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National Security and Climate Change in Perspective

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In early 2007 the group responsible for setting the "Doomsday Clock," a depiction of the risks of imminent worldwide catastrophe, cited the threat of climate change as one reason for moving its minute hand two minutes closer to midnight.[1] Although the nuclear-era clock is perhaps an imperfect depiction of the nature of the challenge posed by climate change—the cumulative impact of human activities that affect the environment versus the kind of events that lead to a sudden conflict—climate change can provide profound and urgent threats to the well-being of mankind. Yet the risk that such catastrophe may lie at this intersection of climate change and national security is not as well understood as it should be, despite decades of exploration of the relationship between the two fields. The overall purpose of this book is to fill this gap: to provide a primer on how climate change can serve to undermine the security of the planet.

For most of 2006 and 2007, a diverse group of experts, under the direction and leadership of the Center for a New American Security (CNAS) and the Center for Strategic and International Studies (CSIS), met regularly to start a new and important conversation about this security-and-climate-change nexus and to consider the potential future foreign policy and national security implications. Our collaboration engaged climate scientists and national security specialists in a lengthy dialogue on the security implications of future climate change. As one notable scholar intoned more than a decade ago, it is necessary for such diverse professionals to "acquire detailed knowledge of a

daunting range of disciplines, from atmospheric science and agricultural hydrology to energy economics and international relations theory."[2] His advice has largely been ignored, and even our eclectic group occasionally struggled to "speak the same language." But a shared sense of purpose helped us develop a common vocabulary and mutual respect, and begin the daunting process of closing these knowledge gaps among us.

A distinguished group of nationally recognized leaders was identified and recruited from the fields of climate science, foreign policy, political science, oceanography, history, and national security to take part in this endeavor. Members of the group included Thomas Schelling, the Nobel laureate in economics in 2005; Jay Gulledge, senior scientist, Pew Center on Global Climate Change; Ralph Cicerone, president of the National Academy of Sciences; Bob Correll, fellow of the American Meteorological Society; Terrence Joyce, senior scientist, and Richard Pittenger, former vice president, Woods Hole Oceanographic Institution; Mike MacCracken, chief scientist, Climate Institute; John McNeill, professor of history, Georgetown University; James Woolsey, a former director of the CIA; John Podesta, chief of staff of President Bill Clinton; Leon Fuerth, national security adviser to Vice President Al Gore; Jessica Bailey, sustainable development program officer, Rockefeller Brothers Fund; Rand Beers, president, Valley Forge Initiative; Sherri Goodman, general counsel, Center for Naval Analysis; Derek Chollet, senior fellow, Center for a New American Security; Eileen Claussen, president, Pew Center on Global Climate Change; Gayle Smith, senior fellow, Center for American Progress; Daniel Poneman, principal, the Scowcroft Group; Susan Rice, senior fellow, the Brookings Institution; and Wendy Sherman, principal, the Albright Group.

The mandate of the exercise was, on its face, very straightforward: employ the best available evidence and climate models, and imagine three future worlds that fall within the range of scientific plausibility. Such scenario planning is more than a creative writing exercise: it is a tool used successfully by businesses and governments all over the world to anticipate future events and plan more wisely in the present. The scenarios in this report use the time frame of a national security planner: thirty years, the time it takes to get major military platforms from the drawing board to the battlefield. The exception is the third, catastrophic, scenario, which extends out to a century from now.

Although the intersection of climate change and national security has yet to be fully mapped, there is a long, rich history of scholars and strategists exploring this territory. We felt it was important to begin this volume by

examining this literature, in order to understand how we might begin to build on and depart from the existing intellectual framework and why the challenge of climate change remains unresolved.

Beyond the Cold War: Redefining Security

Although traditionally considered to be primarily a domestic policy concern, discussion of the environment and climate change as national security and foreign policy matters trickled through the 1970s and early 1980s. George Kennan wrote in *Foreign Affairs* in 1970 of the global scale of such issues and suggested the need for an independent international institution to track and coordinate information on what nations, states, and communities did to impact the environment.[3] In 1974 General Maxwell Taylor suggested creating "an expanded National Security Council charged with dealing with all forms of security threats, military and nonmilitary, and having access to all elements of government and to all relevant resources capable of contributing to this broad task." Taylor criticized the NSC for generally ignoring the environment and many other issues.[4] The environmentalist Lester Brown of the Worldwatch Institute wrote in a seminal 1977 paper, "Redefining National Security," that "threats to security may now arise less from the relationship of nation to nation and more from the relationship of man to nature. Dwindling reserves of oil and deterioration of the Earth's biological systems now threaten the security of nations everywhere."[5] In the late 1980s Egypt's Foreign Minister Boutros Boutros-Ghali warned that the next war in the Middle East would be over water.

Although the concept of conflict over natural resources has long been a strong theme in the public imagination, especially concerning water and oil, conflict related to climate change has long remained a relatively obscure topic. This changed as the threat of the cold war waned, and as carbon loading from a host of developed and developing states increased dramatically in the late 1980s and into the new century.

The Canadian government held the first major international conference focused on climate change, "The Changing Atmosphere: Implications for Global Security," in Toronto in the early summer of 1988. At that conference, Norway's prime minister, Gro Harlem Brundtland, declared, "We are now realizing that we may be on the threshold of changes to our climate, changes which are so extensive and immediate that they will profoundly affect the life of the human race." Scientists offered projections of possible temperature and sea level increases, and politicians from more than forty

countries outlined security, economic, and political consequences of such changes in nature. Representatives of the host nation's government recommended that NATO and other economic and military organizations should be studied as models for international cooperation to combat climate change. However, many participants retained a policy focus of only voluntary solutions.[6]

That year, the United Nations and the World Meteorological Organization established the Intergovernmental Panel on Climate Change; its purpose was to be an independent entity to collect and analyze climate information from around the world, identify weaknesses and gaps in climate and environmental knowledge, and identify what scientific evidence government leaders required to make sound policy. The international community recognized the need for undeniable science rooted in global observations if decisionmakers were to take the threat of global warming seriously and initiate appropriate action.

In the summer of 1988, near-record temperatures and severe drought helped to spark political and popular interest in the United States as well as Canada. James Hansen, the director of NASA's Goddard Institute of Space Studies, testified before the Senate that there was a 99 percent certainty that the climate was indeed changing as a result of human contributions of greenhouse gases to the atmosphere. "It is time to stop waffling so much and say that the evidence is pretty strong," he declared, warning, "Global warming . . . is already happening now."[7]

Hansen's testimony is regarded as a major catalyst for getting Washington to think about climate change. However, it also triggered vociferous reaction from global warming skeptics of all stripes, from those who simply thought there was not yet enough data on the dynamics of clouds or the interactions between atmosphere and oceans to draw firm conclusions, to those who objected to the very concept that human activity could affect global climate patterns. For example, the climatologist Patrick Michaels responded to the uptick in warnings about climate change in a January 1989 *Washington Post* op-ed. "Of the hundred-odd scientists in the world actively involved in the study of long-term climate data, only one—James Hansen of NASA—has stated publicly that there is a 'high degree of cause and effect' between current temperatures and human alteration of the atmosphere," he wrote.[8] Hansen was forced to defend himself, responding in the *Post* the following month, "The evidence for an increasing greenhouse effect is now sufficiently strong that it would have been irresponsible if I had not attempted to alert political leaders."[9]

The Worldwatch Institute, an environmental policy research center, was a leading force in pushing the dialogue about the potential global implications of climate change. Its 1988 *State of the World* report stated: "For four decades, security has been defined largely in ideological terms. . . . The threat posed by continuing environmental deterioration is no longer a hypothetical one." As one author noted, "Threats to human security are now seen much more in environmental and economic terms and less in political ones."[10] Michael Oppenheimer, a prominent atmospheric scientist with the Environmental Defense Fund, summarized the attitude of many: "Any race of animals able to predict the warming of the Earth 100 years ago should be clever enough to stop it."[11] But the question of what to do continued to loom large, and many of the answers that were offered found no strong backing in Washington.

Of course, when it rains, it pours, and a flood of debate came about in 1989 and continued into the early nineties. As scientific evidence on climate change grew and the Soviet Union fell, an opening was created for redefinition of a new national security paradigm. The notion of elevating climate change and the environment to the level of a national security threat spread into the wider foreign policy community, instigating a heated debate.

"The 1990s will demand a redefinition of what constitutes national security," wrote Jessica Tuchman Mathews, then vice president of the World Resources Institute, in the spring 1989 issue of *Foreign Affairs,* in an article titled "Redefining Security," still credited with sparking this debate in earnest. "In the 1970s the concept was expanded to include international economics," she wrote. "Global developments now suggest the need for another analogous, broadening definition of national security to include resource, environmental and demographic issues." She described the key issue: "Environmental strains that transcend national borders are already beginning to break down the sacred boundaries of national sovereignty." She also lamented the inability of current international relationships to manage the coming environmental and climate problems: "No one nation or even group of nations can meet these challenges, and no nation can protect itself from the actions—or inaction—of others. No existing institution matches these criteria."[12]

That spring, Senator Al Gore, one of the more vocal politicians adding weight to the climate change debate, expanded on this notion. "As a nation and a government, we must see that America's future is inextricably tied to the fate of the globe," he wrote. "In effect, the environment is becoming a matter of national security—an issue that directly and imminently menaces the interests of the state or the welfare of the people."[13]

Journalists, politicians, editorial boards, and scientists soon began to echo the concept: climate and environmental issues are of highly relevant national security and foreign policy concern. In the summer of 1989, the G-7 summit in Paris even focused on the environment, the first time the issue was a central discussion point for the group. Though it marked a positive trend that the topic was brought to the table, President George H. W. Bush and his counterparts were criticized for not pledging strong, immediate action.

Some members of the first Bush administration were lambasted for their skepticism regarding the strength of scientific evidence of climate change, and for their adamancy in sticking to that premise in international meetings, but others in government at the time advocated the elevation of this and other environmental issues. Thomas Pickering, Bush's ambassador to the United Nations, warned that "ecoconflicts" could become a major problem in North-South tensions.[14] Bush chose a former World Wildlife Fund director, William Reilly, to head the Environmental Protection Agency (EPA), and halted the strangling of its budget that had occurred under Ronald Reagan. Reilly asserted that "ecological integrity is central to any definition of national security"[15] and proposed an array of measures to combat climate change, including improving vehicle fuel efficiency, increasing solar power research, and creating fees to deter coal and oil use, but to little avail. In the same month, before James Hansen was to testify again to the Senate on global warming, executive branch officials altered his testimony to cast doubt on his own scientific judgment. Congress and the press learned of this before the hearing, sparking a huge backlash at the skepticism and stalling of many members of the Bush administration concerning climate change.[16]

This trend—two contradictory responses to climate change—continued as some in the U.S. government began to treat environmental issues and climate change as strategically important fields, while others, including many in senior positions, pushed back or outright rejected the notion. The debate created enough waves to warrant significant attention from the mainstream press. In October 1989 *Time* magazine indicated which side of the debate seemed to be taking the lead in a special report, "The Greening of Geopolitics," with the headline, "A New Item on the Agenda: The Plight of the Planet Is Finally Serious International Business."[17]

The debate carried over into military considerations as well. Technologies that had been designed for military use or by the military were used to detect climate patterns, and old intelligence was opened for use in evaluating atmospheric data. Senator Sam Nunn, chairman of the Armed Services Committee, articulated in 1990 that "a new and different threat to our

national security is emerging—the destruction of our environment. The defense establishment has a clear stake in countering this growing threat. I believe that one of our key national security objectives must be to reverse the accelerating pace of environmental destruction around the globe."[18]

Secretary of State James Baker's FY 1991 budget request testimony restated plainly that nontraditional threats, including environmental ones, were of national security concern:

> Today and in the future, we must take collective responsibility for ensuring the safety of the international community. Traditional concepts of what constitutes a threat to national and global security need to be updated and extended to such divergent concerns as environmental degradation, narcotics trafficking, and terrorism. Our nonrenewable resources, human lives, and the values of civilized society all are irreplaceable assets which we cannot fail to protect.[19]

But climate change specifically was still treated by most as a very separate track from environmental concerns more broadly. Many who pushed the misconception that the science behind climate change was preliminary and that evidence of the link between emissions of carbon dioxide (CO_2) and global warming was inconclusive only pushed harder into the nineties. EPA administrator William Reilly continued to warn of the dangers of a failure to act, stating in 1992: "We invested so much in responding to [a possible] nuclear attack from the USSR, even though the risk may not have been that high. . . . The risk of climate change is so much larger and yet there has been no equivalent thinking to insure ourselves against it."[20]

The Clinton Years

Global warming and environmental issues in general became one of several major policy areas of focus during Bill Clinton's presidency. Vice President Al Gore and the first undersecretary of state for global affairs, Timothy Wirth, who as Senate colleagues had been two of the leading advocates of action on climate change, signified a wave of change within the government. The cold war was over, and environmentalists advocated using an expected "peace dividend" to halt climate change and ozone depletion. The threat of climate change was often juxtaposed with the nuclear threat, with considerable argument as to which posed the greater danger.

As recognition spread that national security needed to be redefined to encompass threats not strictly military, the focus shifted primarily to

economic and demographic issues. Perhaps this was because it was more direct and obvious *why* and *how* these areas generated significant threats, and because it was more readily apparent how the nation could handle these challenges. This trend snowballed as not only climate change skeptics but also some who agreed that global warming was a challenge of high importance began to portray economic growth and environmental regulation as antithetical. Warnings of a recession and a perception that countering global warming entailed extreme expenses further stalled its moving to a place of high national priority.

In late 1993 Clinton unveiled a Climate Change Action Plan, a series of voluntary measures to reduce greenhouse gas emissions to 1990 levels by 2000. The plan both disappointed many environmentalists for not creating a system of mandatory measures and was praised by others for taking the health of the economy into account. Energy Secretary Hazel O'Leary declared that inaction would be met with the enactment of mandatory measures, which encouraged many in the middle to consider the plan a good first step in slowing the pace of global warming.[21] A few months later, Undersecretary Wirth addressed the link between climate change and national security at a United States Information Agency foreign press briefing: "We're working on—continue to work on—global climate change. The U.S. has put together its action plan." At the same time he signaled that the Clinton administration did not consider global warming as a single, paramount threat: "We have very broad support in the Congress for this [the administration's agenda] in the post–Cold War era as the United States redefines its examination of national security. As the president pointed out . . . this falls into three broad categories of nuclear non-proliferation, focuses on democracy, and sustainable development."[22] Climate change was merely a subheading.

In a 1994 *Atlantic Monthly* article on demographic and environmental issues creating anarchic conditions in Africa that is still cited to this day as another major catalyst for attention to the topic, Robert Kaplan implored, "It is time to understand 'the environment' for what it is: *the* national-security issue of the early twenty-first century" (emphasis in original).[23] But policymakers never elevated it to this level. Press focus also changed, as climate change waned as a political hot topic and morality, globalization, and technology took increasing command of the national conversation. The environment and security scholar Geoffrey Dabelko observed in 1999 that the "bubble burst" after 1994, and "the policy crowd moved on to other theories about

the roots of conflict. Ethnicity and 'the clash of civilizations' . . . now claimed the spotlight."[24]

But although academics and policy wonks may have dropped the serious debate over whether the environment and climate change were national security concerns per se, climate change nevertheless stood in the foreign policy spotlight in Clinton's second term. The 1997 Kyoto Protocol, the international agreement that required the reduction of greenhouse gases to below 1990 levels between 2008 and 2012 on the part of the developed nations that ratified it, became a source of tension throughout much of Clinton's second term.

Greenhouse gas emissions increased through the 1990s, as the global economy boomed with new players such as China on the international scene, and many viewed Kyoto as merely a first step that might reduce the rate of increase of emissions, but not knock them back to earlier levels. For the United States, Clinton proposed a system to cap emissions and a system of trading emissions credits, along with funding research and development through tax credits. Clinton's initial proposal guaranteed no serious action for nearly a decade, and reports trickled out that stronger policies advocated by his environmental advisers were systematically weakened on the advice of administration economists; this meant that the United States would be going into the Kyoto negotiations from this tempered position. The president warned that he was prepared to reject stricter standards demanded by European and other nations and threatened that he would not submit the treaty for Senate approval, with the stated reasoning that developing nations would not be required to comply.[25]

The United States did sign the Kyoto Protocol in 1998, but the *how* of an international system of reducing emissions was a point of great contention. The United States wished to count increased and protected forest and agricultural land as carbon sinks. Other developed nations took this as an easy way out, and this—along with discord over compliance monitoring, enforcement, and the question of which nations would bear what costs—led to the collapse of the Kyoto negotiations by late 2000, the year before ratification was to occur.[26] Clinton never did send the Kyoto treaty to the Senate for approval, but the years of debate over multiple sticking points made it clear that to do so would have been fruitless anyway. The question of whether the United States would agree to international environmental standards was effectively answered by both Democrats and Republicans with a resounding "no."

The New Millennium

Just two months into George W. Bush's presidency, his EPA administrator announced that the administration had no intention of implementing the Kyoto treaty. Bush's reservations echoed Clinton's—it might stall economic growth, and developing nations such as China and India were not required to comply—and cast doubt on the scientific evidence that human activity drove climate change.[27] In March 2001 Bush also wrote in a letter to Republican senators, "We must be very careful not to take actions that could harm consumers. . . . This is especially true, given the incomplete state of scientific knowledge of the causes of, and solutions to, global climate change and the lack of commercially available technologies for removing and storing carbon dioxide."[28] One hundred and seventy-five countries eventually accepted the treaty, and most developed nations ratified it, but not the United States.

Years of government inaction on climate change followed. Bush enjoyed years with a Republican Congress under his strict instruction. The September 11 terrorist attacks, Bush's ambiguous and ambitious Global War on Terror, and two wars distracted attention and funds from virtually all else. Perhaps because the concept of a threat was now painted in such stark terms—attack on the American mainland, and anything that might enable it—a debate over the environmental links to national security was sparked anew, if under the mainstream radar. And though the problem was once compared to the nuclear threat, its comparison with and linkage to terrorism now became prominent. In a 2005 article titled "Climate Change Poses Greater Security Threat than Terrorism," Janet Sawin of Worldwatch Institute asserted that transformations in the climate would disrupt global water supplies and agricultural activities, resulting in drought and famine, which would lead some people to turn to extralegal organizations and terrorist groups that would be able to provide for their basic needs better than existing economic and political institutions.[29]

The momentum to discuss the impact of climate change as a national security issue has finally been building steadily since 2006. Al Gore's climate change slide show, *An Inconvenient Truth,* became both a best-selling book and a documentary film that won multiple awards, including an Oscar. Gore and the Intergovernmental Panel on Climate Change were awarded the 2007 Nobel Peace Prize. Television news programs and presidential candidates hosted "green weeks" to showcase information about climate change and ideas on how to address it. Some in the mainstream press admitted that they long lent narrow special interests too much credence, and thousands of scientists

around the world too little. The prominent *New York Times* columnist Nicholas Kristof has publicly spoken out about what he sees as a failure of the elite media to cover the issue of climate change in all of its manifestations. Climate change rather than the perennial issues of globalization, nuclear proliferation, and the Iraq War dominated the January 2007 World Economic Forum meeting of the world's political and business leaders in Davos, Switzerland.[30] In explaining why he chose to discuss climate change at Davos, the leader of Britain's Conservative Party, David Cameron, said, "There is a consensus . . . that says we need to take action to prevent it, rather than just mitigate its effects. But, at the same time, politicians have a duty to prepare for its consequences in terms of domestic and international security."[31] Policy leaders and academics are now airing and debating concepts for post-Kyoto international cooperation.

The Long-standing Debate Concerning Redefinition

Remarkably, the debate as to whether or not it is appropriate to define climate change in particular and the environment in general as national security concerns still continues today. A primary source of disagreement between the camps as to whether national security should be redefined is the question of whether a security framing implies military, rather than political, solutions. Examples of reasoning from both sides of the debate show how nuanced the intellectual wrangling has become.

Daniel Deudney of Princeton University wrote in 1991 that "such experimentation in the language used to understand and act upon environmental problems is a natural and encouraging development. But not all neologisms and linkages are equally plausible or useful." He argued that environmental and security threats were so inherently different in nature that they should not be linked and contended that threats of all kinds were likened to war to arouse emotional responses and create a sense of urgency, regardless of the appropriateness of such connections.[32]

The environmental scholar Peter Gleick, in the same publication, took a similar tack of rejecting a broadened definition of national security, but with different justification. Citing the Persian Gulf War as an example, Gleick posited that in the future, threats diversely political, military, and environmental in nature would become "more tightly woven" and inherently all pieces of a single greater picture. He suggested that "what is required is not a redefinition of international or national security, as some have called for, but a better understanding of the nature of certain threats to security, specifically

the links between environmental and resource problems and international behavior." He emphasized that threats to the environment will inevitably have to be of concern in the future, and "climatic changes are most likely to affect international politics."[33]

However, as the scholar Joseph Romm wrote of the time after the collapse of the Soviet empire, the reason for broadening the definition of national security is to reorient leaders and the established bureaucracy toward seeking and considering a broader array of solutions: "Our existing security paradigm is increasingly inadequate to address these problems."[34] In 2000 the *New York Times* reporter David Sanger described the Clinton administration's expanded national security definition: "In [Al] Gore's case, the political calculation is obvious: he is trying to portray his opponent, George W. Bush, as a man caught in what he termed a cold-war mindset. . . . It is possible—though hardly certain—that after a decade of unchallenged power and prosperity, Americans are ready to think about their national security in broader terms."[35]

But while academics, analysts, and the media could argue over definition until the end of time, it is still up to elected national leaders to enact serious change. The only way to viably do so is to settle the definitional issue once and for all, by convincing the American people that climate change is perhaps the top national security problem we face.

Predicted National Security Consequences of Climate Change

The range of scholars' predictions of the consequences of climate change and severe environmental degradation has remained largely consistent over the past thirty to forty years. In addition to the diverse speculation over how serious the effects of climate change will be, such predictions cover a broad spectrum of mild to extreme human reaction to the repercussions of global warming, such as sea level rise and altered agricultural productivity.

In his pivotal 1977 paper, "Redefining National Security," Lester Brown wrote that "excessive human claims" on the environment threatened nearly all aspects of life: fishing and crop yields, forest regeneration, economic stability, and energy production and use.[36] Ian Rowlands, of the London School of Economics, intoned in *Washington Quarterly* in 1991 that "no country will be immune from the security challenges posed by global environmental change." Moreover, he described it as a unique issue in that the threat was not external: the behavior of the United States and other nations constituted a threat to themselves, and security would not be dependent upon the actions

of any single player.[37] In the same publication, the environmental consultant A. J. Fairclough wrote that natural resources would become increasingly scarce in the future, aggravating existing tensions and creating new threats of economic stagnation and refugee flows. He summarized: "These threats to environmental security must be seen as threats to the well-being and quality of life of our populations that are every bit as serious as military threats. We need to react accordingly."[38] The High-Level Panel on Threats, Challenges, and Change appointed by former UN secretary general Kofi Annan warned in 2004 of a vicious cycle of poverty, disease, environmental degradation, and civil violence.[39]

Scholars and policymakers have long spotlighted migration, both within and between nations, as an early and pervasive consequence of climate change. In April 1974 the president's National Security Council compiled a National Security Study memo for President Richard Nixon, unique in its consideration of population pressures as a potential threat to national security. This study was quite prescient, as many of the population trends it described came to the fore in the Clinton years and remain of concern in today's debates on global warming. "Population factors appear to have had operative roles in some past politically disturbing legal or illegal mass migrations, border incidents, and wars," the study stated. "If current increased population pressures continue they may have greater potential for future disruption in foreign relations."[40]

One of the most noted theorists of environment-conflict studies, Thomas Homer-Dixon, wrote that change to the environment will impact populations by "decreased economic productivity and disrupted institutions will jointly contribute to relative-deprivation conflicts . . . positive feedbacks may operate: relative-deprivation conflicts may cause further economic decline and institutional dislocation."[41] Joseph Romm echoed this concern in 1993, writing that many nations' being confronted with scarce resources "may lead to conflict or ecosystem collapse, resulting in environmental refugees. Such traumas could threaten U.S. national security if these conflicts were to occur in areas of importance to the United States, or if refugees were to flee in large numbers to this country."[42] And the German climatologist Hermann Ott wrote in 2001, "Water and food shortages, rising sea levels and generally changing patterns of precipitation will lead to mass migrations and a considerable increase in low- and high-intensity warfare in many parts of the southern world."[43]

A group of scholars who used statistical and quantitative methods to track population growth, agricultural production, global climate changes, and war

found the heaviest correlations among these factors in arid regions. Basing their assessments on the overlap of changing climate patterns and conflict, they wrote that "the greater threat from global warming comes from uncertainty of the ecosystem change," for that uncertainty will cause social and economic turmoil and other secondary effects wherever quick adjustment cannot be made. "A change of one key component under global warming would likely cause disastrous results in human societies dependent on the existing human ecosystem." These scholars posed key questions: "Is the changed ecosystem sufficiently adaptable or are the adaptation choices affordable for all of us?"[44]

One-third of the world's population lives within 60 kilometers (about 37 miles) of a coastline, so potential refugee crises are of critical concern if the widespread sea level rises predicted by scientific models of global warming occur. The sheer numbers of potentially displaced people are staggering. One recent World Bank report included calculations that over the course of the twenty-first century, sea level rise due to climate change could displace hundreds of millions of people in developing countries.[45] Christian Aid and other nongovernmental organizations have estimated that climate change could deprive as many as 1 billion people of their homes between now and 2050.[46] A two-day conference in Oslo in the summer of 2005, the International Workshop on Human Security and Climate Change, was dedicated to evaluating how climate change will drive human migration, as scholars around the world are struggling to determine how to best cope with such trends.

Among the long litany of devastating predicted effects, one focus of increasing concern is the disproportionate harm to the world's poorest people. "In low-income countries unable to offset crop shortfalls with imports, a production drop can translate directly into a rise in death rates," Lester Brown wrote in 1977.[47] Norway's Prime Minister Gro Harlem Brundtland warned at the 1988 Toronto climate change conference, "Climatic change will affect us all profoundly, regardless of where we live. And, as always, the poorest countries will be the ones most severely affected."[48] Jessica Tuchman Mathews also made the point that although some areas might benefit from better agricultural conditions, all regions will be susceptible to highly variable and unpredictable changes. Further, adapting to climate change "will be extremely expensive. Developing countries with their small reserves of capital, shortages of scientists and engineers, and weak central governments will be the least able to adapt, and the gap between the developed and developing worlds will almost certainly widen."[49]

Many of the predicted consequences of global warming and environmental change are already occurring. Thomas Homer-Dixon's 1991 list of expected consequences stands out:

> Environmental change may contribute to conflicts as diverse as war, terrorism, or diplomatic and trade disputes. Furthermore, it may have different causal roles: in some cases, it may be a proximate and powerful cause; in others, it may only be a minor and distant player in a tangled story that involves many political, economic, and physical factors. . . . Warmer temperatures could lead to contention over new ice-free sea-lanes in the Arctic or more accessible resources in the Antarctic.[50]

Sixteen years later, in August 2007, a Russian adventurer descended 4,300 meters (about 15,000 feet) under the thinning ice of the North Pole to plant a titanium flag and claim some 1.2 million square kilometers (468,000 square miles) of the Arctic for Russia. Not to be outdone, the prime minister of Canada stated his intention to boost his nation's military presence in the Arctic, with the stakes raised by the recent discovery that the heretofore iced-in Northwest Passage has become navigable for the first time in recorded history. Elsewhere on the globe, the spreading desertification in the Darfur region has compounded the tensions between nomadic herders and agrarian farmers, providing the environmental backdrop for genocide.

What Can Be Done?

Whatever the possible international distribution of climate change effects, there is a general consensus about the need for multilateral cooperation, for isolated and uncoordinated national-level steps are clearly not up to the task. In the October 2006 *Review on the Economics of Climate Change,* the former World Bank economist Nicholas Stern maintained that although the near-term costs of stabilizing the concentration of greenhouse gases in the atmosphere are significant but manageable (approximately 1 percent of global GDP), any major delay in responding would result in substantially higher aggregate costs, amounting to an estimated loss of up to 20 percent of the world's GDP. One of the report's key assessments is that all countries can contribute to combating climate change while still achieving economic growth. In particular, the Stern review urged a multidimensional international response involving expanded use of carbon emissions trading arrangements,

increased cooperation in developing and sharing low-carbon technologies, curbing deforestation, and greater support for adaptation measures.[51]

At the end of March 2007, the U.S. Army War College sponsored a two-day conference at the Triangle Institute for Security Studies on the topic "The National Security Implications of Global Climate Change." Participants included civilian strategists and active-duty and retired military officers, who explored a range of issues potentially linking climate change to international security. A major goal of the conference was to assess how the military could mitigate climate change, assist in efforts to adapt to climate change, and prepare for the security challenges that might ensue from climate change. The attendees stressed that any effective response to climate change–related security problems likely would require multi-agency cooperation, especially for domestic emergency management, and typically multinational action.[52]

In April 2007 the Center for Naval Analysis (CNA) Corporation issued a landmark report that attracted major attention in the national security community because of its advisory board of former senior U.S. military officers.[53] The authors recognized that much scientific uncertainty regarding climate change persists but urged "moving beyond the argument of cause and effect," since observed climate change was already occurring and presenting challenges to national security planners. According to the report, "The chaos that results can be an incubator of civil strife, genocide, and the growth of terrorism." The authors warn that these developments could contribute to state failure, interstate conflicts, or other security problems in many geographic regions that could require a response by an already overburdened U.S. military. Transformations in the environment resulting from climate change could also complicate regular U.S. military operations. Hurricanes and rising sea levels could threaten U.S. military facilities, extremely hot or cold weather could disrupt U.S. military operations, and allied militaries might offer less support for joint missions if they also have to respond to environmental threats. The board affirmed that they as military officers had long recognized the need to assess the risks of climate change–driven events if the consequences could prove sufficiently severe.

In the face of these challenges, the CNA panel recommended that the United States adjust its national security and national defense strategies to account for the possible consequences of climate change.[54] For example, the Department of Defense should conduct an impact assessment of how rising sea levels, extreme weather events, and other effects of climate change might affect U.S. military installations over the next three to four decades. They also cautioned that extreme environmental conditions degrade weapons

systems and the capabilities of military personnel. Beyond the military dimension, the panel members urged that the U.S. government seek to enhance the resilience of the international community in the face of climate-related threats by strengthening the governance, health care, and disaster prevention and relief capabilities of foreign countries. They noted that the recent creation of the U.S. Africa Command (AFRICOM) seems to serve such a purpose. The authors also recommended that the United States help limit climate change through unilateral and multilateral measures; the Department of Defense could contribute through more efficient use of energy and other measures.

Stepping from the foundation these previous works have laid, the working group convened by the Center for a New American Security and the Center for Strategic and International Studies diverged from previous work by looking into the past for historical evidence of what may be to come, then employing the best available evidence and climate models to ponder the national security implications of three plausible future worlds.

These particular scenarios aim not to speculate centuries into the future, as some scientific models do, but to consider possible developments using a reasonable time frame for making acquisition decisions or judgments about larger geopolitical trends. In national security planning, it generally can take about thirty years to design a weapons system and bring it to the battlefield, so it is important to anticipate future threat environments and prepare for the challenges we may face as a result of climate change.

The three scenarios we develop in this study are based on *expected, severe,* and *catastrophic* climate cases. The first scenario projects the effects in the next thirty years with the *expected* level of climate change. The second, *severe,* scenario posits that the climate responds much more strongly to continued carbon loading over the next few decades than predicted by current scientific models. It foresees profound and potentially destabilizing global effects over the course of the next generation or more. Finally, the third, *catastrophic,* scenario is characterized by a devastating "tipping point" in the climate system, perhaps fifty to one hundred years hence. In this future world, radical changes in global climate conditions include the rapid loss of the land-based polar ice sheets, an associated dramatic rise in global sea levels, and the destruction beyond repair of the existing natural environment.

For each of the three plausible climate scenarios, we asked a national security expert to consider the projected environmental effects of global warming and to map out the possible consequences for peace and stability. We also

enlisted a historian of science to consider whether there was anything to learn from the experience of earlier civilizations confronted with rampant disease, flooding, or other forms of natural disaster. Each climate scenario was carefully constructed and the three corresponding national security futures were thoroughly debated and discussed by the group. A synthesis and summary of some of the key findings from the various chapters follows.

Historical comparisons from previous civilizations and national experiences of such natural phenomena as floods, earthquakes, and disease may be of help in understanding how societies will deal with unchecked climate change. In the past, natural disasters generally have been local or abrupt or both, making it difficult to directly compare the worldwide effects of prolonged climate change to historical case studies. No precedent exists for a disaster of this magnitude—one that affects entire civilizations in multiple ways simultaneously. Nonetheless, the historical record can be instructive; human beings have reacted to crisis in fairly consistent ways. Natural disasters have tended to be divisive and sometimes unifying, to provoke social and even international conflict, to inflame religious turbulence, focus anger against migrants or minorities, and direct wrath toward governments for their actions or inaction. People have reacted with strategies of resistance and resilience—from flood control to simply moving away. Droughts and epidemic disease have generally exacted the heaviest toll, in both demographic and economic terms, and both are expected effects of future climate change. Indeed, even though global warming is unprecedented, many of its effects will be experienced as local and regional phenomena, suggesting that past human behavior may well be predictive of the future. This history is explored in chapter 2.

In chapter 3, the climate scientist Jay Gulledge explains how projections about the effects of climate change have tended to focus on the most *probable* outcome, on the basis of mathematical modeling of what we know about the global climate. With climate science, however, the level of uncertainty has always been very high. Indeed, the scientific community has been shocked at how fast some effects of global warming are unfolding, which suggests that many of the estimates considered most probable have been too conservative.[55] When we build climate scenarios in order to anticipate the future, therefore, there is a very strong case for looking at the full range of what is *plausible,* and this task is taken for the effects of climate change by region.

The *expected* climate change scenario considered in this report, an average global temperature increase of 1.3°C (2.3°F) by 2040, can be reasonably taken as a basis for national planning. The authors of chapter 4 write that the

environmental effects in this scenario are "the least we ought to prepare for." National security implications include heightened internal and cross-border tensions caused by large-scale migrations; conflict sparked by resource scarcity, particularly in the weak and failing states of Africa; increased disease proliferation, which will have economic consequences; and some geopolitical reordering as nations adjust to shifts in resources and prevalence of disease. Across the board, the ways in which societies react to climate change will refract through underlying social, political, and economic factors.

In the case of *severe* climate change, corresponding to an average increase in global temperature of 2.6°C (4.7°F) by 2040, massive nonlinear events in the global environment give rise to massive nonlinear societal events. In this scenario, discussed in chapter 5, nations around the world will be overwhelmed by the scale of change and the accompanying huge challenges, such as pandemic disease. The internal cohesion of nations, including the United States, will be under great stress, as a result both of a dramatic rise in migration and of changes in agricultural patterns and water availability. The flooding of coastal communities around the world, especially in the Netherlands, the United States, South Asia, and China, has the potential to challenge regional and even national identities. Armed conflict between nations over water resources such as the Nile and its tributaries is likely, and nuclear war is possible. The social consequences range from increased religious fervor to outright chaos. In this scenario, climate change provokes a permanent shift in the relationship of humankind to nature.

The *catastrophic* scenario, with average global temperatures increasing by 5.6°C (10.8°F) by 2100, is by far the most difficult future to visualize without straining credulity. The author of this scenario notes that intense hurricanes will become increasingly common, and so will droughts, floods, wildfires, heat waves, and churning seas. Hundreds of millions of thirsty and starving people will have to flee these disasters or perish, leaving the globe dotted with ghost towns. The abrupt and sudden nature of many of these phenomena will challenge the ability of all societies to adapt. If the catastrophic scenario described in this chapter comes to pass, the world will be caught in an age where sheer survival is the only goal.

The author of chapter 7 describes climate change as a malignant rather than a malevolent threat. However, one of the other great challenges of our time, terrorism, a malevolent threat, provides surprisingly similar challenges to national security as does climate change. Both threaten the economy and the ways the United States uses energy, and both contribute to the vulnerability of the nation's critical infrastructure. In this sense, diverse

groups whose interests center on either the environment or on national security have cause to come together and act in tandem.

The Kyoto Protocol will expire in 2012. The United States, the European Union, and China are responsible for roughly half of global greenhouse gas emissions. The authors of chapter 8 outline changing views in each of these powerhouse nations, noting that if just these three players can agree to reduce greenhouse gas emissions, and especially if experts from all relevant communities participate, a post-Kyoto climate change framework is likely.

The United States must confront the harsh reality that unchecked climate change will come to represent perhaps the single greatest risk to our national security, even greater than terrorism, rogue states, the rise of China, or the proliferation of weapons of mass destruction. The effects of climate change will further complicate most other security threats as well.

Though the environment-security link has long been debated in different policy circles, scientists and national security practitioners have only recently begun to work together. New dialogues among these communities and scenario planning based on the best current scientific data have begun to paint a harrowing and Hobbesian view of the earth's future. A climatically disrupted future would be marked by sharp increases in global sea levels, endemic drought, more frequent and more extreme weather events, spreading disease vectors, massive extinctions, the prospects for the collapse of agricultural sectors and global fisheries, and the largest human movements and disruptions in history. These outcomes, on a lesser scale, will be seen even if climate change is relatively mild.

Conclusion

When one reviews years of writing, scholarly work, and government policy on climate change and national security, it is striking how well trod the ground is. This report reflects back to concepts that have been part of the national dialogue for decades. Yet even more striking is the lack of resolution. Why has serious action not been taken? After decades of warnings and years of events trending just as those warnings predicted, why has climate change not taken its rightful place as perhaps the biggest security challenge the United States faces?

Part of the explanation is political, part of it lies with the earlier uncertainty of the science, and part of it is institutional. Government bureaucracy is hard to move, as are political will and public opinion. Second, the trend continues today of labeling climate-neutral technologies "too expensive"

or detrimental to economic growth. The price of change is still calculated solely in direct terms, without regard to the nonmonetary quality of life, the second-order costs of the status quo, or the security benefits that change would bring. In a prophetic 1989 *Washington Post* article, "Our Global Eco-Blindness; Earth's Fate Is the No. 1 National Security Issue," Al Gore enunciated this problem:

> The effort to solve the global environmental crisis will be complicated not only by blind assertions that more environmental manipulation and more resource extraction are essential for economic growth. It will also be complicated by the emergence of simplistic demands that development, or technology itself, must be stopped for the problem to be solved. This is a crisis of confidence which must be addressed.[56]

Even more important, the various communities at work on this topic have never truly united as a single, undeniable force for recognizing the urgent need for action. This project was formed in an attempt to play a small role in correcting this critical deficiency. It is the hope of all who contributed to this project that this volume will provide a basis for understanding and action. There are disagreements in all areas of national security, and counter-arguments that challenge prevailing orthodoxies are not treason. But in all manner of security concerns the national leadership is accorded broad latitude to act to protect the country. Climate change must come to be systematically accepted alongside comparable threats to the very security of the nation—and the world.

This report and the interactions among participants highlighted inescapable, overriding conclusions. We hope this study will make an important contribution to the understanding of what might well be the single most significant challenge confronting the United States—indeed, human civilization. We approached the task with humility: understanding the scope and the scale of climate change is not easy. It is even harder to come up with credible ideas and options for managing and mitigating the effects of global warming. We hope that this collaborative effort offers a strong foundation for such efforts.

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