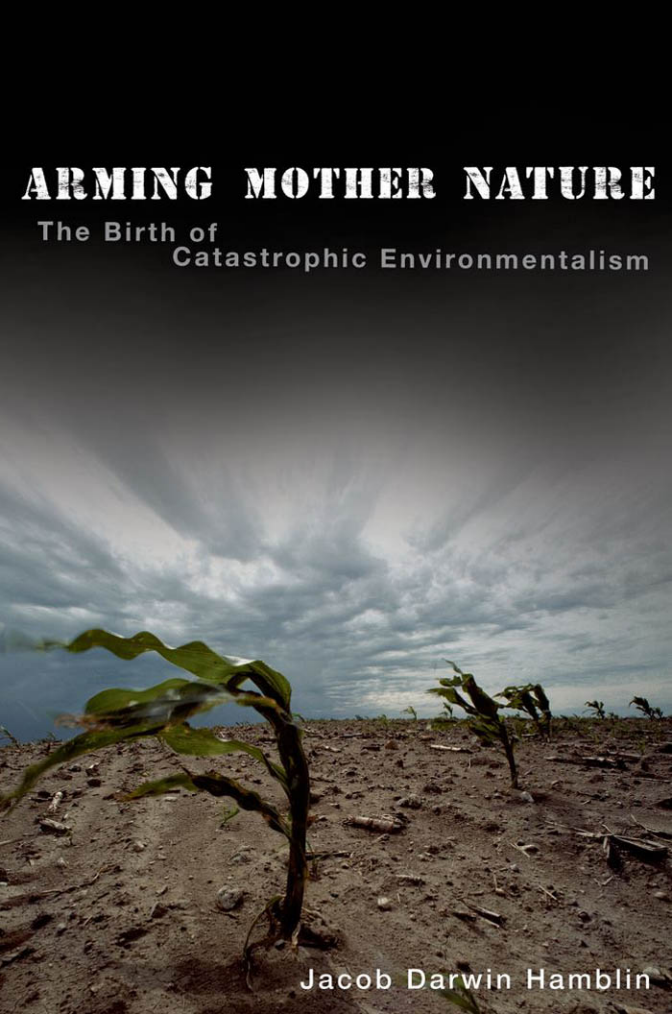
ARMING MOTHER NATURE

The Birth of Catastrophic Environmentalism



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JACOB DARWIN HAMBLIN

OXFORD
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Oxford New York
Auckland Cape Town Dar es Salaam Hong Kong Karachi
Kuala Lumpur Madrid Melbourne Mexico City Nairobi
New Delhi Shanghai Taipei Toronto

With offices in
Argentina Austria Brazil Chile Czech Republic France Greece
Guatemala Hungary Italy Japan Poland Portugal Singapore
South Korea Switzerland Thailand Turkey Ukraine Vietnam

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Published in the United States of America by
Oxford University Press
198 Madison Avenue, New York, NY 10016

Library of Congress Cataloging-in-Publication Data
Hamblin, Jacob Darwin.
Arming Mother Nature : the birth of catastrophic environmentalism /
Jacob Darwin Hamblin.
pages cm
Includes bibliographical references and index.
ISBN 978-0-19-974005-5 (acid-free paper)
1. Environmental policy—United States—History—20th century.
2. Environmentalism—Political aspects—United States—History—20th century.
3. Environmental sciences—Political aspects—United States—History—20th century.
4. Disasters—Environmental aspects—United States—History—20th century.
5. War—Environmental aspects—History—20th century.
6. Military planning—United States—History—20th century.
7. United States—Military policy.
8. Cold War—Environmental aspects—History—20th century.
9. Nature—Effect of human beings on—History—20th century.
10. Global environmental change—History—20th century. I. Title.
GE180.H35 2013
363.340973—dc23 2012045618

1 3 5 7 9 8 6 4 2

Printed in the United States of America
on acid-free paper

To Cathy and Paul Goldberg
for all they made

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Contents

Acknowledgments

I FIRST BEGAN thinking about this project while writing my book, *Oceanographers and the Cold War* (2005), which brought me into contact with numerous intriguing sources about the uses of the oceans and the air during the Cold War. I subsequently was drawn into the subject of environmental contamination while writing *Poison in the Well: Radioactive Waste in the Oceans at the Dawn of the Nuclear Age* (2008). As that book went into production, I decided to pursue the idea of "environmental warfare," and I promised a paper on that topic to John McNeill and Corinna Unger, who were organizing a conference at the German Historical Institute in Washington, DC, on the environmental history of the Cold War. I thought I would write primarily about weather control and atmospheric modification, but my sources drew me deeper into military thinking about fighting a third world war, and I ended up producing a chapter on early planning for biological and radiological warfare. By then I was hooked onto a subject that, over the past several years, has been exhilarating, enlightening, and often sobering.

I happened to walk by the Oxford table at the annual meeting for the Society for Historians of American Foreign Relations some years ago. There I met Susan Ferber for the first time, and we had a brief conversation about my idea for a book called "Arming Mother Nature." I'm thankful to Susan for following up, putting the book under contract, and serving as an extraordinarily responsive, diligent, and patient editor.

The research for this book was made possible through the generous financial support of several institutions and the continued cooperation of archivists and staff at libraries and archives in several countries. I acknowledge the assistance of the National Science Foundation, which offered a generous Scholars Award (project # 0738377). I thank Clemson University for its institutional support from 2006 to 2009, and Oregon State

University ever since then. I especially thank Jens Boel (UNESCO Archives), Anne-Marie Smith (NATO Archives), Giuliano Fregoli (FAO Archives), and numerous specialists at the World Health Organization, United Kingdom National Archives, and United States National Archives and Records Administration.

I would like to thank a number of scholars. I am especially grateful for the encouragement I have received over the years from fellow Gauchos Anita Guerrini, Andy Johns, Fred Logevall, Patrick McCray, Peter Neushul, Mike Osborne, Ken Osgood, Zuoyue Wang, and Ben Zulueta. In addition, I extend my thanks to specific people who helped in this work, either by reading portions of it, providing commentary, talking with me about it, or inspiring it in substantial ways. They include Keith Benson, Lisa Brady, Soraya Boudia, James Burns, Mark Carey, Erik Conway, Angela Creager, Soraya de Chadarevian, Sam Deese, Roger Eardley-Pryor, Ron Doel, Kurk Dorsey, Carmel Finley, Jim Fleming, Greg Good, Michael Gordin, Kristine Harper, Gabrielle Hecht, Toshihiro Higuchi, Joshua Howe, Jeff Hughes, David Kaiser, John Krige, Roy MacLeod, Pam Mack, Steve Marks, John McNeill, Erika Milam, Ben Mutschler, Naomi Oreskes, Jahnavi Phalkey, Ron Rainger, Linda Richards, Peder Roberts, Tom Robertson, Adam Rome, Helen Rozwadowski, Lisa Sarasohn, Richard Tucker, Simone Turchetti, Alex Wellerstein, and Audra Wolfe.

On a personal note, I thank my family, especially the women in my life: my wife, Sara, and my daughters, Sophia and Harper. I also thank my parents, Sharon and Les Hamblin, and my sister Sara, not only for their support but also for their perspectives: I would not think the way that I do had I not grown up as an Air Force "brat." I also am grateful to my in-laws, Cathy and Paul Goldberg, for their constant stream of positive energy.

Finally, I would like to acknowledge the enormous intellectual debt I owe to my late mentor Larry Badash (1934–2010), who first introduced me to the history of science when I was 19 years old, with his course on "The Atomic Age." Thanks, Larry.

Arming Mother Nature

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Introduction

Total War and Catastrophic Environmentalism

IN MAY 1960 the people of Chile faced the most profound human disaster in their history. A seismic event sent several earthquakes rippling along the length of western South America. The quakes shattered buildings, trapping families in their homes, killing and injuring thousands of people in the rubble. The largest convulsion was so intense—a stunning magnitude 9.5—that it threatened life many thousands of miles away. The shifting ocean floor lifted up a tremendous wall of water nearly 30 feet high that smashed against the Chilean coast, drowning villages and towns. The waves fanned away from the coast, moving at 450 miles per hour, sending 35-foot waves to strike Hilo, Hawaii, and 18-foot waves to the shores of Japan, killing dozens. Tsunamis crashed into the Philippines, Australia, the western coast of the United States, and many Pacific islands. By all accounts, it was the largest earthquake in recorded history.[1]

The grisly scenes made some commentators remark that Mother Nature had a way of putting matters into perspective. Despite scientists' conquest of deadly diseases and taming the power of the atom, humans were extraordinarily vulnerable to the slightest whims of nature. It was time to lay aside petty disagreements and show one's humanity in the face of catastrophe, a lesson some took to heart. Strikers went back to work and donated their wages to relief efforts, and blood plasma was flown in from Argentina. After many residents of the coastal city of Concepcion fled to the woods to escape their crumbling homes, the army mobilized to put families in tents; the navy brought in medicine, food, and clothes; and American planes from the Panama Canal delivered supplies.[2]

In Paris, then the headquarters of the North Atlantic Treaty Organization (NATO), scientists and military officers drew a different lesson from the disaster. They saw the Chilean earthquake as a shining example of what

Americans might soon implement against the Soviet Union. If scientists could identify areas of strain and instability in the earth's crust, a well-placed hydrogen bomb might unleash just the kind of power that had wrought so much destruction in the Pacific. "Environmental warfare" NATO called it. It was a newly conceived class of weapons that utilized human knowledge of the natural environment to fight a global war, and to make America and its allies less vulnerable to catastrophic change.

Arming nature, by harnessing its physical forces and exploiting its biological pathways, fit with the methods American scientists and military leaders expected to use to fight a war against the Soviet Union. Aside from earthquakes, scientists in the decades after World War II worked on radiological contamination, biological weapons, weather control, and several other projects that united scientific knowledge of the natural environment with the strategic goal of killing large numbers of people. Vannevar Bush, the American engineer who dominated government scientific research in the 1940s, once wrote that humans avoided such extremes, not wanting to poison or spread diseases among humans, livestock, or crops. Even Adolf Hitler had refrained from it, Bush said in his 1949 book *Modern Arms and Free Men*. Whatever the reason, he wrote, "somewhere deep in the race there is an ancient motivation that makes men draw back when a means of warfare of this sort is proposed." Bush was thinking of biological and radiological warfare, both of which promised to harm one's enemies indirectly through contaminated land, water, or entire ecosystems. He was intimately familiar with the latest developments on them, having served as chairman of the National Military Establishment's Research and Development Board, which liaised with the Joint Chiefs of Staff (JCS) on military matters related to science and technology. Publicly, he suggested that military men did not take such weapons seriously, that little money was spent on them, and that scientists shied away from research on them.

Subsequent history showed how wrong Vannevar Bush was. As his book went to press, the US government was in the process of stepping up, not scaling back, research and production of weapons designed to harm civilians through disease, starvation, and physical destruction. In the public sphere, revulsion toward these weapons, and any kind of modification of the environment for purposes of war, has been reinforced by international conventions—including the Geneva Protocol of 1925 (finally ratified by the United States in 1975), the Biological and Toxin Weapons Convention of 1972, and the Environmental Modification Convention of 1977. But the United States and its allies pursued scientific research on biological and

radiological warfare vigorously after World War II. Other studies to harness the forces of nature in war—for example, to change the course of ocean currents, to manipulate the weather, and to melt polar ice caps—also found a receptive audience among powerful patrons throughout the Cold War. When catastrophes struck innocent people—as in the case of Chile in 1960—scientists and their military partners perceived such events as the future face of war.

As American General Curtis LeMay sent bombers over Japan in the closing months of World War II, he and his statisticians calculated that they had killed between 50 percent and 90 percent of the people in nearly 70 cities prior to dropping atomic bombs. He later confided to a colleague that had the United States lost the war, he would have been tried as a war criminal.[3] His goal had not been to win battles but to kill as many people on the ground as possible. The widespread death of humans, armed or otherwise, became an end in itself. Likewise, in the earliest days of the Cold War, scientists refined their expertise at maximizing human death by arming Mother Nature. They conducted intensive investigations of nature's centuries-old diseases to find out how to create epidemics in humans, animals, and crops. They found military uses for radioactive waste as weapons of large-scale contamination. They also began to experiment with weather control. If war were to break out against the Soviet Union, they knew it would be another world war. That meant another total war, making civilians, factories, and fields legitimate targets.

American strategic planners, particularly the Joint Chiefs of Staff, conceived of a war with the Soviet Union as one that would require mobilizing all industrial and human strength. Imagining future weapons systems, Admiral William Leahy pointed out candidly that civilians would be drawn into a third world war even more than they had been in the second. He and other officers recognized that industrial capacity and human life could not be separated, and they expected to target human population centers.[4] Yet the small number of deliverable atomic bombs (and the lack of them in the Soviet Union) indicated that a war in the near future would be a prolonged conflict in which atomic bombs might not be decisive. This invited research opportunities in other fields targeting entire ecosystems.

Scientific research became a tool to extend "total war" thinking to the natural environment. Top scientists began to imagine contamination on a city and regional scale as an important line of research. For example, scientists at the University of California, Berkeley, knew from wartime work on human patients that internally absorbed radioisotopes could cause severe

health damage without being detected easily. They also discovered that plants readily absorbed radioactivity and that radioactive soil was nearly impossible to decontaminate. Radioactive debris, they concluded, could turn a nation's staple crops into fields of poisonous weeds or poison the water supplies of whole cities. At the height of the Korean War, Congressman Al Gore Sr. even recommended dumping radioactive waste all along the border separating North and South Korea. Given the abundance of this troubling radioactive waste available at American nuclear production facilities, he and others reasoned, why not adapt these plants to situations in which contamination was a desired outcome?

Vannevar Bush had been uncomfortable with weapons whose sole purpose was to cause widespread death, yet the United States and United Kingdom pursued many lines of research on exploiting environmental vulnerabilities for this very aim, as did the Soviet Union and its allies. Scientists helped their governments to push the frontiers of human mastery over nature's processes, and by the 1950s they began seriously to contemplate the control of large-scale geophysical forces. Mathematician John von Neumann wrote in 1955 that scientists and the military were taking global climate control quite seriously, attempting to manage solar radiation. Even as he encouraged the US government in this direction, he marveled at it. Could humans survive their own technology, he wondered, as scientists in one country gained the knowledge to alter the climates of others?[5] The intractable diplomatic problems presented by weapons of environmental modification convinced countries of the two Cold War blocs to ban them in the late 1970s, but scientific research on these weapons continued. Even as diplomats negotiated limits on specific weapons, the expectation of a total war never disappeared.

The Cold War has been over for more than two decades, and formerly classified materials document the kind of future that scientists and military planners expected—a future of global war, of planetary contamination, and of epic struggles to survive in a post-apocalypse world. These documents highlight scientists' and policy makers' learning processes about man's place in nature, his startling ability to make drastic and harmful alterations to the globe, and his inability to control them. In the early 1960s, for example, NATO convened a scientific committee, chaired by famous aeronautics expert Theodore von Kármán, to identify the next decade's most probable military developments. One of the committee's conclusions was that man's ability to harness the forces of nature would soon reach a point at which he could interfere drastically with the environment of the

enemy. Defense establishments in Europe scrambled to confront a future of environmental warfare by consulting leading oceanographers, meteorologists, and ecologists. Some ideas were spectacular in scope: detonations of nuclear weapons to clear the polar ice caps for easy naval passage, to raise the mean sea level and drown coastal cities, or to create artificial tsunamis. Others were no less extreme: setting fire to huge expanses of vegetation, changing local climates, or using biological agents to target vital links in ecological chains in the enemy's homeland. The goal would be the same as it had been in the strategic bombing deployed during World War II—to maximize the number of humans killed.

Although the Cold War era is sometimes characterized as the "nuclear age," all weapons of widespread human death assumed legitimacy in the immediate postwar years. Atomic bombs, made from the fission of uranium or plutonium, soon gave way to thermonuclear bombs, made from the fusion of hydrogen atoms. In the late 1940s, when confronted with the question of whether to build hydrogen bombs, President Truman's scientific advisors—including celebrated atomic scientists J. Robert Oppenheimer and Enrico Fermi—argued that there were no conceivable military targets that could justify a hydrogen bomb. A hydrogen bomb could be the size of a thousand Hiroshimas. To develop hydrogen bombs would be a decision to make a weapon of genocide, they told Truman. Nonetheless the United States, the Soviet Union, and other countries proceeded to develop them.[6] These weapons of genocide stood at the foundation of American and Soviet geopolitical strategy until the collapse of the USSR in 1991.

Nuclear weapons have so dominated strategic thought that it is easy to forget how scientists tried to exploit the pathways and forces of nature in other ways. US Secretary of State John Foster Dulles complained in 1953 about the growing difficulty with nuclear weapons: "Somehow or other we must manage to remove the taboo from the use of these weapons."[7] Likewise, when in 1951 China and North Korea began to accuse the United States of waging biological warfare in Korea, Secretary of Defense Robert Lovett exhorted subordinates to resist using the term "weapon of mass destruction" to describe America's biological weapons arsenal. Doing so made it difficult to explain why they existed in the arsenal at all. In truth, these were all weapons of total war. Scientific research in the service of total warfare asked such questions as what did the enemy eat, where were his water sources, what epidemic diseases had his population already been exposed to? In the late 1940s, that was the kind of war that American

military planners anticipated fighting soon. That expectation lasted for nearly five decades.

ENVIRONMENTAL APOCALYPSE. The planet in peril. Earth in the balance. These familiar phrases about human impacts on the global environment have been popularized in books, television shows, and newspapers. Given recent discussions of climate change, it is easy to assume that scientists' discovery of global warming led them to believe humans were running headlong toward environmental Armageddon. In fact, the catastrophic mode of discussing climate change is a reflection of other environmental crises that date back many decades, among them acid rain, ozone depletion, pesticides, radioactive waste, and nuclear fallout. The common denominator for all these issues was catastrophe on a vast scale.

This catastrophic brand of environmental thinking is typically attributed to two powerful causes. One is the rise of environmental consciousness, as economic development and population growth made countries seem smaller and nature more vulnerable to man's influence, and the other is the rise of environmental science. Efforts to preserve wilderness, to conserve natural resources, to combat pollution, and to mitigate the effects of environmental degradation date back at least to the nineteenth century. After World War II, "the environment" became a global issue, as countries around the world debated the ecological effects of pesticides, the impacts of oil spills or toxic waste in the oceans, and the consequences of emissions on the atmosphere. The United Nations created a special Environment Programme and sponsored "earth summits" in order to call attention to the transnational nature of the issue. Along with that global consciousness came fears of global catastrophe and the pressing need to act together.[8]

The language of the Cold War's global crisis and that of environmental crisis are strikingly similar. That has left room for alternative views about the causes of environmental thought, challenging the prevailing view that postwar affluence, dissatisfaction with pollution, and a new understanding of environmental hazards were the most important factors.[9] For example, sociologist Joseph Masco has argued that the global reach of the nuclear crisis enabled new visions of planetary threats, allowing global warming to take on, in public discourse, the dire characteristics of nuclear war. Long ago ecologist turned environmental activist Barry Commoner said that he dated his "environmental" thinking to the first hydrogen bomb tests. Others have probed further the ways that nuclear issues shaped notions of

ecological relationships and environmental risks.[10] Nuclear weapons were only the most far-reaching and destructive product of an approach to warfare that was total in scope, and of an ongoing scientific project to understand humans' vulnerabilities and the earth's susceptibility to manipulation.

The other known cause of catastrophic environmental thought is the growth of modern science after World War II, particularly the massive expansion of the environmental sciences. Oceanography, meteorology, and ecology were among the many disciplines that underwent unprecedented growth in the postwar decades. Many governments increased their budget allocations to subsidize scientific research, with the United States leading the way. Not only were there more scientists doing research, there was also more international coordination, more data collection around the world, and with the advent of digital computing, more powerful tools for crunching data. International groups of experts could draw from the expertise of many nations. With considerable confidence, they could make broad claims about the earth's vulnerability and man's role in it.[11]

Scientific growth after World War II owes its greatest debt to the US armed services, which paid the lion's share of the bill. Indeed, the discovery of global warming would have been impossible without scientific projects funded by the American military.[12] The same can be said of countless subfields of science and technology. But Cold War–funded science is only one part of the story. Especially in the environmental sciences, the Army, Navy, and Air Force routinely asked scientists to help them define their missions and to build the world's most technologically savvy organizations.[13] These armed services explored all possible uses for, manipulations of, and effects upon the global environment. They routinely thought about total war and human fragility and tried to integrate these issues into national security.

Explanations for catastrophic environmental thought typically overlook the historical actors who tried to bring such catastrophes about and who, in planning for a total war, attempted to understand how vulnerable humans were to hostile manipulations of the natural world. This book squarely focuses upon them, on the collaborative activities of scientists and military partners, and on the roots of today's concerns about environmental catastrophe in the geopolitics of the Cold War. It explores the development of weapons of massive death, the contamination of large areas of land, the poisoning of crops, the harnessing of geotectonic forces, the steering of storms, and, most important of all, the vulnerability of man to large-scale environmental changes of his own making.

These perspectives on the natural environment, especially those that are global in scope and predict dire consequences for humans, have firm roots in the plans for a war that never happened: World War III. Military questions and the environmental questions were often identical and pursued by the same people. Boundaries were hazy: as scientists, military leaders, and diplomats tried to figure out how realistic environmental weapons were, in what context they could be used, and how politically acceptable they might be, they also fundamentally shaped conversations about peacetime changes to the environment. For example, in the United Kingdom, the same Oxford botanists who published on ecology were consulting on agricultural defense at home, as well as advising British military commanders in Malaya how to protect rubber trees and kill enemy crops. In the United States, the National Academy of Sciences anticipated environmentalists' arguments when it warned the Air Force that Americans' reliance on technology had made them more susceptible to disease and starvation, vulnerabilities easily exploited by the Soviet Union. NATO advisors such as Edward Teller and William Nierenberg, who in the 1960s tried and failed to find easy ways to harness vast geophysical forces, became leading skeptics of environmental predictions. The same computer modeler who helped develop defense systems for the entire northern hemisphere in the 1950s, Jay Forrester, was one of the first to publish quantitative predictions of environmental doomsday in the early 1970s. Several of the biologists, oceanographers, and atmospheric scientists who advised governments on the 1977 treaty to ban military uses of environmental modification—the ENMOD convention—were enlisted to craft the first major reports on anthropogenic climate change. The two worldviews went hand in hand, both attempting projections of catastrophic environmental consequences on a massive scale.

Arming Mother Nature consists of three main sections that are both thematic and loosely chronological. These divisions are partly a reflection of the changing subject emphases of scientists working with military partners, as they moved away from biological and ecological questions and focused increasingly on the opportunities and threats raised by hydrogen bombs, and then as they began explicitly to confront the politically charged questions about large-scale alterations to the natural world. They also reflect a gradual change in emphasis, from military questions of maximizing human death toward environmental questions about human-caused cataclysm. Throughout the book, strategic issues predominate, from the 1940s decision to pursue biological weapons to the 1980s Central

Intelligence Agency (CIA) analyses of the effects of climate change on Soviet crop yields. The first part, "Pathways of Nature," discusses the unpredictable migrations of organisms, research on biological and radiological warfare, the threat of epidemic disease, and political clashes between the United States and the Soviet Union—including accusations of clandestine use of biological weapons in Korea, Czechoslovakia, and East Germany. The next part, "Forces of Nature," treats the thermonuclear era beginning in the 1950s, when it became clear that nuclear warfare with hydrogen bombs would dominate any conflict between the superpowers. It shows the government efforts to envision post-apocalypse survival, to understand the effects of fallout, and to channel geophysical forces such as oceans and winds to develop weapons on a vast scale. Finally, "Gatekeepers of Nature" tells the story of diplomats' efforts to ban weapons of environmental modification in the 1970s, ties the science of the environmental movement to this military research, and reveals how deeply these ideas informed environmental thought and protection efforts at the international level. This section also reveals how deeply the Cold War conflict shaped responses to the environmental challenges of the 1980s—from the droughts in Africa to the global acquired immune deficiency syndrome (AIDS) epidemic and the science of climate change.

In attempting to narrate the interplay of science in the Cold War and the history of environmental thought, this book makes three arguments. One is that the collaboration between scientists and the armed services created a scientific worldview obsessed with environmental change, manipulation, and vulnerability. Scientists extended "total war" thinking to the natural world, believing that human population centers would be the most important targets in the coming war, and the entire earth would be the battleground. In part this meant research on what NATO called environmental warfare. It also meant geophysical studies of the earth, which would provide the information necessary to allow bombers to fly over the poles to deliver nuclear bombs to their targets, to measure the shape and gravity of the earth to enable guidance of intercontinental ballistic missiles, and to detect radioactivity from enemy nuclear tests. In addition, it encouraged ecological studies of how vulnerable Americans and their allies were to scorched landscapes, destroyed crops, contaminated fish and livestock, and epidemic diseases. These were not merely scientific projects that pushed the frontiers of their disciplines; rather, they asked questions about vulnerability and manipulability on a vast scale.

The second contention is that such scientific research, much of it secret but some quite open, encouraged the belief that large-scale human-induced changes already were within the power of American and Soviet scientists. Accusations of natural manipulations flew both ways across the Iron Curtain many times in the postwar decades. The United States stood accused of waging biological warfare in Korea and of spreading potato bugs in Eastern Europe to cripple its economy. Both the British and Americans actually did engage in crop destruction in Southeast Asia, and the Americans tampered with the weather in Vietnam. The Soviet Union denounced the United States for having concocted the AIDS epidemic in its biological weapons laboratories, and Americans suspected that some outbreaks of disease in the Soviet Union were really experiments gone awry. Nuclear weapons tests often had unexpected effects, as when Japanese fishermen were blanketed with radioactive debris in 1954 or some of Hawaii's electrical grid was inadvertently shut down by an electromagnetic pulse in 1962. Scientists reported that, with the aid of nuclear detonations, they had created artificial radiation belts surrounding the earth. These experts working with the armed forces seemed quite willing to tamper with the earth, the oceans, and the atmosphere. "We know how we can modify the ionosophere," nuclear physicist Edward Teller once proudly stated. "We have already done it."[14]

The third argument is that Cold War geopolitics fundamentally shaped how scientists, economists, military leaders, and politicians responded to the scientific evidence of large-scale harm from human actions. Perhaps one of the surprises of this book is not how little was known about environmental change, but rather how much. During most of the Cold War, change was not as much denied as it was justified. Large-scale environmental change could be justified in national security terms, as in the case of worldwide nuclear fallout from nuclear tests. It could be justified in strategic terms, as when Herman Kahn insisted that global contamination from a full-scale thermonuclear war was survivable. It could be justified in economic terms, as when free-market economists preferred mass migrations to socialist-sounding suggestions to curb economic growth. It could be justified in military terms, as in the case of chemical spraying in Malaya and Vietnam. It could be justified in terms of Soviet intransigence, as in the case of carbon emissions. And it could even be justified in scientific terms, as when American scientists argued that humans could not hope to compete with the forces of nature, making even large-scale changes seem ephemeral in the grand sweep of natural history. In these and many other

ways, American and allied responses to environmental issues depended on their perceptions of the global contest with the Soviet bloc.

The philosopher Alfred North Whitehead once said that the progress of civilization has not been a uniform drift toward better things. His cynicism may have stemmed from watching respected colleagues turn their knowledge of nature into the lethal poisons used in the trenches of World War I. During the Cold War scientists gained an extraordinary amount of knowledge about the global environment, the earth's dynamics, its natural resources, and the biological web of life. This was knowledge of human vulnerability on a global scale, serious research motivated by military concerns. When scientists learned about the environment during the Cold War, they were asking questions, drawing conclusions, and learning about change and vulnerability. This book is a step toward understanding how fully the experience of the Cold War transformed thinking about humanity, the vulnerabilities of the earth, and the poisoned fruits of human labor—bestowing the idea that, as President Richard Nixon once claimed, man holds in his hands too many of the seeds of his own destruction.

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PART ONE

Pathways of Nature

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I

The Natural Vulnerability of Civilizations

It is the mass conscience of mankind—the dominance of the moral or the amoral—which determines whether research is to be used for life or death.

—US Surgeon General THOMAS PARRAN, 1946

This is not a prediction of horrors to come. These weapons exist.

—US Navy Rear Admiral ELLIS M. ZACHARIAS, 1947

IN JULY 1945, dozens of distinguished American and European professors gathered to condemn German scientists for their part in the heinous crimes perpetrated by the Nazis against civilians. Scientists, they proclaimed, had "contributed, actively or passively, to the prostitution of science for the purposes of total warfare."[1] A month later, a mere two atomic bombs, built by American and European scientists, laid waste Hiroshima and Nagasaki, killing or wounding a quarter of a million Japanese people. When World War II ended, no amount of sanctimonious condemnations could hide the reality that total war had come, and civilians had become acceptable targets. Scientists on all sides of the conflict had become experts at maximizing human death.

This extraordinary moral shift toward civilian death altered not only strategic thought but also the role of scientists after the war. No longer were they charged merely with developing war-winning weapons. They also thought earnestly about ways to use natural scourges to fight in the next war. They began to ask how people lived—what sustained them, what protected them, and how the natural world could be used against them. Some scientists joined new international agencies to find ways to make humans more secure and to prevent future war. Others began to plan for

the conflict to come, joining national research establishments designed to exploit human susceptibility to hunger and disease.

How vulnerable were the peoples of the world in the first full month of peace, September of 1945? Japan had surrendered to the Americans in August, and the Nazi hold over Europe had collapsed the previous May. Already the alliance against Hitler showed signs of splintering, with the future of democracy in Eastern Europe uncertain and a growing pall of gloom about a world with atomic bombs. In Asia, the fighting was not really over. The Chinese Civil War, stalled by years of Japanese imperialism and the Soviet occupation of Manchuria, would resume in less than a year's time. Yet the Cold War between the United States and the Soviet Union had not truly begun. For a brief moment in history, peace had come.

The sheer scale of death in the Second World War is difficult to contemplate. More than 60 million people died. A small fraction of these—less than half a million people—were Americans. About 25 million were Soviets—some 14 percent of the Soviet Union's prewar population. In China, between 10 and 20 million people were killed, a huge range that suggests how little is known about what happened in Asia under Japanese rule. Estimates of Germans killed range between 4 and 8 million, and of Poles slightly less than 6 million. The rest were citizens of scores of countries around the world. The Nazi regime massacred nearly 6 million people in the Holocaust. Roughly two-thirds of the war's casualties were civilians, not soldiers. Some resulted from acts of genocide, slaughter, and the indiscriminate bombing of cities. Others were consequences of malnourishment, starvation, and disease, the byproducts of all wars.[2]

For governments at war's end, one immediate task was to prevent further human disasters. The war itself had entailed the wide-ranging movements of people—as refugees, as migrants, and as soldiers. The coming of peace brought more of the same, threatening to spread disease even further. During the war, syphilis had debilitated entire armies—a problem solved by the Allies when the Americans began to mass produce penicillin. In China, military commanders had come to expect the cycles of epidemic disease that inevitably broke out among troops, but after the war, these problems did not dissipate. The soldiers returning home took their diseases with them. Occupying forces continued to impose their will on local people, particularly women. The problem of rape in the Soviet zone of Germany was an especially severe one, but given the level of pain and ruin that Germany had inflicted on the Soviet people, officials were reluctant to clamp down on the soldiers except for public health reasons.[3]

Public health officials were well aware of the disruptive effects of the movement of people, plants, and animals. At the onset of war in Europe in September 1939, the British government had enacted a major evacuation of London in order to limit casualties from German bombers. In the autumn of 1939 nearly 1.3 million inhabitants relocated, making it the largest migration in England since the city's Great Fire of 1665. Those who did not leave had to pack themselves in bomb shelters during air raids. Public health authorities in England and elsewhere justifiably feared new outbreaks of the world's scourges: plague, cholera, typhus, smallpox, tuberculosis, dysentery.[4] In some parts of the world, where public health services already had been weak, the war left millions to die of disease. Just one month after the Japanese surrender, *The Times* of London reported staggering figures for death by communicable disease in India. On average during the war, cholera took some 145,000 lives per year, smallpox killed 70,000, and tuberculosis claimed half a million. Another 3.6 million died each year from some form of "fever." The country had one doctor for every 10,000 people.[5] Even in places with good medical care, pathogens rather than bombs often were the real killers.

The prospect of peace was no more heartening. Once the peoples of the world would be able to travel safely again, they would spread diseases over even larger areas. Public health officials braced for impact. A former medical director in the League of Nations, Frank G. Boudreau, warned in 1945 that epidemic disease would be the most acute problem in Europe and Asia immediately after the war. "The stage has been set," he proclaimed, "for epidemics of typhus fever, dysentery, and cholera." He urged national health services to enact strong control measures and, most important, to work together across national lines. The peoples of the world had never been more vulnerable to wide-ranging, uncontrollable plagues.[6]

The war's victors tried to stem the tide of disease. In 1946 a returning officer of the Royal Army Medical Corps unwittingly initiated a smallpox outbreak in Essex, precipitating a string of quarantine policies by local authorities throughout England.[7] Across their occupation zones American and British forces de-loused people with the synthetic pesticide DDT to control outbreaks of typhus. The Soviets saw louse-borne typhus outbreaks in Slovakia, Hungary, Romania, Poland, and parts of Russia. Around the Mediterranean, spraying marshlands with DDT was the only effective way to halt malaria. There were plentiful cases of typhus, diphtheria, and typhoid fever throughout Europe—in Germany, cases of typhoid fever rose to 30 times their normal levels. Exacerbated by the

problem of rape in the occupied zone, the cases of syphilis rose between three- and ninefold in most of Europe—20-fold in Germany. "Progress made in twenty years of venereal disease control has been virtually wiped out by war years in Europe," one United Nations report lamented.[8]

The persistence of regional conflict after the war only intensified human vulnerability to disease. In China, the withdrawal of Japanese and Soviet forces by 1946 opened the path for renewed fighting between the Nationalists under Chiang Kai-Shek and the communists under Mao Zedong. Mao's promises of land reform helped to mobilize millions of peasants against Chiang, but that meant millions of people gathering together to march long distances without much medical care—falling ill, dying, and spreading pathogens. In India, Hindus and Muslims fought intermittently in the Punjab region after Britain's creation of Pakistan in 1947 and soon entered full-scale war over Kashmir. Refugee camps began to fill up, and the cases of cholera infection began to mount.[9]

Such diseases were the most significant ones to attack in human populations at mid-century. Even without humans fighting each other, harmful pathogens followed nature's pathways through water supplies, food chains, air, and the human touch. The threat was global in scope, and public health officials readily called to mind the fact that the greatest epidemic in history—the Spanish Influenza of 1918–1920—had occurred toward the end of the First World War. By war's end, the flu had become a global pandemic. All forms of crisis, such as famine or war, increased the odds of spreading infectious disease. Epidemics were effective killers within armies, aboard ship, and in cities, towns, and villages. That is why in 1946 public health scientists and officials of several governments banded together and signed what US Surgeon General Thomas Parran called "a Magna Carta for Health," outlining the goals of the future World Health Organization. It would disseminate drugs to combat disease, find ways to keep water supplies free from contamination, and, above all, promote cooperation between nations. Peace and security would be impossible, Parran and others argued, without health and well-being for all people. They would target the "ancient human plagues," such as malaria, cholera, tuberculosis, and syphilis.

Essential to the spirit of all the United Nations' (UN's) specialized agencies at their founding was a plea for an end to war. The first agencies explicitly addressed the causes of war: disease, starvation, and morality. These required agencies focusing not only on health but also on food (the Food and Agriculture Organization). Morality was trickier to pinpoint, but the UN started by