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THE NATIONAL SECURITY IMPLICATIONS OF CLIMATE CHANGE

HEARING

BEFORE THE

SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

COMMITTEE ON SCIENCE AND TECHNOLOGY

HOUSE OF REPRESENTATIVES

ONE HUNDRED TENTH CONGRESS

FIRST SESSION

SEPTEMBER 27, 2007

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THE NATIONAL SECURITY IMPLICATIONS OF CLIMATE CHANGE

THURSDAY, SEPTEMBER 27, 2007

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
Washington, DC.

The Subcommittee met, pursuant to call, at 10:05 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Brad Miller [Chairman of the Subcommittee] presiding.

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THE SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

HEARING ON

THE NATIONAL SECURITY IMPLICATIONS OF CLIMATE CHANGE

Thursday, September 27, 2007
10:00 a.m. – 1:00 p.m.
2318 Rayburn House Office Building

WITNESSES:

PANEL 1

General Gordon R. Sullivan, USA (Ret.)
Chairman, Military Advisory Board, the CNA Corporation

Mr. R. James Woolsey
Vice President, Booz Allen Hamilton

PANEL 2

Dr. Alexander Lennon
Research Fellow, International Security Program, Center for Strategic and International Studies

Dr. Andrew Price-Smith
Professor, Department of Political Science

Dr. Kent H. Butts
Director, National Security Issues, Center for Strategic Leadership, U.S. Army War College

HEARING CHARTER

SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

The National Security Implications of Climate Change

THURSDAY, SEPTEMBER 27, 2007
10:00 A.M.–12:00 P.M.
2318 RAYBURN HOUSE OFFICE BUILDING

Purpose:

The purpose of this hearing is to examine current thinking on the nature and magnitude of the threats that global warming may present to national security, and to explore the ways in which climate-related security threats can be predicted, forestalled, mitigated, or remedied.

Among the many direct consequences of warming temperatures may number: flooding, drought, soil and coastal erosion, melting of glaciers and sea ice, and change in the range of disease vectors. Such phenomena can lead to water shortages, diminution of food supplies from both agriculture and the oceans, the spread of disease to new areas and the emergence of new diseases, increased risk of fire, and decreased production of electrical power. Through famine, epidemic, and competition of resources, these can contribute to the breakdown of civil order—and, where governments are already stressed, disintegration of the state—as well as rampant human misery, mass migration, the rise of extremist ideologies, and armed conflict. This hearing will look at the current state of research into these possibilities, as well as the strategic thinking that is being developed in hopes of anticipating and coping with such threats.

In so doing, the hearing should help the Committee in identifying new areas of research, or new emphases in existing areas, that have begun emerging with the recently burgeoning of attention to the links between climate change and national security.

Background:

The Committee on Science and Technology has long been a leader in bringing the importance of climate change to the attention of the Nation and in advocating measures to deal with this critical problem. It played a crucial role in the creation of the U.S. Global Change Research Program in 1990 and, just this June, reported out a measure, H.R. 906, amending that original act. This legislation would require the President to present to Congress a quadrennial assessment that analyzes, among other things, "the vulnerability of different geographic regions of the world to global change, including analyses of the implications of global change for international assistance, population displacement, and national security."

In addition, both Houses of Congress are now considering legislation that would put Federal intelligence experts to work studying the connection between climate change and national security. Both H.R. 2082 and S. 1538 would direct the Director of National Intelligence to submit to Congress, within 270 days of enactment, "a National Intelligence Estimate (NIE) on the anticipated geopolitical effects of global climate change and the implications of such effects on the national security of the United States." The provision was inserted into the Senate version of the bill via an amendment offered by three Democrats and three Republicans.

Even with the legislation pending, the National Intelligence Council (NIC) has begun working with the U.S. Global Change Research Program and the Joint Global Research Institute, a collaborative effort of Battelle Memorial Institute and the University of Maryland, on a study of the sort the bills describe. Whether the study will be published as an NIE or a National Intelligence Assessment is to be determined closer to publication, which is expected in early 2008.

This legislation parallels the rise in prominence in policy circles of the issue of global climate change's potential impacts on U.S. national security. Early this year the Global Business Network, a private consultant, issued a report titled *Impacts*

of Climate Change: A System Vulnerability Approach to Consider the Potential Impacts to 2050 of a Mid-Upper Greenhouse Gas Emissions Scenario.

A report to be considered at this hearing appeared shortly thereafter: The CNA Corporation, which incorporates the Center for Naval Analyses, produced *National Security and the Threat of Climate Change.* The Subcommittee will receive testimony on this report presented by a former U.S. Army Chief of Staff, General Gordon Sullivan, USA (Ret.), who chaired the Military Advisory Board that CNA formed in conjunction with this project. At about the same time, the Strategic Studies Institute of the Army War College and the Triangle Institute for Security Studies jointly held a colloquium on "Global Climate Change: National Security Implications" two of whose speakers, Dr. Butts and Prof. Andrew Price-Jones of Colorado College, will also be among the witnesses at this hearing.

Awaiting publication within the next year is a report, to be titled *"The Foreign Policy and National Security Implications of Global Climate Change,"* based on a year-long review by the Center for Strategic and International Studies. Two men involved with its production will testify at this hearing: Mr. James Woolsey, the former Director of Central Intelligence, who wrote one of the three climate change scenarios that make up the report; and Dr. Alexander Lennon, who is serving as Co-Director of the report for CSIS.

Witnesses:

Panel One

General Gordon R. Sullivan, USA (Ret.), is the former Chief of Staff of the U.S. Army and is serving as the Chairman of the Military Advisory Board that The CNA Corporation formed in conjunction with its report *National Security and the Threat of Climate Change.*

Mr. James Woolsey, a former Director of Central Intelligence and currently Vice President of Booz Allen Hamilton, is the author of a chapter of the forthcoming Center for Strategic and International Studies report *"The Foreign Policy and National Security Implications of Global Climate Change."*

Panel Two

Dr. Kent Hughes Butts is the Director of National Security Issues at the U.S. Army War College's Center for Strategic Leadership.

Dr. Alexander Lennon is a Research Fellow in the International Security Program at the Center for Strategic and International Studies and co-director of the forthcoming CSIS report *"The Foreign Policy and National Security Implications of Global Climate Change."*

Dr. Andrew Price-Smith is Assistant Professor of Political Science at Colorado College, Director of the Project on Health and Global Affairs, and author of the book *The Health of Nations: Infectious Disease, Environmental Change, and Their Effects on National Security and Development.*

Chairman MILLER. Good morning. This hearing will come to order. Today's hearing is entitled *The National Security Implications of Climate Change.*

The seeds of the Second World War and the Holocaust were sown in the world-wide depression of the 1930s. European democracies fell and were replaced with authoritarian regimes with repugnant ideologies.

Last year the British Government issued a report that concluded that environmental devastation from global warming could result in a five to 20 percent decrease in the world's economic production, which would be comparable to the Great Depression or the World Wars.

The report concluded that global warming could result in hunger from diminished agricultural production and fisheries, water shortages, epidemics, and coastal flooding that could displace as many as 200 million people. Other experts argued that the report's conclusions were overstated and alarmist. But what if the report was right?

Are we ready for the world we could face if the report's conclusions prove correct? Will environmental and economic devastation result in failed states, authoritarian regimes, the spread of extremism and terror, and warfare over scarce resources?

Our national security professionals don't like surprises. They make it their business to anticipate events and plan for different contingencies, however unlikely. In the '40s and the '50s we were frequently surprised when governments we thought were stable fell to coups or revolutions. Our intelligence community developed models to predict which societies were unstable or might become unstable. And contingency planning is second nature to our military. Few adversaries are polite enough to tell us in advance what their military plans are.

Have we considered which societies may become unraveled as a result of environmental and economic devastation, whether or not we are certain that those results will materialize? The possibility of a world transformed by climate change is not a science fiction myth of a post-apocalyptic society. It is not a road warrior movie. It is happening now.

There is another Holocaust now in Darfur. The barbaric Bashir regime certainly is responsible for the genocide in Darfur, but the U.N. General Secretary Ban Ki-Moon recently called the Darfur conflict an "ecological crisis" that had arisen "at least in part from climate change."

Arab tribes and African tribes lived together more or less in harmony for centuries, maybe millennia, but precipitation in what was already an arid region has declined by 40 percent in the last two decades, as the Sahara moves south into what had been Sub-Saharan Africa. There is no longer enough water both for Arab herders and for African farmers. The fighting in the Sudan has resulted in 400,000 to 450,000 deaths, 2.5 million people are living in refugee camps, and four million people in Darfur, about half the region's population, depend on food assistance to survive.

How many struggling governments in developing nations will collapse from the economic consequences of global warming? Will

those ungoverned regions become, to use General Anthony Zinni's phrase, petri dishes for extremism and terrorism?

The consequences of global warming affect the work of many Committees of this Congress. They have certainly been the subject of other hearings by the Science and Technology Committee. The national security implications of global warming certainly may guide the work of this committee. What research should we be doing that we are not doing already? What research should we move up in priority because of national security concerns?

Can we be better prepared to protect our national security interests by conducting research that will predict what consequences can come from global warming and where? Can we be better prepared by conducting research into how to mitigate the consequences of global warming because the consequences are so dire, whether or not we are certain they will happen?

To give just one example of the decisions this committee faces, this committee fought for years the decision to eliminate sensors designed to collect climate-related data from the NPOESS satellite, the National Polar Orbiting Operational Environmental Satellite System. The Department of Defense decided to eliminate the sensors to save money in what was already an embarrassingly large cost overrun. Is the elimination of those sensors shortsighted just on the basis of national security concerns and our national security needs?

Each of our witnesses today will have five minutes to answer those questions. If you do not need the entire five minutes, of course, you may waive your time.

And now I will recognize Mr. Sensenbrenner for his opening remarks.

[The prepared statement of Chairman Miller follows:]

PREPARED STATEMENT OF CHAIRMAN BRAD MILLER

The seeds of the Second World War and the Holocaust were sown in the worldwide depression of the 1930s. European democracies fell and were replaced with authoritarian regimes with repugnant ideologies. Last year the British Government issued a report that concluded that environmental devastation from global warming could result in a five to 20 percent decrease in the world's economic production, which would be comparable to the Great Depression or the World Wars. The report concluded that global warming could result in hunger from diminished agricultural production and fisheries, water shortages, epidemics, and coastal flooding that could displace as many as 200 million people.

Other experts argued that the report's conclusions were overstated and alarmist. But what if the report was right? Are we ready for the world we would face if the report's conclusions prove correct? Will environmental and economic devastation result in failed states, authoritarian regimes, the spread of extremism and terror, and warfare over scarce resources? Our national security professionals don't like surprises. They make it their business to anticipate events, however unlikely, and to plan for different contingencies.

In the forties and the fifties, we were frequently surprised when governments we thought were stable fell to coups or revolutions. Our intelligence community developed models to predict which societies were unstable, or might become unstable. And contingency planning is second nature to our military. Few adversaries are polite enough to notify us of their military plans.

Have we considered which societies may come unraveled as a result of environmental and economic devastation, whether or not we are certain that those results will materialize? The possibility of a world transformed by climate change is not a science fiction image of a post-apocalyptic society, it is not a road warrior movie, it is happening now.

There is another holocaust now in Darfur. The barbaric Bashir regime certainly is responsible for the genocide in Darfur, but U.N. Secretary General Ban Ki-Moon

recently called the Darfur conflict an "ecological crisis" that had arisen "at least in part from climate change." Arab tribes and African tribes had lived together more or less in harmony for centuries, perhaps millennia. But precipitation in what was already an arid region has declined by 40 percent in the last two decades as the Sahara moves south. There is no longer enough water for Arab herders and for African farmers. The fighting in the Sudan has resulted in 400 to 450 thousand deaths, 2.5 million are living in refugee camps, and 4 million people in Darfur—roughly half the region's population—now depend on food assistance. How many struggling governments in developing nations will collapse from the economic consequences of global warming? Will those ungoverned regions become, to use General Anthony Zinni's phrase, petri dishes for extremism and terrorism?

The consequences of global warming affect the work of many Committees of this Congress, and have been the subject of other hearings by the Science and Technology committee. The National Security implications of global warming certainly may guide the work of this Committee. What research should we be doing that we're not doing? What research should we move up in priority? Can we better prepared to protect our national security interests by conducting research that will predict what consequences can come from global warming, and where? Can we be better prepared by conducting research into how to mitigate the consequences of global warming?

To give just one example, this committee fought for years the decision to eliminate sensors designed to collect climate-related data from the national polar orbiting operational environmental satellite system. The Department of Defense decided to eliminate the sensors to save money in a program with embarrassingly cost overruns. Is the elimination of the sensors shortsighted on the basis of our national security needs? Each of our witnesses today will have five minutes to answer those questions. But won't be the last time we discuss the topic.

Mr. SENSENBRENNER. Thank you, Mr. Chairman. The purpose of today's hearing is to examine the current thinking on the nature and magnitude of the threats that global warming may present to national security. I have experience with this issue.

This April I participated in a hearing on exactly the same topic before the Select Committee on Energy Independence and Global Warming. The issue was not new to me then either. As Chair of the Science Committee I have held numerous hearings on that topic.

I chaired related hearings as evidence that I believe it is important, but increasingly discussions about climate change are dominated by alarmism instead of commonsense. As global warming has become more and more popular politically, predictions of the Earth's future have become more and more dire, and the images of a world a degree warmer sound almost post-apocalyptic.

Some of the scenarios I am told we are destined to face include increased border and immigration stress on the United States from Mexico and the Caribbean, a widening wealth cap and fleeing of intellectual and financial elite within developing countries, increased poverty, floods, monsoons, melting glaciers, tropical cyclones, hurricanes, water contamination, ecosystem destruction, political unrest throughout Asia and Europe, even full-scale war between China and Russia.

Education and understanding of the effects of global warming are critical, but sermons about an environmental apocalypse, while effective in rallying political support, ultimately monger fear, force a poor prioritization of resources, and threaten our ability to respond to more imminent threats.

The national security risk posed by climate change need to be balanced against other threats and priorities. Climate change and its effect on national security have not exactly been ignored. As I mentioned, the Select Committee has already held an identical

hearing. There have been a slew of books and policy papers, several of which will be discussed today. And most importantly, the intelligence community is already studying the issue.

The Office of the Director of National Intelligence informed me that it expects to release an NIE on the issue in early 2008. Nonetheless, both the Senate and House are considering legislation that would force the DNI to submit that NIE that his office is already working on. Holding identical hearings and mandating reports that are already being written has more to do with politics than preparedness.

This is not the first time someone has claimed the sky is falling. The predictions surrounding Y2K were similarly dire. Of course, this time it is different. Every time the sky falls it is different, and every time those who advocate commonsense are chastised for ignoring inescapable peril. Maybe it is my unwavering optimism that protects me from paranoia, or maybe it is just a lifetime of experience with dire prognostications.

As unwise as it would be for us to ignore the national security implications of climate change, it is equally unwise to politicize our security to agree that we exaggerate certain threats and ignore others.

Environmental consequences are not the only problems we have to address in our response to global warming. The other side of this challenge, the side that politicians and green extremists are reluctant to acknowledge, is that our energy demands are rising and will continue to rise. Running out of conventional power plants is a real threat. We need to find solutions like nuclear power that limit carbon emissions but also ensure that our energy needs will be met.

We are also facing unprecedented economic challenges. Does the challenge of competing in the globalized economy mount, rapidly-growing countries like China and India have made it clear again and again that they do not intend to hinder their economic growth to curb climate change. This means that any modest successes we enjoy at limiting our emissions will be completely offset by China and other nations. That also means that we cannot afford to stall our own economic development when other nations will not be similarly handicapped. Solutions that compromise our ability to produce energy or compete in the global economy will be disastrous for America's future.

Fostering a more robust economy is our strongest defense against climate change. The *New York Times* published an article called "Feel Good Versus Do Good on Climate." The weather matters a lot less now than how people respond to it. According to the article, Robert Davis, a climatologist at the University of Virginia, concluded that the number of heat-related deaths in New York in the 1990s was 33 percent lower than in the '60s. That it was not, of course, cooler in the '90s than it was the '60s, but an increase in air conditioning saved lives.

Because it is too late to prevent rising temperatures, the best response is to insure our economy is strong enough to adequately respond. Everyone agrees that the wealthiest countries' individuals will be the least affected by global warming. Putting more people in a position to afford air conditioning will actually save lives.

It has become controversial in today's warming political climate, but it not outrageous to trust that American ingenuity can respond to this challenge as it has responded to challenges in the past. Preparedness demands that we consider how changing circumstances affect the overall picture of our national security, but ultimately solutions to global warming and the multitude of problems that it presents will be solved by the scientific community and emerging technological industries.

As policy-makers our focus should be on encouraging these industries, insuring that our energy needs are met by sources that limit carbon emissions, then by responding to anticipating problems engendered by climate change.

Thank you.

[The prepared statement of Mr. Sensenbrenner follows:]

PREPARED STATEMENT OF REPRESENTATIVE F. JAMES SENSENBRENNER, JR.

The purpose of today's hearing is to "examine current thinking on the nature and magnitude of the threats that global warming may present to national security." I have experience with this issue. This April, I participated in a hearing on the same topic before the Select Committee on Energy Independence and Global Warming. The issue was not new to me then either. As Chairman of the Science Committee, I held numerous hearings on this topic.

That I chaired related hearings is evidence that I believe it is important, but increasingly, discussions about climate change are dominated by alarmism instead of common sense. As global warming has become more and more popular politically, predictions of the Earth's future have become more and more dire and images of the world a degree warmer sound almost post-apocalyptic. Some of the scenarios I am told we are destined to face include: increased border and immigration stress on the United States from Mexico and the Caribbean, a widening wealth gap and fleeing of intellectual and financial elite within developing countries, increased poverty, floods, monsoons, melting glaciers, tropical cyclones, hurricanes, water contamination, ecosystem destruction, political unrest throughout Asia and Europe, and even a full-scale war between China and Russia.

Education and understanding of the effects of global warming are critical, but sermons about an environmental apocalypse, while effective at rallying political support, ultimately monger fear, force a poor prioritization of resources, and threaten our ability to respond to more imminent threats. Each of the above disasters could happen, but the risks need to be balanced against other threats and priorities.

Climate change and its affect on national security have not exactly been ignored. As I mentioned, the Select Committee on Energy Independence has already held an identical hearing. There have been a slew of books and policy papers, several of which will be discussed today. And, most importantly, the intelligence community is already studying the issue. The Office of the Director of National Intelligence informed me that it expects to release a National Intelligence Estimate (NIE) on the issue in early 2008. Nonetheless, both the House and Senate are considering legislation that would force the Director of National Intelligence to submit the NIE that his office is already working on. Holding identical hearings and mandating reports that are already being written has more to do with politics than preparedness.

This is not the first time someone has claimed that "the sky is falling." The predictions surrounding Y2K were similarly dire. Of course, this time is different. Every time the sky falls it is different, and every time, those who advocate common sense are chastised for ignoring the inescapable peril. Maybe it is my unwavering optimism that protects me from paranoia, or maybe it is just a lifetime of experience with dire prognostications. As unwise as it would be for us to ignore the national security implications of climate change, it is equally unwise to politicize our security to a degree that we exaggerate certain threats and ignore others.

Environmental consequences are not the only problems we have to address in our response to global warming. The other side of this challenge, the side that politicians and green extremists are reluctant to acknowledge, is that our energy demands are rising and will continue to rise. Running out of conventional power plants is an actually imminent threat. We need to find solutions, like nuclear power, that limit or eliminate carbon emissions but also ensure that our energy needs will be met.

We are also facing unprecedented economic challenges. As the challenges of competing in a global economy mount, rapidly growing countries like China and India have made clear that they do not intend to hinder their economic growth to curb climate change. This means that any modest successes we enjoy at limiting our emissions will be completely offset by China and other nations. It also means that we cannot afford to stall our own economic development when other nations will not be similarly handicapped. Solutions that compromise our ability to produce energy or compete in a global economy will be disastrous for America's future.

Fostering a more robust economy is our strongest defense against climate change. As the *New York Times* published in an article titled "Feel Good vs. Do Good on Climate," "the weather matters a lot less than how people respond to it." Robert Davis, a climatologist at the University of Virginia, concluded that the number of heat-related deaths in New York in the 1990s was 33 percent lower than the number of deaths in the 1960s. It was not, of course, cooler in the 1990s than it was in the 1960s, but the increase in air conditioning was saving lives. Because it is too late to prevent global warming, the best response is to ensure that our economy is strong enough to adequately respond. Everyone agrees that the wealthiest countries and individuals will be the least affected by global warming.

It has become controversial in today's warming political climate, but it is not outrageous to trust that American ingenuity can respond to this challenge as it has responded to challenges in the past. Preparedness demands that we consider how changing circumstances affect the overall picture of our national security, but ultimately, solutions to global warming and the multitude of problems that it presents will be solved by the scientific community and the emerging technological industries. As policy-makers, our focus should be on encouraging these industries, ensuring that our energy needs are met by sources that limit carbon emissions, and by responding to and anticipating problems engendered by climate change.

As our witnesses testify today, I hope they will focus their answers less on scare tactics and hypothetical cataclysms than on common sense approaches to dealing with the problems we are facing. After all, we know the sky isn't falling if only because hot air rises.

Chairman MILLER. Thank you. Other Members may submit written testimony for the record.

[The prepared statement of Mr. Costello follows:]

PREPARED STATEMENT OF REPRESENTATIVE JERRY F. COSTELLO

Good morning. I want to thank the witnesses for appearing before our committee to discuss *The National Security Implications of Climate Change.*

Within the past year, the Nation has focused on the increasing trends of global warming and the potential devastating results. I believe it is vital to understand the potential national security threats due to the effects of global warming combined with our limited energy supply.

Congress continues to focus on energy reform and ways to curtail our dependence on foreign oil while maintaining a sound environment and national economy. Given the volatility of the oil and gas markets, it makes sense to develop policies that place a greater dependence on domestic resources. As I have said before, one way to accomplish this goal is through the use of domestic fuels.

Towards this end, the United States enjoys an abundant amount of coal, which currently used to produce half of our electricity. I firmly believe coal used in conjunction with carbon capture and storage (CCS) gasification and other clean coal technologies, is part of the solution to achieving U.S. energy independence, continued economic prosperity and improved environmental stewardship.

As we continue to address our energy crisis and the potential threats it poses to the United States, it is imperative to invest in multiple domestic energy sources in order to reduce our dependence on foreign oil and strengthen our national security. I look forward to working with my colleagues as we find practical solutions that lead us down the path of energy independence.

Chairman MILLER. At this time we will, I would like to introduce our first panel, and it is an impressive, distinguished panel.

General Gordon R. Sullivan is the former Chief of Staff of the United States Army and is currently the Chairman of the Military Advisory Board to the Report by the CNA Corporation entitled, "National Security and the Threat of Climate Change." Mr. James Woolsey is the former Director of the Central Intelligence Agency

and is currently Vice-President at Booz Allen Hamilton. He is the author of a chapter in a forthcoming report by the Center for Strategic and International Studies entitled, "Potential Foreign Policy and National Security Implications of Global Climate Change."

It is the spoken testimony—the oral testimony is limited to five minutes. I think you, yes, you all have both submitted written testimony, which is longer or may be longer. It is the practice of the Subcommittee to take testimony under oath. We are an investigations committee. This is not truly an investigation. Since we are asking you to speculate about the future, it is pretty hard to imagine you will be prosecuted later for perjury if your forecasts prove to be incorrect, but do either of you have any objection to being sworn in? We do prefer that you tell us the truth, however, even if perjury prosecutions appear unlikely.

And you have the right to be represented by counsel. Do either of you have counsel with you today?

All right. These are men who are confident of their, of what they will say. If you would now please stand and raise your right hands.

[Witnesses sworn]

Chairman MILLER. Thank you. General Sullivan, you may begin.

Panel 1:

STATEMENT OF GENERAL GORDON R. SULLIVAN, USA (RET.), CHAIRMAN, MILITARY ADVISORY BOARD, THE CNA CORPORATION

General SULLIVAN. Mr. Chairman, Members of the Committee, I am here as the Chairman of the Military Advisory Board to the CNA Corporation. The Advisory Board consists of retired three- and four-star flag officers from the Army, Navy, Air Force, and Marines.

We were charged with looking at the emerging phenomenon known as global climate change through the prism of our own experience and specifically looking at the national security implications of global climate change.

Having said this, I must admit I came to the Advisory Board as a skeptic. There are lots—and I am not sure some of the others didn't as well—there are lots of conflicting information on the subject of climate change, and like most public policy issues in America, many opinions on this specific issue.

After we listened to leaders of the scientific, business, and Governmental communities, both I and my colleagues came to agree that global climate change is and will be a significant threat to our national security. The potential destabilizing impacts of global climate change include reduced access to fresh water, impaired food production, health issues, especially from vector and food-borne diseases, and land loss, flooding and so forth. And the displacement of major populations.

And overall we view these phenomena as related to failed states, growth of terrorism, mass migrations, and greater regional and inter-regional instability.

The findings of the Board are first, projected climate change poses a serious threat to America's national security. Potential na-

tional threats to the Nation—potential threats to the Nation's security require careful study and prudent planning. Read the NIE.

Second, climate change acts as a threat multiplier for instability in some of the most volatile regions of the world.

Projected climate change will add to tensions even in stable regions of the world.

Fourth, climate change, national security, and energy dependence are a related set of global challenges.

The recommendations of the Board are that we cannot wait for certainty in this issue, as been pointed out here in the two statements this morning. There is a lack of certainty, but there is certainly no lack of challenges, and in our view failing to act because a warning isn't precise would be imprudent.

Second, the United States should commit to a stronger national and international role to help stabilize climate changes at levels which will avoid significant disruption to global stability and security.

And we should commit to global partnerships to work in that regard, and I believe there have been a number of activities this week which support that finding.

Fourth, the Department of Defense, which it is doing, should enhance its operational capabilities by accelerating the adoption of improved business processes and innovative technologies.

And fifth, DOD should conduct an assessment of the impact on military installations worldwide of the rise of sea level, extreme weather events, and other possible climate change impacts over the next 30 to 40 years.

Climate change, national security, and energy dependence are all interrelated. Simply hoping that these relationships will remain static is simply not acceptable given our training and experience as military leaders. And hoping that everything is going to be great probably won't work, at least in our view.

In closing, I would say that most of us on the Advisory Board were in the military service of the United States of America for over 30 years, most of it during the Cold War. Very high levels of catastrophe would have—could have taken place and might have taken place—if we didn't invest in military preparedness and awareness of the threats we face. In our view there is uncertainty here, and it would be prudent for us to pay attention and to do our best to understand what is really going on so that we could respond if asked.

Mr. Chairman, I request my full statement be added to the report, and I stand ready to answer your questions.

[The prepared statement of General Sullivan follows:]

PREPARED STATEMENT OF GENERAL GORDON R. SULLIVAN, USA (RET.)

Thank you, Mr. Chairman, and distinguished Members of the Subcommittee, for the opportunity to appear before you on this important issue. Today I am here as Chairman of the Military Advisory Board to The CNA Corporation report on *"National Security and the Threat of Climate Change."* The Advisory Board consists of three and four star Flag Officers from the Army, Navy, Air Force and Marine Corps. Our charge was to learn as much as we could in a relatively short period about the emerging phenomenon of global climate change using our experience as military leaders to process our learning through a national security lens. In other words, what are the national security implications of climate change?

When I was asked to be on the Military Advisory Board, I was both pleased and skeptical. Pleased because of one simple and straightforward fact—I am 70 years old, I have served my country for over 50 years in both peace and war and now in the late stages of my life I feel as if the sacrifices I and my soldiers, colleagues, friends, and my family made for America are now being overtaken by a much more powerful and significant challenge to the well-being of our nation.

Having said this, I must admit I came to the Advisory Board as a skeptic. There is a lot of conflicting information on the subject of climate change and like most public policy issues in America, many opinions, on the subject.

After listening to leaders of the scientific, business, and governmental communities, my colleagues and I came to agree that global climate change is and will be a significant threat to our national security and in a larger sense to life on Earth as we know it to be.

The potential destabilizing impacts of climate change include: reduced access to fresh water; impaired food production, health catastrophes—especially from vector- and food-borne diseases; and land loss, flooding and the displacement of major populations.

What are the potential security consequences of these destabilizing effects? Overall, they increase the potential for failed states and the growth of terrorism; mass migrations will lead to greater regional and global tensions; and conflicts over resources are almost certain to escalate.

The findings of the Military Advisory Board are:

- **First, projected climate change poses a serious threat to America's national security.**
  Potential threats to the Nation's security require careful study and prudent planning—to counter and mitigate potential outcomes.
- **Second, climate change acts as a threat multiplier for instability in some of the most volatile regions of the world.**
  Many governments in Asia, Africa, and the Middle East are already on edge in terms of their ability to provide basic needs: food, water, shelter, and stability. Projected climate change will exacerbate the problems in these regions and add to the problems of effective governance.
- **Third, projected climate change will add to tensions even in stable regions of the world.**
  Developed nations, including the U.S. and countries in Europe, may experience increases in immigrants and refugees as drought increases and food production declines in Africa and Latin America. Pandemics and the spread of infectious diseases, caused by extreme weather events and natural disasters, as the U.S. experienced with Hurricane Katrina, may lead to increased domestic missions for U.S. military personnel-lowering troop availability.
- **And, fourth, climate change, national security and energy dependence are a related set of global challenges.**
  As President Bush noted in his 2007 State of the Union address, dependence on foreign oil leaves us more vulnerable to hostile regimes and terrorists, and clean domestic energy alternatives help us confront the serious challenge of global climate change. Because the issues are linked, solutions to one affect the others.

The recommendations of the Military Advisory Board are:

- **First, the national security consequences of climate change should be fully integrated into national security and national defense strategies.**
  As military leaders we know we cannot wait for certainty. Failing to act because a warning isn't precise is unacceptable. Numerous parts of the U.S. Government conduct analyses of various aspects of our national security situation covering different timeframes and at varying levels of detail. These analyses should consider the consequences of climate change.
- **Second, the U.S. should commit to a stronger national and international role to help stabilize climate changes at levels that will avoid significant disruption to global security and stability.**
  All agencies involved with climate science, treaty negotiations, energy research, economic policy, and national security should participate in an interagency process to develop a deliberate policy to reduce future risk to national security from climate change. Actions fall into two main categories: mitigating climate change to the extent possible by setting targets for long-term

reductions in greenhouse gas emissions and adapting to those effects that cannot be mitigated.

- **Third, the U.S. should commit to global partnerships that help less developed nations build the capacity and resiliency to better manage climate impacts.**
  Some of the nations predicted to be most affected by climate are those with the least capacity to adapt or cope. This is especially true in Africa. The U.S. should focus on enhancing the capacity of weak African governments to better cope with social needs and to resist to overtures of well-funded extremists to provide schools, hospitals, health care, and food.
- **Fourth, the Department of Defense (DOD) should enhance its operational capability by accelerating the adoption of improved business processes and innovative technologies that result in improved U.S. combat power through energy efficiency.**
  DOD should require more efficient combat systems and include the actual cost of delivering fuel when evaluating the advantages of intervention in efficiency.
- **And, fifth, DOD should conduct an assessment of the impact on U.S. military installations worldwide of rising sea levels, extreme weather events, and other possible climate change impacts over the next 30 to 40 years.**
  As part of prudent planning DOD should assess the impact of rising sea levels, extreme weather events, drought, and other climate impacts on its infrastructures so its installations and facilities can be made resilient.

Climate change, National Security and energy dependence are inter-related. Hoping that these relationships will remain static is simply not acceptable given our training and experience as military leaders.

The path to mitigating the worst security consequences of climate change involves reducing global greenhouse gas emissions. There is a relationship between carbon emissions and our national security. I think that the evidence is there that would suggest that we have to start paying attention.

The Federal Government and the Department of Defense can help and lead in this area. DOD is the largest energy user in the U.S. Government and one of the largest energy users in the Nation. One of our key vulnerabilities on the battlefield today is transportation of fuel for combat use. We are using a lot of fuel in Iraq, and the Army in particular is experiencing battlefield casualties on their fuel convoy's—they are difficult to protect—so to the extent that DOD can develop new technologies to protect the troops by improving energy efficiency, so too can those technologies be beneficial to our country. In fact, a Defense Science Board study now underway and another one in 2001 said that the energy challenges of our nation and those of our military are similar and that DOD can lead in resolving our nation's energy challenges even as DOD meets its own challenges in this area. In a very real sense, the buying power of the Federal Government can help lead our nation to low carbon energy futures.

In closing I would say that most of us on the Military Advisory Board were in the service through the Cold War. All of us served for over 30 years. Most of us retired in the '90s. Very high levels of catastrophe could have occurred at that time, and by investing in military preparedness we were able to avert the dangers of that time. In our view, there's a lot of uncertainty here, but we need to be paying attention to what might happen and what is happening around the world from the threats of climate change.

Thank you again, Mr. Chairman, for the opportunity to appear before you here today. Mr. Chairman, I request my statement and the report to be entered into the record.

BIOGRAPHY FOR GENERAL GORDON R. SULLIVAN

General Sullivan was the 32nd Chief of Staff—the senior general officer in the Army and a member of the Joint Chiefs of Staff. As the Chief of Staff of the Army, he created the vision and led the team that helped transition the Army from its Cold War posture.

During his Army career, General Sullivan also served as Vice Chief of Staff (June 1990–June 1991); Deputy Chief of Staff for Operations and Plans (July 1989–June 1990); Commanding General, 1st Infantry Division (Mechanized), Fort Riley, Kansas (June 1988–July 1989); Deputy Commandant, U.S. Army Command and General Staff College, Fort Leavenworth, Kansas (March 1987–June 1988); and Assistant

Commandant, U.S. Army Armor School, Fort Knox, Kentucky (November 1983–July 1985). His overseas assignments included four tours in Europe, two in Vietnam and one in Korea. He served as he served as Chief of Staff to Secretary of Defense Dick Cheney under the first Bush Administration.

General Sullivan was commissioned a second lieutenant of Armor and awarded a Bachelor of Arts degree in History from Norwich University in 1959. He holds a Master of Arts degree in Political Science from the University of New Hampshire. His professional military education includes the U.S. Army Armor School Basic and Advanced Courses, the Command and General Staff College, and the Army War College.

General Sullivan is currently the President and Chief Operating Officer of the Association of the United States Army, headquartered in Arlington, Virginia. He assumed his current position at the Association in February 1998 after serving as President, Coleman Federal in Washington, D.C.

He is the co-author, with Michael V. Harper, of *Hope Is Not a Method* (Random House, 1996), which chronicles the challenges of transforming the post-Cold War Army. Gordon Sullivan is a trustee of Norwich University and serves on the boards of several major corporations, including Newell-Rubbermaid, Shell Oil and Getronics Government Solutions, L.L.C. He is also a Director of the Atlantic Council of the United States and the George C. Marshall Foundation and the Chairman Emeritus of the Marshall Legacy Institute.

Chairman MILLER. Thank you, General. It will, of course, be added.

Mr. Woolsey.

STATEMENT OF MR. R. JAMES WOOLSEY, VICE PRESIDENT, BOOZ ALLEN HAMILTON

Mr. WOOLSEY. Thank you, Mr. Chairman. It is an honor to be asked to appear before you today and to appear beside my friend, General Sullivan.

I want to stress I am speaking only for myself and not for any institution that I am associated with. I have attached a 24-page draft of the chapter that you referred to when you introduced me, and I would like to use these five minutes to point out several things in that chapter.

I deal there with two types of risks to our future. I call them malignant and malevolent disruptions. By malignant I mean something that, like cancer in the human body, is not intentionally caused but is the, results from our behavior to some extent—and this could either be overloading our electricity grid and having it fail because of storms and tree branches falling in Ohio, as it did four years ago, or putting too much carbon into the atmosphere and, some decades from now, perhaps contributing to sinking Bangladesh beneath the waves. We are not trying to take down Canada's electricity, and we are not trying to sink Bangladesh beneath the waves, but sometimes our behavior can cause cascading failures in complex systems.

We also, however, face a second set of problems that I called malevolent because terrorists are a lot smarter than tree branches. And the vulnerabilities of our energy systems to intentional malevolent interference from terrorism are set forth and described rather fully in the first pages of the report.

I think with respect to climate change, it is important to realize that the most disastrous potential effects are, I think, ocean, sea-level height changes. And those may come about at unexpected times and in unexpected ways, because we have entered a period in which there is exponential change as a result of warming to a degree that we have not—even if we have not accurately forecast

precisely when that is going to occur. I think certainty is very difficult in this field, but what should not be difficult is realizing that, for both potential malignant changes such as climate change and malevolent changes such as terrorism, the cause may operate and act in ways that we cannot fully understand at this point.

What I want to stress is, and I set it up in a perhaps curious way as a dialogue between what I call a tree hugger and a hawk: My tree hugger is the ghost of John Muir, and my hawk is the ghost of George S. Patton. Muir in the chapter is concerned exclusively with carbon. Patton is concerned exclusively with terrorism. The point is that, although they don't convince one another of the importance of their concern, what they end up finding they need to do in order to deal with both sets of problems rather remarkably overlaps.

Both in the chapter come to the conclusion that radical improvement in efficiency of buildings, particularly as steps that have positive paybacks, not costing anything but having internal rates of return of 10 percent or more, radically increasing the use of combined heat and power or cogeneration as Denmark does, and substantially changing the incentives for long-term movement toward distributed generation of electricity and heating and cooling. Together with following California's lead in decoupling revenues from earnings for electric utilities, so that a utility may make money by improving its efficiency and investing, even if that doesn't produce more electricity. That has led California in the last 20 years to be absolutely level in its degree of energy use per capita, electricity use per capita, whereas the rest of the country has gone up 60 percent.

Some of these changes, including—and I have run out of time—moving toward also plug-in hybrid gasoline electric vehicles, flexible fuel vehicles, biofuels, more use of electricity for automobile propulsion as well, are all steps that Patton and Muir find they can agree on, even though they are solving different problems.

And I would urge on really all participants in this debate, Mr. Chairman, that even though I think both of these problems are serious, I consider myself in this context both a tree hugger and a hawk. I don't think there should be any problem, nearly as much problem in cooperating and working together on solutions as there may be on convincing one another of the substantive concern that each of several different groups may have.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Woolsey follows:]

PREPARED STATEMENT OF R. JAMES WOOLSEY

Mr. Chairman and Members of the Committee. It is an honor to be asked to testify before you today on this important subject. By way of identification, I am now a Vice President of a large consulting firm, where I work on energy issues; before I became a consultant five years ago I practiced law for 22 years in the field of civil litigation and I have also served in the Federal Government for a total of twelve years on five different occasions, holding Presidential appointments in four administrations, two Republican and two Democratic—all in the field of national security. Most recently I served as Director of Central Intelligence 1993–95. I am speaking today solely on my own behalf and not that of any institution with which I am associated.

I have attached to this opening statement a 24-page draft of a chapter I am contributing to a collection to be published in several months on national security and climate change. As the chapter's text indicates, of the several authors submitting

contributions to this book I was asked to concentrate on the extremely severe case of several possible climate change scenarios.

In my view, in the interest of our nation's security, for the foreseeable future we need to keep our attention on two potentially disastrous types of disruptions of our society. I call these "malignant" and "malevolent" disruptions. The first, like cancer in the human body, is not intentionally caused but the risk of disruption or even disaster may be enhanced by some aspects of our behavior—if we overload our electricity grid we may become more vulnerable to blackouts, or if we put too much carbon into the atmosphere we may enhance the risk of climate change. But terrorists are smarter than tree branches in storms, so we also need to be concerned about "malevolent," or intentional, attacks. Some of these may exploit vulnerabilities in our energy production and distribution or other weaknesses in our infrastructure.

If we want to be as secure as possible, we cannot ignore either type of threat. But normally these two threats are addressed by different groups who sometimes give short shrift to the threat that is of central concern to the other. In the chapter I call the group that focuses on malignant threats such as climate change the "tree huggers" and that which focuses on malevolent threats such as terrorism the "hawks." The first 15 pages of the chapter address both of these types of risk: malignant and malevolent.

I would emphasize that although there is broad scientific agreement that future climate change is a serious problem and, in important measure, one that is caused by human activity, there is substantial uncertainty in predicting the point at which the increasing concentration of global warming gases in the atmosphere would have enough of an effect on temperature to lead to irreversible climate change. This is because climate models tend to be linear and have great difficulty forecasting the exponential changes which at some point could tip us over into irreversibility—for example, the rapid melting of the West Antarctic ice sheet, which could cause a rise of five meters or more in sea levels. So most of the predictions of disastrous change rely on data but use that data to construct analogies to climate change in the past (pp. 4–6 of chapter). As NASA's James Hansen puts it, "I'm a modeler, too, but I rate data higher than models."

Still, even relying on analogies, when one considers today's level of CO_2 emissions and the prospect of substantial growth in them as world population increases and economies develop (pp. 6–7), it seems clear that there is enough degree of risk that some action must be taken. This is in substantial part because of prospective sea level rise and coastal flooding, which Dr. Hansen calls "the big global issue." Such flooding could have disastrous effects on populations in this country and all over the world and seriously affect our military capabilities, world political balance, energy and water systems, and much else (pp. 7–11).

At the same time, many aspects of our society, including the way we produce and use energy, make us vulnerable to terrorist attack for the foreseeable future. These include our dependence on oil (pp. 11–13) and the vulnerability of our electricity grid, particularly to physical attack on its transformers and cyber attack on its Supervisory Control and Data Acquisition (SCADA) systems (pp. 13–14). An important recent commission report also describes the vulnerability of the grid to Electro-Magnetic Pulse (EMP) attack, unfortunately something that could readily be contemplated in the not-distant future by countries having only a primitive nuclear weapon, a SCUD missile, and a fishing boat (pp. 14–15).

The last eight pages of the chapter set out an imaginary meeting between a "tree hugger" and a "hawk" to try to design an energy policy for the country in light of the need to deal with both malignant and malevolent risks. I picked two of my favorite Americans for these roles. For the tree hugger I chose the ghost of John Muir and for the hawk the ghost of General George S. Patton. In the meeting Muir is focused exclusively on climate change and Patton exclusively on terrorism, but although there are points where they disagree, they are somewhat surprisingly able to come up with a common nine-part energy plan that reduces both types of risks substantially—it involves energy conservation, distributed and renewable production of both electricity and alternative fuels, plug-in hybrids and flexible fuel vehicles. Whatever package the United States settles on, Mr. Chairman, in my view we should do so in the spirit of this mythical Muir-Patton discussion and treat seriously both of these looming threats to our nation and indeed to civilization itself.

BIOGRAPHY FOR R. JAMES WOOLSEY

R. James Woolsey joined Booz Allen Hamilton in July 2002 as a Vice President and officer. He is with the firm's Energy practice, located in McLean, Virginia. Previously Mr. Woolsey served in the U.S. Government on five different occasions, where he held Presidential appointments in two Republican and two Democratic ad-

ministrations. He was also previously a partner at the law firm of Shea & Gardner in Washington, DC, where he practiced for 22 years in the fields of civil litigation and alternative dispute resolution.

During his 12 years of government service Mr. Woolsey was: Director of Central Intelligence from 1993 to 1995; Ambassador to the Negotiation on Conventional Armed Forces in Europe (CFE), Vienna, 1989–1991; Under Secretary of the Navy, 1977–1979; and General Counsel to the U.S. Senate Committee on Armed Services, 1970–1973. He was also appointed by the President as Delegate at Large to the U.S.–Soviet Strategic Arms Reduction Talks (START) and Nuclear and Space Arms Talks (NST), and served in that capacity on a part-time basis in Geneva, Switzerland, 1983–1986. As an officer in the U.S. Army, he was an adviser on the U.S. Delegation to the Strategic Arms Limitation Talks (SALT I), Helsinki and Vienna, 1969–1970.

Mr. Woolsey is currently Co-Chairman (with former Secretary of State George Shultz) of the Committee on the Present Danger. He is also Chairman of the Advisory Boards of the Clean Fuels Foundation and the New Uses Council, and a Trustee of the Center for Strategic & International Studies and the Center for Strategic & Budgetary Assessments. He also serves on the National Commission on Energy Policy. Previously, he was Chairman of the Executive Committee of the Board of Regents of The Smithsonian Institution, and a trustee of Stanford University, The Goldwater Scholarship Foundation, and the Aerospace Corporation. He has also been a member of The National Commission on Terrorism, 1999–2000; The Commission to Assess the Ballistic Missile Threat to the U.S. (Rumsfeld Commission), 1998; The President's Commission on Federal Ethics Law Reform, 1989; The President's Blue Ribbon Commission on Defense Management (Packard Commission), 1985–1986; and The President's Commission on Strategic Forces (Scowcroft Commission), 1983.

Mr. Woolsey is presently a managing director of the Homeland Security Fund of Paladin Capital Group and a member of VantagePoint Management, Inc.'s Cleantech Advisory Council. He has served in the past as a member of boards of directors of a number of other publicly and privately held companies, generally in fields related to technology and security, including Martin Marietta; British Aerospace, Inc.; Fairchild Industries; Yurie Systems, Inc.; and USF&G. He also served as a member of the Board of Governors of the Philadelphia Stock Exchange.

Mr. Woolsey was born in Tulsa, Oklahoma, and attended Tulsa public schools, graduating from Tulsa Central High School. He received his B.A. degree from Stanford University (1963, With Great Distinction, Phi Beta Kappa), an M.A. from Oxford University (Rhodes Scholar 1963–1965), and an LL.B from Yale Law School (1968, Managing Editor of the *Yale Law Journal*).

Mr. Woolsey is a frequent contributor of articles to major publications, and from time to time gives public speeches and media interviews on the subjects of foreign affairs, defense, energy, critical infrastructure protection and resilience, and intelligence. He is married to Suzanne Haley Woolsey and they have three sons, Robert, Daniel, and Benjamin.

DISCUSSION

Chairman MILLER. Thank you, Mr. Woolsey. It is difficult to wear both Birkenstocks and combat boots at the same time.

Mr. WOOLSEY. Well, it is one foot each maybe.

CLIMATE CHANGE DISASTER PLANNING

Chairman MILLER. In the draft of your report that you did provide us, you began with a quote from a British intelligence officer who retired in 1950 after 47 years of service and said, "Year after year the worriers and the fretters came to me with awful predictions of the outbreak of war. I denied it each time. I was only wrong twice."

Mr. WOOLSEY. Yes, sir.

Chairman MILLER. How dire—well, how probable—do the consequences that we have. . .? Neither of you are scientists. Neither of you really can predict. We haven't called you for that reason. But

how probable do the dire consequences need to be for us to feel some urgency in planning for the possibilities?

General Sullivan.

General SULLIVAN. Well, my response to that is that I, first of all, I believe there is some planning going on, and it is interesting that this morning, when I arrived at the office, I had the statement of General George Casey, Jr., Chief of Staff in the Army, which was made yesterday in a hearing. General Casey said the following: "Population growth and its youth bulge will increase opportunities for instability, radicalism, and extremism. Resource demand for energy, water, and food for growing populations will increase competition and conflict. Climate change and natural disasters will cause humanitarian crises, population migrations, and epidemic diseases." That was in his hearing yesterday before the Senate.

I think the leadership in the Pentagon and around the globe in their official positions are well aware of the nature of this phenomenon and responding appropriately. I have every reason to believe they are. AFRICOM, the new African command, which is being stood up, I feel quite sure will be paying a lot of attention to some of the issues which are raised.

Chairman MILLER. Mr. Woolsey, do you have any sense of what kind of planning should be taking place and how probable the different scenarios need to be for us to be well deep into planning for them?

Mr. WOOLSEY. If one looks at probabilities, as the models of the IPCC do, one comes up with sea-level rise, and I tend to use that as a proxy for a number of climate effects. Sea-level rise of something between six or eight inches and two feet during the 21st century. That could be substantial for some parts of the world, such as Bangladesh. And it could be accompanied by a number of very difficult climate circumstances such as glacial melting, which would make parts of South America very difficult to live in from the point of view of water and the like. It could be quite serious.

But the really serious problem is if we hit—and it is hard to attach a probability to this—if we hit one of these tipping points which causes something like a rapid melting of the West Antarctic ice shelf. If I could just, an analogy in history: Between 14,000 and 15,000 years ago, sea level was rising at four or five times today's rate. And then it went from rapid to amok and increased another factor of four or five and went up by about 20 meters in 400 years, so about five meters a century. Five meters a century is absolutely huge.

A lot of climatologists believe that was because the West Antarctic ice shelf may have melted. It could have been something else. But what we have to worry about is not something that human beings can predict very well with their models, which operate in a linear fashion. The key point is: When do you hit these tipping points, the knee of the curve, the exponential change in which from our point of view everything begins to accelerate? From the point of view of nature it has probably been operating exponentially all the time, going up by factors of one to two to four to 16, et cetera.

So I—it is a long-winded way of saying—I have a hard time attaching a probability to it, and I think the climatologists do, too.

It is the judgment of people like Dr. Hansen and others about these historical analogies and when things have changed rapidly in the past and why, that I think we really have to rely on to say it is prudent to begin to do some things, and some important things, now.

But a lot of what we need to do serves other purposes such as making us more resilient against terrorism, and a good deal of it actually makes money rather than costing money. So I come out that we should begin to move now, even if we don't have a really good sense of the probabilities.

Chairman MILLER. My time is now expired.

Mr. Sensenbrenner.

Mr. SENSENBRENNER. Thank you very much, Mr. Chairman.

STRATEGIC PLANNING TO CREATE GOODWILL TOWARDS THE U.S.

I guess I want to go from big philosophical things to little, practical things.

I think we all know that America's standing in many parts of the world is not what we would like to have it be. I look back at when the earthquake and tsunami hit in Southeast Asia. The fact that we had military assets available ended up being a lifesaver in Indonesia, again, one of the countries where our approval rating is in the tank.

But even people who might have been Islamic fundamentalists who hate the values that we stand for recognize that we saved a lot of lives, and we also saved a lot of suffering of people whose lives were not in jeopardy.

How do you, each of you think that we ought to be looking at an intelligence estimate in terms of not necessarily dealing toward a catastrophic event which may or may not have been caused by climate, but essentially building up goodwill that we are on their side in things like providing agricultural self-sufficiency, which we have done very well since the end of the Second World War, encouraging reforestation, which everybody agrees helps sop up carbon, and reversing the denuding of the rainforests in certain parts of Africa and South America and other parts of the world.

How does intelligence and strategic planning fit into that?

General SULLIVAN. I think very closely. If you look at East Africa, there is migration from north to south out of Somalia into Kenya and nations south. The problem is—well, not the problem—they are seeking food, they are seeking in some cases fish, but the Wildlife Federation has a program to assist countries in East Africa to create coast guards. Interestingly enough, with relatively small boats people in those countries are able to go out to patrol their own shores, which, in fact, limits overfishing.

I think there are many things as you point out which can be done, and I think commands like AFRICOM under General Kip Ward and his people, they are looking at those issues: deforestation and economic self-sufficiency, agricultural self-sufficiency. And there have been pretty good examples of how reforestating—if there is such a word; reforesting, or whatever the word is—helps.

And I think those are simple things which can be done and will be done. I feel reasonably sure they will be done.

Mr. SENSENBRENNER. How do you put an American face on that, though?

General SULLIVAN. How do you put it?

Mr. SENSENBRENNER. How do you put an American face on that?

General SULLIVAN. Well, I think, I don't know this for sure, but I think the Special Forces and some of the military missions which are going in parts of our effort do have an American face.

Mr. WOOLSEY. Congressman, I think that in the. . . Even short of any of these sort of catastrophic changes that I referred to earlier, even modest amounts of climate change, particularly warming in the Southern Hemisphere let us say here, is likely to have enough weather changes associated with it and crop yield changes and fresh water changes that you may start to see rather substantial beginnings of migrations. And a lot of refugees and so forth, particularly from places which are very low-lying: deltas, Bangladesh, et cetera.

I think that until one gets into rather large levels of sea-level rise, the worldwide potential deploying and assistance that U.S. military forces can provide can be of benefit, very substantial benefit in foreign countries, such as they were in Indonesia, as you said—after the tsunami. But they can also be good ambassadors for the country.

And I think that some of relatively easy things to do could pay big dividends. For example, we have some amphibious ships, as I understand it, that are about to get scrapped. And it might not be too expensive, I know some groups are talking about doing this, to turn one or more of them into hospital ships for the purpose of rapid deployment for our own country—in case we have to deal with another tsunami of our own, such as the hurricane damage in New Orleans—but also for places like Indonesia and the rest. One can do a great deal by showing up with even a relatively small contingent of the U.S. Navy in a hospital ship.

Mr. SENSENBRENNER. Thank you.

General SULLIVAN. Can I come back to follow up?

Chairman MILLER. General Sullivan, go ahead.

General SULLIVAN. Just to Sensenbrenner. I have just been told Colonel Retired Kent Butts will be on the next panel. Next week—I don't want to steal his thunder, I will let him explain it—but he is hosting a conference up at Carlisle Barracks with AFRICOM and the Army people, working on the type of issues you just raised, and I would let him explain it to you.

Chairman MILLER. Thank you, General Sullivan.

Mr. Baird.

OCEAN ACIDIFICATION

Mr. BAIRD. Just a couple of questions. Thank you, first of all, for your service and for being here today.

We tend to focus on climate change as the, maybe, the headline impact of CO_2 accumulation in the atmosphere. But the CO_2 accumulation also has another effect which in some ways may be at least as dramatic, and that has to do with increasing the acidification of the oceans. And at least some research studies are suggesting rather strongly that as acidification goes up, the coral reefs go down. In fact, my understanding is in geological history the last

time that we estimate that CO_2 levels were this high and acidification was this high, there are no fossil records of coral reefs for that period. Because—basically, and this is not—you don't have to look at climate trends, you can replicate this in a lab. You can make an enclosed base, pump some CO_2 into the air, it gets dissolved into the water, that changes the acidity. That acidity takes up the calcium carbonate, and there you go: You have got no coral reefs.

And I don't know if that has been looked at. And I am not—it is not clear to me how the national security implications—except, for some countries, it is their nation, the lack of coral—so any comments on that would be more than welcome on that issue. And also it has an effect on sea life, et cetera.

General SULLIVAN. I am not, as been pointed out—and truth in lending—I am not a scientist. I am a history major. I was a soldier for the bulk of my adult life, so let the record show that.

But number two, I have visited Woods Hole Oceanographic Institute and actually I have visited a couple of times, and I do know that scientists there are very clear on the subject which you raise. That is, acidization of the oceans is having a detrimental effect on plankton, on the growth of krill, so forth and so on. And coral reefs are, in fact, diminished, which is reducing sea life, which is reducing food for populations which get their, frankly, get their protein—much of their protein—from the ocean.

And there is a direct link in my view connecting the dots, not as a scientist, but as a soldier. There is a direct link between that—those phenomenon—and unrest, and that unrest causes the rest of the chain to be activated: that is, extremists, opportunists who are selling food for exorbitant amounts of money and so forth and so on. Terrorism.

Mr. WOOLSEY. Congressman, I would agree with General Sullivan, but I would jump perhaps quickly to what do we do about it. And if we look at the fact that today the carbon dioxide concentrations in the atmosphere are approaching double what they have historically been when the world's climate has been more or less like this, two major recent studies by institutions cited on page 17 of my chapter indicate that if you just take the world's buildings and just look at projects to improve their, reduce their use of energy, that has a 10 percent or greater internal rate of return. So all of these make money. They don't cost anything. Up front they cost something, but they all have at least a 10 percent or greater internal rate of return.

Just from the buildings in the world, one could hold global warming or, say, CO_2 concentrations to somewhere between 450 and 550 parts per million. That would be a stunning achievement compared with all of what else is being discussed, with respect to CO_2 concentrations. That is the first thing that my mythical John Muir and mythical George Patton agree on doing. And it is money-making.

So I think if one is even to a modest degree concerned about CO_2 concentrations in the ocean—I think for the reasons General Sullivan said we ought to be more than modestly concerned—why not go ahead and make the money and do it: make these changes anyway before we have to decide whether it is disastrous or just difficult?

TRANSPORTING FUEL IN IRAQ

Mr. BAIRD. I appreciate it. Let me raise one other issue, and my time will probably be expired, but if you look at the situation we have in Iraq right now with the infrastructure—particularly energy being a critical factor—transporting petroleum products or energy over either long pipelines or long transmission lines creates a system that is vulnerable to even the most rudimentary insurgent group of RPGs. You can blow up a pipeline, you can knock down a transmission line with a hacksaw.

Amory Lovins, who I am sure you gentlemen probably know, has done some very important work on national security implications of dispersed energy versus local energy, soft energy paths. My understanding is he has gotten scant attention. He has tried to get attention from our planners in Iraq, but I would certainly think we ought to spend a whole lot more time talking to Amory, listening to Amory Lovins, and implementing some of his recommendations in Iraq rather than trying to secure these pipelines at the lives of our boys over there.

Mr. WOOLSEY. Congressman, Amory is an old friend of mine. I wrote the forward to his book, *Brutal Power,* 25 years ago. He was on my panel for the Defense Science Board. I chaired the policy panel of their recent study of energy issues in defense that is about to come out.

And I think you are exactly right. The real fuel cost at the front lines is many hundreds of dollars per barrel of fuel if you allocate all of the logistical training that is needed to get the fuel forward. And energy-savings capabilities for our deployed forces are a very important part of their being able to fight effectively, as well as all of the other issues that we are discussing today.

Mr. BAIRD. Thank you.

General SULLIVAN. Seventy percent of the weight the Army carries into battle is liquid. It is either fuel or water. It is a huge number, and they are working very hard: I can assure you the scientists and the research and development people are working very, very diligently to reduce energy usage to move, you know, this. I am not looking at the numbers, but it is big. We will have to get it there.

Chairman MILLER. Thank you for your testimony. Your written testimony also makes a point that gasoline convoys are especially difficult to protect. I believe it was, maybe it was General Woolsey, Mr. Woolsey.

General SULLIVAN. Right.

Chairman MILLER. Mr. Rohrabacher.

ARE HUMANS CAUSING CLIMATE CHANGE?

Mr. ROHRABACHER. Thank you. I can tell from your testimony that you both believe that there is climate change taking place, and I think most people will agree that there is a climate change taking place. Are you both convinced that the climate change that is taking place is manmade as compared to the many other climate changes that we have gone through as Mr. Woolsey has already made reference to in his testimony?

Mr. WOOLSEY. I am not certain it all is. I think it is, a substantial share of it is, as the scientists call it, anthropogenic. That is certainly the conclusion of the Inter-Governmental Panel on Climate Change, but I don't think it matters in a way.

Mr. ROHRABACHER. Okay. I am going to follow up on that, but General, do you believe that the climate change that we are going through as compared to all these other times that there has been a climate change that has occurred on this Earth is now caused by human activity?

General SULLIVAN. No.

Mr. ROHRABACHER. That is very important, because in the decisions that we are making here, we are being told we have to do certain things and restrict human activity in a way to stop the climate change, which both of you now seem to indicate there is a natural occurrence.

Now, those of us who are skeptical about the climate change theory are not skeptical that there are climate, major climate changes that happen in the Earth, and as Mr. Woolsey has repeatedly pointed out in his testimony, we should be prepared for that.

And also let me note that those of us who are skeptics of the global warming theories that were being presented, I would agree totally with you, Mr. Woolsey, when you suggest that we should be making our engines more efficient for energy independence, also for health reasons, and because we are concerned about clean air and the health of our people. And also there are long-term economic benefits to having more efficient engines.

But there is a difference about where you put your emphasis if you buy into what is being told to us today that the climate cycle that we are in is caused by human activity, by humans producing more CO_2. And then it is a whole different thing. I certainly buy into, I think there is nothing we are going to do that is going to prevent a cycle of climate that, by the way, is going on on Mars and Jupiter at the same time.

General SULLIVAN. Well, I——

Mr. ROHRABACHER. Yes, sir. Go right ahead.

General SULLIVAN.—don't agree with that.

Mr. ROHRABACHER. Okay.

General SULLIVAN. I don't agree with that.

Mr. ROHRABACHER. So you think——

General SULLIVAN. I think——

Mr. ROHRABACHER.—you think there is some things that we can actually do——

General SULLIVAN. I think there are some things we can do to mitigate——

Mr. ROHRABACHER. Oh, no, no. Not mitigate. Reverse. No, no. Mitigate is——

General SULLIVAN. Well, I don't know, even reverse. We reversed ozone.

Mr. ROHRABACHER. Well——

General SULLIVAN. We reversed the hole, the ozone hole, by limiting hair spray and other, the use of freon in our cars.

CAN HUMAN BEHAVIOR REVERSE CLIMATE CHANGE?

Mr. ROHRABACHER. But that is another issue that I will have to say deserves some debate, but in terms of actually reversing the climate change that we are going through today by changing human activity is a lot different than saying, which is what Mr. Woolsey is saying, we need to do things to plot a strategy so that that does not, this climate change that is coming about like the many other cycles that have, we have gone through on this Earth, that we need to be prepared for it because there will be national security implications.

Mr. WOOLSEY. Congressman.

Mr. ROHRABACHER. Go ahead.

Mr. WOOLSEY. Even if some portion of the climate—let us say the CO_2 concentrations—are from non-anthropogenic causes, if the pace is the pace that we are seeing now, and we do a number of things that make sense anyway for counter-terrorism purposes, for saving money purposes——

Mr. ROHRABACHER. Yeah.

Mr. WOOLSEY.—et cetera, we may be able to have an effect whether or not they are all, the changes are all anthropogenic, or as I believe, probably substantially all anthropogenic——

Mr. ROHRABACHER. Well, that is correct.

Mr. WOOLSEY.—or only a little bit anthropogenic.

Mr. ROHRABACHER. That is correct. However, there is a great debate, and obviously there are, you may not be aware that there are a large number of scientists who suggest that as the Earth changes and has gone through this cycle, that is what is producing more CO_2. It is not the fact that human beings are producing more CO_2 that is creating the climate change.

And thus what we should be doing is, many of the suggestions you have made, which are absolutely on target, and I might add, this is my continual conversation with Governor Schwarzenegger in California, is that there are areas, a large number of areas where those of us who are skeptical that the human beings are causing global warming, but we should be doing the right thing. And making things more efficient and cleaner for that reason.

But to try to do this in the name of stopping this climate change, Mr. Woolsey, I think you are more on target that we should be aiming our efforts, realizing that the climate is changing, as it has so many times in the past, prepare for it in case there are national security implications.

Mr. WOOLSEY. We can do smart things for Patton reasons or for Muir reasons or for Patton and Muir reasons, and I am perfectly happy for scientists who don't go along with the climate change theory to take these——

Mr. ROHRABACHER. Very well.

Mr. WOOLSEY.—taking these steps for Patton.

Mr. ROHRABACHER. Thank you very much.

GLOBAL WARMING IS AN IMPORTANT ISSUE

General SULLIVAN. Speaking for myself, and I believe the rest of this committee, we make it very clear that we are not scientists. We are not physicists, although some of them happen to be sci-

entists. One happens to be an astronaut, and the other is intimately involved with the nuclear industry, nuclear power, but as a group we were not into all of the data because the data can be contradictory, and we are not qualified.

What we tried to do is look at the trends, and the fact that you can sail a boat from the Atlantic Ocean to the Bering Sea, and they actually have people sailing 35-foot boats, tells us something. Something is going on, and I have no idea.

Mr. ROHRABACHER. General, what it tells us is that just as the Vikings were able to do that very same thing, the Earth is going back to a warmer time period just as it was during the Viking time period.

General SULLIVAN. Agreed. I don't have any problem with that, but the fact——

Mr. ROHRABACHER. All right. Thank you.

General SULLIVAN.—of the matter is it is worth paying attention to.

Mr. ROHRABACHER. Yes, sir. Thank you.

Chairman MILLER. Mr. Rohrabacher's time has expired.

We have been joined by Dr. Ehlers, not a Member of the Subcommittee but someone for whom this is a subject near and dear to his heart. And in the interest of having more material for late-night special orders, Dr. Ehlers, do you have questions?

Mr. EHLERS. Thank you, Mr. Chairman. I appreciate you recognizing me.

I just simply came here to learn something, and I have learned something. I can't help but respond to my colleague about the many thousands of scientists he says support his point of view. I would say there are many, many, many more scientists who disagree with that. So it is a preponderance of scientific evidence and scientific belief that is on the other side. I normally don't bother arguing this point, but I just wanted to make that particular point.

The, I, as I say, I came here primarily to learn, but in terms of the response we make, I was intrigued by Mr. Sensenbrenner's comment relating to Indonesia, and it occurred to me that perhaps the response, the military's response, since that is what this hearing is about, the military response might more appropriately be just send larger contingents of the Army Corps of Engineers than to send combat troops abroad, if, in fact, the problem is flooding of Bangladesh, which is a major concern. Maybe the Army Corps can do much more than combat troops could.

I have not, I don't want to get into all the pluses and minuses, but I appreciate the comments that both of you have made, and I appreciate the understanding you displayed. This is a serious problem, and it does have very strong national security factors related to it, as does our continued overuse of energy from various other parts of the world. I think it is one of our greatest national security problems, not just so much the consumption of it, but the fact that we have developed such a dependence on it that we have become very vulnerable to military actions which reduce the amount of energy available from other countries.

So I appreciate the insight that both of you have brought. I have no specific questions. Just wanted to make those comments, and thank you for being here.

I yield back.

MORE ON HOW HUMANS EFFECT GLOBAL WARMING

Chairman MILLER. Thank you, Dr. Ehlers. I now recognize myself for a second round of questioning.

There have been questions about the extent to which the changes in the climate—the warming of the globe—are natural, cyclical, and the extent to which they are caused by human activity. And I am not sure either of you got to answer your questions entirely, and again, neither one of you are scientists. You are dealing with information from scientists on that, but is it your understanding or belief that human activity can affect the extent to which the planet may warm, and therefore what consequences may result?

Mr. Woolsey.

Mr. WOOLSEY. Mr. Chairman, you have not one but two history majors in front of you today, so I would very much stress that. But I would, I think, basically go with what I understand is a preponderance of scientific views here as reflected in the IPCC report, that at least a very substantial share—possibly all, but perhaps slightly less than all—of the concentrations of CO_2 that we see today are anthropogenic. They tend to have taken off around the beginning of the industrial era, a couple of centuries ago. They are approaching double what they have been for extended periods of time, although Congressman Rohrabacher's right, of course: There have been many periods in the history of the world in which climate has changed a lot.

But the correlation seems substantial to, I think, about 90 percent of the scientists that have looked at this, and I can't do any better than to say I would go along with that. But there is, I think, some uncertainty. There are some distinguished people who have not signed onto it.

Chairman MILLER. General Sullivan, your testimony is that military planning or national security planning generally doesn't just take into account what is certain to happen. You plan given a certain amount of uncertainty what might happen, how likely it is, and how to be prepared for those different events. Is it also part of military planning or national security planning to see how the likelihood of different events may be changed by what we do?

General SULLIVAN. Mr. Chairman, you are right on both counts. We normally look at any number of threats and the likelihood of something happening, and try to figure out how we could stop it from happening or do something that might stop it from happening, if it is in our area of responsibility. And I think that is what is going on in this case.

In all cases, though, it is not within the military's purview or the Department of Defense purview to be the only action agent. Other agencies of the government are involved, and we recognize that.

So you are right on both counts, and that is really what the basis of our study is. Look, the trends are not good, and what can we do in our planning and our analyses? And I think what is going on at Carlisle next week up at the Army War College is a pretty good indicator of how people are starting to think about it.

Mr. WOOLSEY. Mr. Chairman, if I could just have one——

Chairman MILLER. Mr. Woolsey.

Mr. WOOLSEY. When I was Director of Central Intelligence, the head of the National Intelligence Council for me was Joseph Nye of the Kennedy School, Harvard. And Joe and I came up with an effort to try to put probabilities on things that really depend on human judgment—what an enemy or a potential enemy may do—that it is very, very hard actually to put odds on. We would try to use vague formulations of gamblers' odds—you know, one change in ten, something like that—in order to give a feel for probabilities.

But the reality is that in dealing with a conscious enemy, a malevolent enemy, it depends on whether he is shrewd or not. If you are fighting Stonewall Jackson, you are probably going to lose unless you have an equally—and there were very few—brilliant general on your side. And if you are trying to deal with something like climate change here, it depends on in a sense at what point—and we don't know—the methane begins to be released from the tundra. And since it is 20 times worse than carbon dioxide as a global-warming gas, it begins to speed up the warming and the release, and speed it up further and further and further. Where is that tipping point? Nobody really knows.

So it is very tough, if you are dealing with really serious matters like a conscious enemy or something like these tipping points, to put probabilities on it. We try, but it is really something that is probably doomed to failure. Qualitative judgment is about the best you can do, I think.

Chairman MILLER. Thank you. Mr. Sensenbrenner is not here, so we will turn to Mr. Rohrabacher.

SCIENTISTS WHO OPPOSE THE IDEA OF MAN-MADE GLOBAL WARMING

Mr. ROHRABACHER. Thank you very much.

I take it that when you were doing your studies that you did not have any in-depth discussions with any of the major scientists who oppose this concept of manmade global warming. Is that correct?

General SULLIVAN. No. In our case we did.

Mr. ROHRABACHER. Okay. Which scientist——

General SULLIVAN. Am I on or off?

Mr. ROHRABACHER. Well, do you have a name of one or two of the scientists who you talked to?

General SULLIVAN. Dr. Hansen was the first one.

Mr. ROHRABACHER. Dr. Hansen is a major proponent of the——

General SULLIVAN. Yeah. I mean——

Mr. ROHRABACHER. Okay. Let me just note for, I will put in the record at this point the statements by several prominent and respected, world class scientists who not only doubt global warming but lament the fact that many of their fellow scientists are being lured away from their integrity by grants over the last 10 and 20 years, which have been readily available to those people who support the manmade global warming theory but not available to those people who were opposed to the manmade global warming theory. And I will put those quotes into the record from several very renowned, respected scientists.

[The information follows:]

INFORMATION FOR THE RECORD

The following are examples of scientists who are skeptical of global warming and have had their careers significantly affected by their positions.

Summary

1. Dr. William Gray was cut off from funding during the Clinton/Gore Administration for his position on climate change.
2. Dr. Fred Singer was pressured by Gore and his staff to remove Dr. Roger Revelle's name from a paper criticizing Gore. Revelle was a mentor to Gore on climate change.
3. Dr. William Happer was asked to resign his position as Director of Energy Research at the Department of Energy for his views on climate change.
4. Dr. Christopher Landsea resigned from the IPCC for the politicalization of his work.
5. Dr. Hendrik (Henk) Tennekes was dismissed from the Royal Dutch Meteorological institute for questioning the scientific basis for climate change assertions.

Dr. William Gray

William M. Gray is a world famous hurricane expert and emeritus Professor of Atmospheric Science, Colorado State University.

From an interview with Dr. William M. Gray in *Discover Magazine,* September 2005 Title: "Weather Seer: 'We're Lucky.'"

"Are your funding problems due in part to your views?

"G: I can't be sure, but I think that's a lot of the reason. I have been around 50 years, so my views on this are well known. I had NOAA money for 30 some years, and then when the Clinton administration came in and Gore started directing some of the environmental stuff, I was cut off. I couldn't get any NOAA money. They turned down 13 straight proposals from me."

Dr. Roger Revelle/Dr. Fred Singer

Roger Revelle was a leader in the field of oceanography. Revelle trained as a geologist at Pomona College and at U.C. Berkeley. Then, in 1936, he received his Ph.D. in oceanography from the Scripp Institution of Oceanography. Revelle was a member of the National Academy of Sciences (NAS) and served as a member of the Ocean Studies Board, the Board on Atmospheric Sciences and Climate, and many committees. Dr. Revelle passed away in 1991. See *http://dels.nas.edu/osb/about_revelie.shtml*

S. Fred Singer, an atmospheric physicist, is professor emeritus of environmental sciences at the University of Virginia, adjunct scholar at the National Center for Policy Analysis, and former director of the U.S. Weather Satellite Service. He is also a research fellow at the Independent Institute and author of *Hot Talk. Cold Science: Global Warming's Unfinished Debate* (The Independent Institute, 1997).

Al Gore refers to Dr. Revelle in his film *An Inconvenient Truth* and his book *Earth in the Balance.* He cites Dr. Revelle as a person who influenced his views regarding the dangers of global warming.

But an article, co-authored by Revelle in the April 1991 issue of *Cosmos* magazine, and later reprinted in the New Republic, states: "The scientific base for a greenhouse warming is too uncertain to justify drastic action at this time," and "[t]he bright light of political environmentalism [Gore], seems increasingly to believe that the only correct stance is to press the panic button on every issue."

A dispute ensued regarding whether Dr. Revelle's name should be shown as co-author of the *Cosmos* article which was being subsequently being placed in an anthology on climate change by Dr. Richard Geyer.

According to Dr. Fred Singer, on July 20 1992, in a telephone conversation between Singer (a co-author of the article) and Dr. Julian Lancaster (a former associate of Revelle) Lancaster requested that Revelle's name be removed.

"When I refused his request, Dr. Lancaster stepped up the pressure on me. ...he suggested that Dr. Revelle had not really been a co-author and made the ludicrous claim that I had put his name on the paper as a co-author 'over his objections.'"

See *http://www.findarticles.com/p/articles/mi_m1282/is_n12_v46/ai_15544248*; *http://media.hoover.org/documents/0817939326_283.pdf*

"Subsequently, Dr. Anthony D. Socci, a member of Senator Gore's staff, made similar outrageous accusations in a lengthy letter to the publishers of the Geyer volume, requesting that the *Cosmos* article be dropped."

Jonathan Adler in the *Washington Times* on July 27, 1994:

> "Concurrent with Mr. Lancaster's attack on Mr. Singer, Mr. Gore himself led a similar effort to discredit the respected scientist. Mr. Gore reportedly contacted 60 Minutes and Nightline to do stories on Mr. Singer and other opponents of Mr. Gore's environmental policies. The stories were designed to undermine the opposition by suggesting that only raving ideologues and corporate mouthpieces could challenge Mr. Gore's green gospel. The strategy backfired. When Nightline did the story, it exposed the vice president's machinations and compared his activities to Lysenkoism: The Stalinist politicization of science in the former Soviet Union."

Nightline 2/24/94 Ted Koppel:

> "There is some irony in the fact that Vice President Gore, one of the most scientifically literate men to sit in the White House in this century, that he is resorting to political means to achieve what should ultimately be resolved on a purely scientific basis."

Dr. William Rapper Jr.

In 1991 William Happer was appointed by President George Bush to be Director of Energy Research in the Department of Energy and served until 1993. On his return to Princeton, he was named Eugene Higgins Professor of Physics and Chair of the University Research Board. Dr. Happer is a Fellow of the American Physical Society, the American Association for the Advancement of Science, and a member of the American Academy of Arts and Sciences, the National Academy of Sciences and the American Philosophical Society.

Happer, Director of Energy Research at the U.S. Department of Energy for two years, was asked to leave. "I was told that science was not going to intrude on policy he says."

"With regard to global climate issues, we are experiencing politically correct science," Happer says. "Many atmospheric scientists are afraid for their funding, which is why they don't challenge Al Gore and his colleagues. They have a pretty clear idea of what the answer they're supposed to get is. The attitude in the administration is, 'If you get a wrong result, we don't want to hear about it."

See *http://www.sepp.org/Archive/controv/controversies/happer.html*

. . .Bush appointee William Happer, the highly regarded Director of Research at the Department of Energy, was slated to stay on-board after the 1992 election. But Happer, in internal discussions and congressional testimony, continued to discount global-warming alarmism and push for additional research before taking draconian action. One former Energy employee remembers a meeting where a high-ranking civil servant told Happer, "I agree with you, Will, but I'd like to keep my job." Happer got the axe.

From an article in *National Review* October 14, 1996.

See *http://www.findarticles.com/p/articles/mi_m1282/is_n19_v48/ai_18763610/pg_3*

Dr. Christopher Landsea

Christopher Landsea, formerly a research meteorologist with Hurricane Research Division of Atlantic Oceanographic & Meteorological Laboratory at NOAA, is now the Science and Operations Officer at the National Hurricane Center. He is a member of the American Geophysical Union and the American Meteorological Society. He earned his doctoral degree in Atmospheric Science at Colorado State University.

Dr. Landsea wrote an open letter withdrawing from the IPCC because of politicalization of his work on the committee. The first and last paragraphs of that letter are below. For the complete letter see *http://www.lavoisier.com.au/papers/articles/landsea.html*

"Dear colleagues,

After some prolonged deliberation, I have decided to withdraw from participating in the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). I am withdrawing because I have come to view the part of the IPCC to which my expertise is relevant as having become politicized. In addition, when I have raised my concerns to the IPCC leadership, their response was simply to dismiss my concerns."

. . . . . .

I personally cannot in good faith continue to contribute to a process that I view as both being motivated by pre-conceived agendas and being scientifically unsound. As the IPCC leadership has seen no wrong in Dr. Trenberth's actions and have retained him as a Lead Author for the AR4, I have decided to no longer participate in the IPCC AR4.

Sincerely,

Chris Landsea

17 January 2005

Dr. Hendrik (Henk) Tennekes

Hendrik (Henk) Tennekes is formerly Director of Research at the Royal Dutch Meteorological Institute and a professor of aeronautical engineering at Penn State. Tennekes pioneered methods of multi-modal forecasting.

Richard Lindzen is an atmospheric physicist, the Alfred P. Sloan Professor of Meteorology at MIT and a member of the National Academy of Science Lindzen is known for his research in dynamic meteorology—especially atmospheric waves.

In an article posted on the Science & Environmental Policy Project web site (Jan 2006) he said:

> "I protest against overwhelming pressure to adhere to the climate change dogma promoted by the adherents of IPCC. . .. The advantages of accepting a dogma or paradigm are only too clear. . .. One no longer has to query the foundations of one's convictions, one enjoys the many advantages of belonging to a group that enjoys political power, one can participate in the benefits that the group provides, and one can delegate questions of responsibility and accountability to the leadership. In brief, the moment one accepts a dogma, one stops being an independent scientist."

See *http://www.sepp.org/*

According to Richard Lindzen: "In Europe, Henk Tennekes was dismissed as research director of the Royal Dutch Meteorological Society after questioning the scientific underpinnings of global warming."

From a *Wall Street Journal* op ed, April 12, 2006; Page A14

See *http://www.opinionjournal.com/extra/?id=110008220*

MILITARY PRIORITIZING TO REDUCE GLOBAL WARMING

Let me ask both of you in your professional, you both come from a national security background. If it was being proposed by Congress, if there was a motion in Congress that would require the military in the name of doing our part to stop this global warming and the military's part, but would insist, for example, on lighter armor on tanks or that the tanks wouldn't produce as much pollution out the other end, even though that lighter armor put our men in jeopardy, or lighter body armor because the process in developing the body armor was something that caused more pollution, CO_2 going into the air. Would you support that move by Congress?

General SULLIVAN. No.

Mr. WOOLSEY. Congress is the wrong institution to design armored vehicles, I think.

PUBLIC PRIORITIZING TO REDUCE GLOBAL WARMING

Mr. ROHRABACHER. Right. But they prioritize. I agree with that, but they—if we end up with global warming, we say, okay. That is going to be our greatest worry now, not terrorism, not military, possible military, so the military has to step in line. You guys would both oppose this.

Let me ask you this. When they say to us, we have to then make our automobiles less armored, meaning you can't have a heavy car. I have three kids at home. I want them safe, I want them in a heavier car. Now, the people who are global warming advocates would like to outlaw me.

Now, is it any less reasonable for me to say that I am going to make the decision as to the weight of my car than it is for you to say that you would oppose the efforts of Congress to oppose the weight of armored vehicles of men going into action?

Mr. WOOLSEY. For several years of my life I had three little boys who were in Boy Scouts and soccer teams and baseball teams, and I drove a Chevy Suburban because I was driving baseball teams——

Mr. ROHRABACHER. Right.

Mr. WOOLSEY.—around. But what I would say today is that if you want a large SUV and you need one for any reasonable purpose, as long as we have it be a plug-in hybrid—that is also a flexible fuel vehicle and is running on 85 percent ethanol—it will be getting something on the order of 200 miles per gallon of gasoline. And that isn't bad.

Mr. ROHRABACHER. Sure.

Mr. WOOLSEY. I think——

Mr. ROHRABACHER. And the market will take care of that because people will want to pay less for their gasoline. But what if someone wanted to mandate it, which is basically like I said, it is going to be mandated whether or not that hybrid technology is already available and thus Dana or whoever else who has kids cannot make the choice of buying a heavier car.

Mr. WOOLSEY. And Congress's role and the Executive Branch's role ought to be to get the incentives right and to do away with barriers to competition, such as having vehicles that can only drive on gasoline and can't also drive on alternative liquid fuels.

But when the Executive Branch or Congress or together has tried to pick a solution, they picked the Synfuels Corporation in the late '70s and early '80s, which went bankrupt in '86, when the oil price went down. And it picked the hydrogen highway at the beginning of this decade, which has not worked out well at all for family cars and the rest.

So I don't think the record, frankly, of either Congress or the Executive Branch in picking a single solution is very good, but in terms of getting the incentives right for all of us in removing barriers, I think that is——

Mr. ROHRABACHER. The greatest incentive, Mr. Woolsey, probably is the high price of oil, which will make the American people choose more efficiency.

Mr. WOOLSEY. I agree

Mr. ROHRABACHER. And by the way, thank you, General and Mr. Woolsey, and Mr. General, I will make you, give you that last say here. But I do appreciate the fact that it was very clear to you that military is going to do their primary mission, and even though you do obviously hold it important that we be involved with global trends, but your job is to make sure those men going into action are safe. And you are not advocating——

Chairman MILLER. General Sullivan, do you have an answer that you wanted to——

General SULLIVAN. Yeah. I want to make it very clear that the Department of Defense, certainly the Department of the Army is trying to make tanks lighter. That gives the same protection and make vehicles lighter and giving the same protection.

Chairman MILLER. Right.

MORE ON MILITARY PRIORITIZATION

General SULLIVAN. Research and development efforts are moving in that direction. Now, whether they are going to be able to solve the problem or not remains to be seen. That is out there, and it may be ceramics or something, but the point is we cannot afford to have 70 percent of the weight which the Army carries be liquid, and that relates to how we power these pieces of equipment. And we have to get them there, to the fight, quickly.

By the way, our job is to win. Okay. It is to win for the American people, and we will do our best, and I am speaking for myself. I believe the Army, Navy, Air Force, and Marines will do their best to do that with these tradeoffs.

Chairman MILLER. All right. Mr. Rohrabacher's time has expired. Mr. Baird, in your last round of questioning I think you established that the Maldives have a good deal more to worry about than we do. Mr. Baird.

MORE ON ENERGY IN IRAQ

Mr. BAIRD. Yeah, I think the Maldives do. But I also hope I established that a decentralized energy approach, as that advocated by Amory Lovins, is much more likely, I think, to provide a sustainable power source. Not only ultimately for our troops; and I was really referring to how you get lights on in Baghdad, and air conditioning working. Because we——

But I will tell you when I was over there, and I met the energy minister of Iraq, the electrical energy minister, his main concern was that the Iraqis face a difficult challenge. If they use oil to produce energy, then they don't have oil to sell on the foreign reserve market or, sorry, on the international market and then thereby bring capital in. When I asked him if they had talked to Amory Lovins, and I asked the U.S. consultants who were accompanying them, they did not know who Amory Lovins was.

So I would encourage you, Admiral, if you have a chance to try to talk to General Lute or any of our lead strategists over there to give another look at that, because I spoke personally after that visit to Iraq, I called Amory Lovins and spoke to him on the phone, and he said he had tried three times to get folks to really pay attention, and basically they don't get the concept. And I hate to think our guys are going to try to defend a couple hundred or a thousand-mile pipeline when we could have some alternatives.

I welcome any thoughts you have about how you can convince our military.

And then the second question, if I may, is if you look at some of the areas where we have conflicts, they are clearly related to oil, and if you look at some of the international impressions of our

country, it is that we go to war for oil regardless of human rights sometimes. And certainly I have heard that from constituents back home. And you look at Nigeria and elsewhere in the world where our policies have not necessarily backed progressive regimes.

A second question after the Amory Lovins one if you have time to get to both would be how does our dependence on oil cause us to back regimes that may lower our international standing or actually lead ultimately to conflict that we might otherwise avoid.

General SULLIVAN. One of our panel members—this is to the Lovins question—one of our panel members was Admiral Truly, and he and Dr. Lovins have collaborated on a number of issues. And Dr. Lovins, certainly his name and some of his feelings, came up during the study group. In a previous study that our executive director, this man behind me, participated in, he was a part of that. So I think his feelings were well known by the group.

Mr. BAIRD. The Pentagon is not paying much attention, I will tell you. In Iraq they didn't even know the guy's name.

General SULLIVAN. I don't know.

Mr. BAIRD. This was the electrical minister for Iraq. So the concepts are alien to them.

Mr. WOOLSEY. Congressman, I think the notion of distributed-generation electricity that is dealt with on pages 18 and 19 of the text of my chapter that I submitted is very important for the military, and sometimes it takes awhile for things to filter through. But the Science Board report that is about to come out moves us both domestically and, I think, in terms of operations overseas toward fuel conservation in many ways and distributed generation in many ways. I think you will find it a useful thing.

DEPENDENCE ON THE WRONG REGIMES

As far as dependence on the wrong regimes, I surely could not agree more. There is a professor at Oxford named Paul Collier who was an economist for the World Bank, I believe, for some years, and he has written extensively about the degree to which oil—or, indeed, it is true of anything that has a lot of economic rent associated with it, that is, a lot of economic return that is not based on either investment or labor. A lot of economic rent tends to concentrate power in the central government of the country that is producing it. It is not accidental that of the top 12 oil reserve countries in the world, about ten of them are either dictatorships or autocratic kingdoms.

And as Bernard Lewis puts it, there should be no taxation without representation, but it is also true that there is no representation without taxation. If you don't need taxes, you don't need a legislature, and a number of these countries that are very rich in oil don't have real legislatures. The executive branches of those countries don't have to sit in front of hearings and be asked questions by independent, elected representatives of the people.

And so in a way, by helping move away from oil I think, for powering our transportation system almost exclusively, by introducing competitive fuels—electricity, ethanol, butanol, whatever—I think one is, over the long run, taking some very positive directions for the governments of some of these other countries and societies. But I think you are exactly right on that.

Mr. BAIRD. Very grateful for your comments. I wish our Administration would call upon the American people to make some of these changes as a patriotic duty in the interest of our national security. I think it would put a much different light on our energy policy, and it is certainly merited. And I am grateful for your service and insights today.

Thank you, Mr. Chairman, for this good hearing.

Chairman MILLER. Thank you. Mr. Sensenbrenner. Mr. Broun.

DOMESTIC ENERGY SOURCES

Mr. BROUN. Mr. Woolsey, in your report you point to the Nation's dependence on foreign oil as a major point of concern, and I certainly agree with that and concur fully. Yet, there are significant supplies of domestic oil and natural gas in areas such as out on the continental shelf and in Alaska, not only in ANWR but in other areas up there. Nuclear power has proven to be one of the cleanest energy sources on Earth, and the last nuclear power plant that we built in this nation I believe was in 1973.

Now, I know that there are no permanent solutions, but it seems to me that the most expedient solution might be looking for domestic sources of oil as well as other energy sources. Certainly in my area of Georgia we don't have the amount of wind that they do out west to develop energy through wind technology or other things, some of these other alternative sources of fuel.

And I am for one very eager to search for alternative energy sources, not only to power automobiles but also electricity and certainly we seem to use a lot of that around here, too. So don't you think that maybe searching for domestic sources of energy is maybe a best type of policy that we should have as a government?

Mr. WOOLSEY. It is certainly part of what we need to do, Congressman. Nuclear is not going to substitute for oil, imported oil or any other oil, however, because only about two percent of our electricity is produced by oil. Back in the '70s it was different. Twenty [percent] or so was produced. So if you built a nuclear power plant in the '70s, you could well be replacing oil consumption, but today our use of oil for electricity is almost negligible.

I think nuclear power has some advantages. Lack of global warming gas emissions is certainly one, and if Congress and the Executive Branch can agree on the degree of essentially public insurance that is to be provided for nuclear power, it may well take up some of the slack that may be needed for new power-plant construction.

But I don't think we ought to look at it as a long-term solution globally because I believe today over 60 percent of the new nuclear power plants that are being built are being built in developing countries. And because the International Treaty Regime for proliferation does not really deter countries that have nuclear power plants from getting into the fuel cycle with uranium enrichment or plutonium reprocessing; once you have a nuclear power plant, you are unfortunately likely to be off into the business of producing fissionable material. It is not really a problem here, although we have to store our nuclear waste and agree on how to do it, but it is a problem in lots of parts of the world unless we want to see proliferation grow substantially.

As far as domestic oil is concerned, I have been generally in favor of offshore drilling. I think that is now ecologically and in engineering terms quite sound. I have opposed drilling in the Alaskan National Wildlife Refuge in substantial measure because of the insecurity of the Alaska Pipeline, which Amory Lovins and I have written together about and call a very large piece of Chapstick just about to happen. It is extremely vulnerable even to rifle fire, much less anything else.

I think that what has to take place is that we need to do to oil and its monopoly on transportation, its 97 percent monopoly of transportation, what electricity and refrigeration did to salt at the end of the 19th century. In the late 19th century salt was a strategic commodity. It mattered whether your country had salt mines, countries fought wars over salt mines. It is hard to imagine now. Today we don't care, because salt's unique role in preserving meat was effectively destroyed by electricity and refrigeration.

What we need to do is not destroy oil and not stop using oil, but we need to break oil's monopoly on transportation. And I think that if we do that, things will sort themselves out—given the amount of carbon used, given its accessibility and so forth—in a reasonable way. But I think the first priority to me is things like plug-in hybrids and alternative liquid fuels so that we can break oil's monopoly on transportation, and then I think some domestic oil production, particularly off shore, sure.

Mr. BROUN. Well, I think with the current technology with the hybrids, if, it depends on how far you drive every day whether they make sense economically or not, and it looks to me in the short run maybe expediting building safe nuclear power plants as well as looking for domestic sources of petroleum products and maybe new coal technology, et cetera, make more sense if we can ever figure out how to create hydrogen. That may be even another source, but that is just my point.

And looking domestically makes more sense to me than trying to further things that may be not economically feasible now. So——

Chairman MILLER. Thank you.

Mr. BROUN.—would you comment about that?

Chairman MILLER. Well, actually the gentleman's time has expired.

Mr. BROUN. Excuse me.

Chairman MILLER. That is all right. Dr. Ehlers, do you have any questions? You don't have to if you don't want to but——

Dr. Ehlers, your mike apparently is not on.

Mr. EHLERS. I am sorry.

Chairman MILLER. Or not working. Okay.

Mr. EHLERS. Thank you.

NUCLEAR POWER AND PLUG-IN HYBRIDS

I have been an advocate of nuclear energy for some time, even though I am Mr. Muir. I have been a Sierra Club member for many years and have argued with them on this point simply because the issue is not displacing oil. It is displacing carbon dioxide producing materials, which is largely coal and natural gas and the power plants at this point.

And if we are going to impinge, and I agree with you Mr. Woolsey, that the real problem is transportation, and if we do, in fact, go the route of plug-in hybrids, we are going to need considerable amounts of electricity, and I would prefer that that be produced by nuclear plants rather than coal burning or natural gas burning plants, particularly since natural gas in my opinion is too good to burn. It is an incredible feedstock for the petro-chemical industry, and it is ideal for serving, for providing heat for residences. Burning it in an electric power plant I think is not an optimum use.

Mr. WOOLSEY. Congressman, I certainly agree that electricity needs to be produced cleanly, and nuclear may be one way to do that, with the qualifications I mentioned earlier. I would only add that the Pacific Northwest National Laboratories has done a very thorough study of plug-in hybrids, and they say that 85 percent of the cars on the road could be plug-in hybrids before you need a single new power plant, because you are using off-peak, overnight power.

Mr. EHLERS. Yeah.

Mr. WOOLSEY. And that is one of the reasons why shifting from an internal combustion engine to a plug-in hybrid, even in coal-heavy states where the grid is largely run by coal, still saves something on global warming gas emissions. And in a state like California with very clean grid it saves a great deal with respect to global warming gas emissions.

Mr. EHLERS. Yes.

Mr. ROHRABACHER. Would the colleague yield for a question?

HIGH TEMPERATURE GAS-COOLED REACTORS

Mr. EHLERS. Yes. I will be happy to yield.

Mr. ROHRABACHER. Yes. This is where we agree.

I appreciate your comments on nuclear energy, and I would draw your attention and ask, this is in the form of a question, but drawing our attention of the panel as well to the high temperature gas-cooled reactor that has now been designed and prototypes have been built by General Atomics in San Diego. Are you aware of the high temperature, gas-cooled reactor?

Mr. EHLERS. I am aware of a number of different reactors, and I think the great lack is we have not done adequate research on the many types of reactors. For example, the hydrogen project which is, no one seems to say much about today, depends entirely on being able to produce and transport hydrogen at fairly low cost. Clearly the traditional ways of doing it are not good. Perhaps I——

Mr. ROHRABACHER. The reason I bring up that, Mr. Ehlers, is that Mr. Woolsey brought up the problems of nuclear waste and also the proliferation issue, and those two issues do not need to prevent us from moving forward with nuclear energy, and I would suggest that maybe our panel would like to look at this alternative, because it is a nuclear power plant that cannot, that does not produce waste at the same level and it will not produce material that can be turned into bombs. And so it takes care of a lot of problems, and I would hope that you, Mr. Ehlers, as someone I deeply respect and pay attention to, as well as our panel, would look at this alternative when looking at the issue we are discussing today.

Thank you very much.

Mr. EHLERS. I yield back.

Chairman MILLER. Thank you. I accept your time. Mr. Reichert.

Mr. REICHERT. I have no questions.

Chairman MILLER. All right. That was convenient. We have time, I think, for another round of questions if everyone does their length of time, and then we do have a set of votes. We probably will need to carry over into the first couple of minutes of votes, but if we could have a quick last round of questions for this distinguished panel, and the next panel is also distinguished, and we will hear their testimony after the votes.

NEW MATERIALS FOR ARMORING VEHICLES

General Sullivan, in the earlier questions whether you would favor reducing the armor if it made armored vehicles less sturdy in battle, you said "No," but you also said that you thought that the need for lighter vehicles because of fuel needs certainly justified research and developing lighter but still strong materials. Is that correct?

General SULLIVAN. That is correct. I am not in favor of . . . Protection, validity, and mobility are the three variables which are considered in armored vehicles, and you can see in the MRAP—this new vehicle which the troops will receive—the vehicle is very heavy because that is what you need to protect the troops, . . .

Chairman MILLER. Uh-huh.

General SULLIVAN. . . .our most precious asset. But that doesn't mean that the scientists and the people in the labs aren't working to reduce the weight of the armor which goes on vehicles, and it may be that it is ceramics or some substance which—I am sorry the doctor left—plastics and so forth and so on.

So you have got a tradeoff, and I am sure they will work their way through that.

JUSTIFYING COST TO REDUCE EMISSIONS

Chairman MILLER. The British report that I referred to in my opening remarks estimated that the world's response to carbon dioxide emissions, greenhouse gas emissions, would cost perhaps one percent of the world's GDP. In view of the threat, does that expense seem justified by the threat we face? General Sullivan.

General SULLIVAN. One percent. I don't know. I am not qualified to——

Chairman MILLER. Okay.

General SULLIVAN.—I am really not qualified to draw that kind of conclusion.

Chairman MILLER. Okay. Mr. Woolsey.

Mr. WOOLSEY. I think it does, yes—in part, however, because taking the steps that one needs to take also makes the whole system much more resilient against terrorism. And also a number of those steps that the Stern, I guess it is the Stern report, in the numbers, I think, don't take into account some of the things we were talking about before: some of the ideas that Amory Lovins's Rocky Mountain Institute has been instrumental in pushing, of what they call "negawatts"—that is, of efficiency improvements that make money. I don't think those types of considerations played

a major role in the Stern report: for example, these building improvements that my Patton and Muir start off with.

So, yes, I mean, if it takes one percent—because these are both important issues, both terrorism and climate change—in my personal judgment it is worth it. But I think we ought to make sure that we aren't taking expensive and unnecessary steps rather than profit-making ones in order to get where we want to go.

Chairman MILLER. You think one percent may have been overstated?

Mr. WOOLSEY. It is possible. I think so. I think if you turn the Stern report over to the Rocky Mountain Institute and ask them to critique it, I will bet you would find that they would say there are cheaper ways to take the steps that we are taking.

EVALUATING CURRENT METHODS TO REDUCE EMISSIONS

Chairman MILLER. And I think both of you have either explicitly or implicitly already addressed this. Whether the steps are—or what the Stern report suggested—are there other cheaper, smarter things to do? Do you think what we have done to this point or [are] doing now are aggressive enough in view of the threats we face?

General Sullivan.

General SULLIVAN. I will only speak to what I know. I think that General Casey's point yesterday was indicative of an awareness by the senior leaders—one of the chiefs, a member of the Joint Chiefs, a senior Army officer—that these issues are important. And I have reason to believe AFRICOM is another case in point that the senior military leaders of our country are addressing the issue of global climate change. And the NIE, I think, is another example: Admiral McConnell, who is doing the NIE, who is responsible for it, has said that it is important. And so I think everybody is getting the word, and it is moving.

Chairman MILLER. Mr. Rohrabacher is recognized for just five minutes.

TRADE-OFFS IN DECISION-MAKING

Mr. ROHRABACHER. Well, thank you, and I do think it is important for us to note that the general said exactly the right thing, and that is his job is making sure that our country is protected and those people can do their job in defending our country. And while no one disagrees with the fact that we should try and be trying to develop better, more efficient technologies, the question is when we have to make decisions right now versus climate change that we are going to have some effect on climate change that will in some way prevent the military from doing their job, the General is going to have the military do their job.

General SULLIVAN. Well, I think that is exactly what happened with the MRAP and body armor and everything else that is protecting the troops. They are giving the troops what they need. We can't wait for 10 or 20 years——

Mr. ROHRABACHER. There you go.

General SULLIVAN.—to make it happen.

Mr. ROHRABACHER. And General, the same principle is true, unfortunately, we are being told by the alarmists here about climate

change that we have to have another criteria for how we make our decisions based on, and certainly I agree with Mr. Woolsey, yes. We should have SUVs that can protect our people, our kids, and our families, but we should not necessarily mandate it now if the technology isn't ready and say that SUVs have to be lighter or whatever, if that is not ready right now.

And the alarmists would have us put people in jeopardy. It is as simple as that. And I, first of all, I appreciate both your testimony today, and I respect both of you tremendously.

INTER-GOVERNMENTAL PANEL ON CLIMATE CHANGE REPORT

This question. When you look over this report, when you examined the Inter-Governmental Panel on Climate Change report, what it did say that if we implemented all of their recommendations at, with the tremendous cost to the world that we are talking about, what percentage of the climate, of the increase in the temperature of the planet would we achieve?

Mr. WOOLSEY. I don't——

Mr. ROHRABACHER. What are we going to get out of—if we went along with all the Inter-Governmental Panel Climate Change (IPCC) recommendations and the things that they said we need to do, which many of them are very draconian, what type of change would we expect to achieve and did they say they would achieve in terms of the, preventing the increase in the temperature of the plant?

Mr. WOOLSEY. Congressman, I tend to use the sea-level rise as the proxy. And I realize that is not a perfect way to go at it, but the IPCC's predicted range, I think, for the 21st century is somewhere between around eight inches and two feet.

Mr. ROHRABACHER. And how, if all the recommendations were followed with all of the costs associated with that, what would be the change in the ocean?

Mr. WOOLSEY. I don't know. I don't think of the IPCC as being the institution that is likely to be providing the best recommendations for action. I think——

Mr. ROHRABACHER. No, no. I am not talking about action. If they, if all of their actions, the IPCC had recommendations for us and with the Kyoto treaty, et cetera, through the Kyoto treaty, if all of those recommendations were put in place, let me just note for the record the actual achievement would be minuscule. Minuscule. And I don't have it with me right here the exact amount, and but just let us note that you have to, one of the reasons some of us were skeptical about what is going on not only is the fact that leading scientists have said that their colleagues have been lured away from their integrity by the promise of grants, but that what the General suggested, his reasonable decision-making process was not being used in meeting the other demands on the civilian economy in terms of what we would get out of those decisions. So, out of implementing those recommendations.

Mr. WOOLSEY. There are a number of things that the IPCC doesn't touch on that could be far cheaper and far more effective than other points that are being made. I will just refer you to Pat-

ton's and Muir's nine points in this chapter I wrote. And these are not original with me. They have been picked up from all——

Mr. ROHRABACHER. Sure.

Mr. WOOLSEY.—sorts of different sources, but some of them are rather dramatic. For example, Denmark today gets 50 percent of its electricity from combined heat and power. It means they just take the waste heat from factories, turn generators, supply power to themselves. It is heat that is wasted today.

Mr. ROHRABACHER. I appreciate——

Mr. WOOLSEY. We are way under 10 percent of that in the United States.

Mr. ROHRABACHER. My time is——

Mr. WOOLSEY. Simply by being smart——

Mr. ROHRABACHER.—up, and let me just note I appreciate your testimony. I agree with everything you have said today, and the bottom line is is that we should be more efficient and more save consumption of oil and et cetera, become more independent for a lot of the reasons——

Chairman MILLER. The gentleman's time——

Mr. ROHRABACHER.—other than climate change. Thank you.

Chairman MILLER. Mr. Baird.

Mr. BAIRD. You recognize me for just five minutes?

Chairman MILLER. If you use less, you would be viewed by the Chair as a great American.

RALLYING AMERICANS BEHIND ENERGY PROBLEMS

Mr. BAIRD. Thank you. I would like to thank these two great Americans for what I think is one of the—actually we have a tremendous number of hearings in this body as you know, and I think this hearing is one that all Americans should have a copy of. And I commend you for your insights and the perspective you bring to this.

As historians I would ask you this question. One of my concerns about this conflict we currently face in Iraq—and about how we deal with potential for climate change, acidification of the oceans, and all the other impacts—is that there seems to be a reluctance on the part of our political leaders to truly call on the American people to dig deep in the spirit of patriotism and national and international interest to change their behaviors.

Post-World War II. . .when World War II broke out, the Nation was in the fight. When September 11 happened, we were told to go shopping. As historians, what insights can you give us in terms of ways that we might rally the American people to change their behavior in relation to how we use energy and where energy comes from—as a national security as well as environmental—and other interests?

General SULLIVAN. Well, first of all, I am, you know, a soldier, I am a retired general officer. I am somewhat reluctant to get into an area that is not my own. But certainly as you allude to, I think, this is an important conflict we are in. However you may feel about it politically; and I understand there are varying views on that, certainly up here as well as elsewhere throughout America. But we do have young men and women serving in both Afghanistan and Iraq, and they could use more of their fellow citizens. And asking

the American people to support the Army, Navy, Air Force, and Marines with qualified people is, in my view, an important indication of how Americans feel about their own security. And service to the Nation in uniform is a noble calling.

Now, to your point about sacrificing: If somebody somewhere can draw a link, and I am not sure I can, but if they could draw a link—as I say, I don't see how I could. If I were in the position of trying to mobilize public opinion to this issue that we are discussing here and this conflict, I think, I suppose you could if you went into the discussion that Mr. Woolsey was involved in and where oil comes from and the politics of all of that. Okay. Reduce the consumption of oil, I think in the long run that is very important. But other than as a catalyst for that discussion, I think it would be tough to sell it on what is going on in Iraq, and Iraq mainly.

It could be done, but other people more expert than me in that: the mobilization of the American people, à la World War II and Ken Burns and all of that which is apparent to everyone who watches it. I think you have a good point but——

Mr. WOOLSEY. Congressman, I would say that a clear call for a national commitment to move toward alternative fuels for transportation and distributed generation of energy: both fuels and electricity, with an eye towards renewables, but if you move toward distributed generation, it tends to be renewables. It is hard to put a coal-fired power plant on your roof. And I think the technologies are moving that way. Photovoltaics is taking off in part because of the progress that was already made with silicon chips for computers, and much of the technology is similar. Genetically modified biocatalysts to make transportation fuel out of waste and so forth is taking off because of genetic modification work done for pharmaceuticals, and battery capabilities are taking off because nobody wants to recharge their cell phones more than once a day.

And because, unrelated to energy, these three things are all happening, and they give us an opportunity to exploit these technologies, and, I think, have the kind of call for national action that you were suggesting.

Chairman MILLER. Thank you. This panel is now concluded. I think we all need to run to the Floor to vote, but thank you very much, both Mr. Woolsey and General Sullivan.

We will be in votes for a while, it looks like. There are five votes, so we could be gone for 45 minutes. But we will take the testimony of the next panel when we return. Thank you.

[Whereupon, at 11:43 a.m., the Subcommittee recessed, to reconvene at 1:05 p.m., the same day.]

Ms. HOOLEY. [Presiding] Dr. Alexander Lennon is a Research Fellow in the International Security Program at the Center for Strategic and International Studies and Co-Director of the forthcoming CSIS report, *"The Potential Foreign Policy and National Security Implications of Global Climate Change."* Dr. Andrew Price-Smith is an Assistant Professor of Political Science at Colorado College, Director of the project on Health and Global Affairs, and author of the book, *"The Health of Nations: Infectious Disease, Environmental Change, and Their Effects on National Security and Development."* Dr. Kent Hughes Butts is Professor of Political Military

Strategy and the Director of the National Security Issues Group at the U.S. Army War College's Center for Strategic Leadership.

Welcome to all of you. As our witnesses should know, spoken testimony is limited to five minutes each, after which the Members of the Committee will have five minutes each to ask questions.

It is also the practice of the Subcommittee to take testimony under oath. Do you have objections to being sworn in?

You also have the right to be represented by counsel. Is anyone represented by counsel at today's hearing?

Okay. Please stand and raise your right hand.

[Witnesses sworn]

Ms. HOOLEY. Dr. Lennon, you may begin, and you can be seated.

Panel 2:

STATEMENT OF DR. ALEXANDER T.J. LENNON, RESEARCH FELLOW, INTERNATIONAL SECURITY PROGRAM, CENTER FOR STRATEGIC AND INTERNATIONAL STUDIES; EDITOR-IN-CHIEF, THE WASHINGTON QUARTERLY

Dr. LENNON. Thank you, Madam Chairman. It is an honor to be invited here before the Subcommittee to share my experiences with you today.

Coming from the national security community, I think most Members traditionally approach climate change thinking about how Russia might be affected and how our competition with other major powers could come into play.

With Members from the environmental community, climate change connotes images of glaciers melting, sea levels rising, polar bears losing their homes.

My experience with this issue has turned both of these premises on their head. Over the next generation the foreign policy and national security implications for the United States are strongest because of the weakness that simply things like more frequent storms, more severe storms, and changes in rainfall patterns might be able to cause over a generation. Over the past year I have learned a tremendous amount from being the Co-Director of a project at CSIS, the Center for Strategic and International Studies, that has sought to combine the best insight of two traditionally separate communities: both the scientists in policy and climate change with analysts of foreign policy and national security.

The project intentionally did not delve into questions about whether climate change is occurring, who is responsible for it, or what to do about it. It focused exclusively on how to understand the better potential foreign policy and national security implications, if climate change were to occur.

The key to our focus was to change the timeframe of both communities' traditional analysis. That timeframe was to bring the national security community to look at a problem over the course of a generation, or about 30 years, or the time it takes for the purchases of major military platforms.

Over the climate change what we found is that while the greatest temperature changes will be observed toward the Poles, the fragility of societies and governments that are closest to the equator

means that the national security implications for the United States are greatest in those regions of the world.

Four risks in particular struck me through our work. First is that climate change would exacerbate water, food, and energy shortages and increase the risk of at least political stress, particularly because of water shortages in the Middle East.

Second, while many countries face stress from climate change, the geopolitical significance of China and the water shortages, desertification, migration, and public unrest that it may face over the next 30 years could undermine any fragile progress in economic and political modernization in that country or Beijing's ability to act as a responsible stakeholder in the international system.

Third, migration within and from both South Asia and Sub-Saharan Africa, particularly to Europe, threatens to cause instability in the developing world and increase the risk of radicalization in Europe of Muslim communities, which then must deal with politically-sensitive migration issues.

Finally, and potentially of greatest concern to me, the effects of global climate change such as famine, disease, and storms can strain the poor regions of the world, undermine brittle confidence in governments, and increase the risk of state weakness and failure, a contributing cause to terrorism over the course of the next generation.

The single greatest lesson from the project that I learned is that well before we get to the stage of rising sea levels or islands disappearing, there are sincere national security consequences to at least consider from simply storms and changing patterns of rainfall.

I have a longer testimony that I prepared that I would request would be submitted for the record, but in the interest of time and to keep the statements short and engage in questions, I thank you for your attention, and I am happy to answer any questions I might be able to.

[The prepared statement of Dr. Lennon follows:]

PREPARED STATEMENT OF ALEXANDER T.J. LENNON

THE FOREIGN POLICY AND NATIONAL SECURITY IMPLICATIONS OF GLOBAL CLIMATE CHANGE

The Center for Strategic and International Studies (CSIS), in collaboration with the Center for a New American Security (CNAS), has been conducting a project over the past year to identify and analyze a wide range of potential foreign policy and national security effects of major disruptions in the world's climate patterns. I have co-directed this project with Julianne Smith, Deputy Director of the International Security Program when the project started and now Director of the Europe program at CSIS, with the guidance of Executive Director, Kurt Campbell, who was Senior Vice President and Director of the International Security Program at CSIS when the project started and is now the co-founder and Chief Executive Officer of CNAS.

The project has not collectively delved into questions about whether climate change is occurring or who might be responsible. Nor has the group sought to make recommendations about what to do about the issue. That is not our area of expertise. It has exclusively sought to better understand the potential foreign policy and national security implications if climate change occurs.

Within this national security framework, the project has proceeded from two premises. First, the national security community is not traditionally accustomed to planning for contingencies more than thirty years into the future, or about the time frame for developing new military capabilities. Therefore, most of the work in this

project focused on national security implications over the next three decades. Project members have concluded that it is not necessary for doomsday predictions of glaciers melting, ice sheets breaking off, or catastrophic sea level rise to come to fruition for U.S. foreign policy and national security interests to be harmed. Instead, the analysis focuses on consequences associated with effects such as more severe and frequent storms as well as changes in rainfall patterns over the next thirty years. Second, national security planning is based on being aware of, and contingency planning for, the worst consequences that may be encountered in the foreseeable future.

Through a series of working groups, this effort has sought to combine the best insight of two traditionally separate expert communities—specialists in the science and policy of climate change with analysts of foreign policy and national security. In consultation with scientific experts through these working groups, Jay Gulledge of the Pew Center for Global Climate Change took the lead in outlining scenarios for three posited worlds, two over the next thirty years (expected and more dramatic climatic changes, respectively), as well as more cataclysmic global climate change over the next 100 years.

Based on these scenarios, foreign policy and national security experts John Podesta, former Chief of Staff for President Bill Clinton; Leon Fuerth, former Vice President Gore's National Security Adviser; and R. James Woolsey, former Director of Central Intelligence, then respectively assessed a wide range of possible foreign policy and national security consequences—political, economic, social, military, and religious—of each world. The highlights are expected to be published as a monograph later this fall and in greater detail as a book in 2008.

Unless otherwise noted, the testimony presented today is principally based on the *mildest* of these three scenarios, or the expected climate change over the next thirty years, based primarily on a scenario presented by the Intergovernmental Panel on Climate Change (IPCC) and analyzed by John Podesta and Peter Ogden with feedback from the working group. The frame for presenting these issues in this testimony is my own, highlighting what most struck me as Co-Director of the project, but my role here is to convey the findings as a co-director and group member, not to present my original analysis. The credit for the analysis goes principally to the authors as well as working group members.

Overall, project authors have emphasized that two general remarks about climate change should be highlighted. First, while rising average global temperatures tend to be discussed when analyzing climate change, the reality is that such changing temperatures usually vary widely both in different parts of the globe and across time, with impacts not evolving linearly but often suddenly. Changes in ocean currents, atmospheric conditions, and cumulative rainfall will vary dramatically across different regions and geographies. It is unfortunately also true that current modeling capacity focuses on continent-sized areas. We currently lack the models for smaller regions, countries, or areas.

Second, at least as important as the way that the climate reacts to rising temperatures is the way that societies around the world react to temperate and climate changes. While the greatest changes in temperature will be seen toward the poles, the greatest vulnerabilities lie near the equator where fragile societies in Africa, south Asia, and central and South America will experience the greatest impact from climate change.

While authors raise a variety of concerns throughout the three scenarios, four consequences stand out to me as the greatest concerns to U.S. foreign policy and national security interests.

- First, climate change would exacerbate water, food, and energy shortages and increase the risk of at least political stress if not resource conflicts, possibly over water in the Middle East and even sources of protein, such as fish, in East Asia.
- Second, while many countries will face stress from climate change, potential consequences in China present unique challenges because of its geopolitical significance.
- Third, migration within and from south Asia and Sub-Saharan Africa, including to Europe, threatens our foreign policy and national security interests.
- Finally, and potentially of greatest concern to me, the effects of global climate change will increase the risk of state weakness and failure, exacerbating the threat of global terrorism over the next generation.

These crises are all the more dangerous because they are interconnected: water shortages can lead to food shortages, which can lead to resource conflicts, which can drive migration, which can create new food shortages in new regions, all of which

can strain a state's ability to govern, particularly when it is already weak or failing. Collectively, the greatest risks of global climate change in the next thirty years come from its impacts in the developing world—not just the demands for disaster relief, development assistance, and conflict prevention that will be placed on the developed world, particularly the United States, but also to U.S. security itself from state failure and terrorism.

Water and other resource shortages

An August 20 *Washington Post* article raised concerns that warming will exacerbate global water shortages. To put it simply, hotter temperatures mean that more water will evaporate into the air, increasing droughts, while at the same time potentially causing floods when it descends back to Earth as more severe rain storms, only to evaporate again in an increasingly violent hydrological cycle. Increasing water scarcity due to climate change will contribute to instability throughout the world.

Although references to this threat may evoke images of armies amassing in deserts to go to war over water, Podesta and Ogden emphasize that the likelihood of such open conflict over the next 30 years is low. Nevertheless, while we are not likely to see "water wars," water scarcity can shape geopolitical order when states directly compete with neighbors over shrinking water supplies.

This is likely to be the case in the Middle East, where water shortages will coincide with a projected population boom. According to current projections, the Middle Eastern and North African population could double in the next 50 years. Meanwhile, seventy-five percent of all the water in the Middle East is located in Iran, Iraq, Syria and Turkey. Situated at the headwaters of the Tigris and Euphrates, Turkey is the only country in the Middle East that does not depend on water supplies that originate outside of its borders. Yet climate change will leave all of the other countries dependent on water from the Tigris and Euphrates Rivers more vulnerable to deliberate supply disruption.

Israel, for example, is extremely water poor and will only become more so. By 2025, Israel will have less than half the minimum amount of water per capita considered necessary for an industrialized nation. Moreover, Israel's water is in politically unstable territory with one-third in the Golan Heights, a source of strain in its relations with Syria, and another third in the mountain aquifer that underlies the West Bank.

Strains over water are not limited to the Middle East, particularly in more severe scenarios of climate change according to Leon Fuerth. The Indus River system is the largest contiguous irrigation system on Earth with the headwater of its basin in India, making it the most powerful player in political disputes over water. Pakistan, Bangladesh, and Nepal are already engaged in water disputes with India and severe climate change would exacerbate those tensions.

The ongoing genocide in Darfur may have begun as a consequence of water scarcity. Water shortages have led to the desertification of large tracts of farmland and grassland. Arab nomads in North Darfur subsequently moved south for livestock to graze, thereby coming into conflict with southern sedentary farmers and mixing with simmering ethnic and religious tensions. Government refusal to address the grievances of southern farmers led in stages to rebellion, counter-insurgency, and eventually ethnic cleansing.

Other resources may be affected as well, according to Fuerth, particular under more severe predictions for climate change. For example, China could find itself in direct confrontation with Japan and even the United States over access to fish. Rising standards of living are already leading to increased demands for higher quality food and sources of protein, such as fish, in China. This increasing demand combined with severe climate change at a time when all major fisheries may have crashed as the result of unsustainable fishing practices, along with the ongoing, worldwide decimation of wetlands, would create at least political strains over sources of protein.

China's challenges

Depleted fisheries are not the only challenges that climate change will present to China or that China will present to the world. China's current energy production and consumption patterns alone threaten the long-term global environment. Unless its pattern of energy consumption is altered, China's carbon emissions will reinforce or accelerate several existing domestic environmental challenges—ranging from water and food shortages to desertification to unrest within China—and become the primary driver of global climate change itself.

Water shortages will pose a major challenge to China. Two-thirds of China's cities are currently experiencing water shortages, and will be exacerbated by shifts in pre-

cipitation patterns and increased water pollution. In 2004, the UN reported that most of China's major rivers had shrunk, and in December 2006 it found that the Yangtze River's water level dropped to an all-time low because of climate change. Northern China faces the greatest threat in this respect, as it will be subject to heat waves and droughts that will worsen existing water shortages.

According to the IPCC's Fourth Assessment Report in 2007, these regional water shortages will also lead to food shortages as "crops in the plains of north and northeast China could face water-related challenges in coming decades, due to increases in water demands and soil-moisture deficit associated with projected decline in precipitation." China's first national report on climate change, released in late 2006, estimates that national wheat, corn, and rice yields could decrease by as much as an astounding 37 percent in the next few decades.

China, moreover, is severely affected by desertification. More than a quarter of China is already desert, and the Gobi is steadily expanding, threatening roughly 400 million people according to the UN Convention to Combat Desertification. The United Nations Framework Convention on Climate Changes (UNFCCC) notes that desertification-prone countries are "particularly vulnerable to the adverse effects of climate change."

In spite of the colossal development projects that China has initiated, domestic social and political turmoil are expected to increase. One source of unrest will be increased human migration within China due to environmental factors. Much of this migration will reinforce current urbanization trends, putting added pressure on already overpopulated and dangerously polluted Chinese cities. Those regions of China that do benefit from some additional rainfall will also need to cope with an influx of migrants from water-scarce areas. In China's northwestern provinces, where rainfall may increase, the acceleration of the movement of Han Chinese into Muslim Uighur areas will aggravate tensions that have led to low-level conflict for many years.

In the last few years, concerns over environmental issues have provoked thousands of Chinese to demonstrate across the country. In April 2005, as many as 60,000 people rioted in Huaxi village in Zhejiang Province over the pollution from a chemical plant. Just three months later, 15,000 people rioted for three days in the eastern factory town of Xinchang, 180 miles south of Shanghai, over the pollution from a pharmaceutical factory.

More broadly, the findings of a poll conducted in China last year by the Chicago Council on Global Affairs and WorldPublicOpinion.org indicate that much of the Chinese public believes that climate change is a uniquely serious environmental problem. Some 80 percent of respondents concurred that within ten years, global warming could pose an important threat to their country's "vital interest."

On one hand, this may lead to internal political reform designed to address public concern. It is also possible, however, that the Chinese leadership will not make necessary adjustments, potentially leading to larger protests and violent clashes with police, as well as more restrictions on the press and public use of the internet. Relations with the West would rapidly deteriorate as a result. Whatever the political response, many experts including SAIS China Director David Lampton, former Assistant Secretary of State Jim Kelly, and Secretary Rice have all argued that it is not in the U.S. interest to have a massive country like China be weak and unstable.

Migration

Challenges from migration are not limited to China. The United States itself, like most wealthy and technologically advanced countries, will not experience destabilizing levels of internal migration due to climate change, but will still be affected. According to the IPCC, tropical cyclones will become increasingly intense in the coming decades, and will force the resettlement of people from coastal areas in the United States.

The United States will also experience border stress due to the severe effects of climate change in parts of Mexico and the Caribbean. Northern Mexico will be subject to severe water shortages, which will drive immigration into the United States in spite of the increasingly treacherous border terrain. Likewise, the damage caused by storms and rising sea levels in the coastal areas of the Caribbean Islands—where 60 percent of the Caribbean population lives—will increase the flow of immigrants from the region and generate political tension.

In the developing world, however, the impact of climate-induced migration will be most pronounced. Migration will widen the wealth gap between and within many of these countries. It will deprive developing countries of sorely need economic and intellectual capital as the business and educated elite who have the means to emigrate abroad do so in greater numbers than ever before. Podesta and Ogden focus

on the effects on three regions in which climate-induced migration will present the greatest geopolitical challenges are South Asia, Africa, and Europe.

South Asia

No region is more directly threatened by human migration than South Asia. The IPCC warns that "coastal areas, especially heavily populated mega-delta regions in South, East and Southeast Asia, will be at greatest risk due to increased flooding from the sea and, in some mega-deltas, flooding from the rivers." Bangladesh, in particular, will be threatened by devastating floods and other damage from monsoons, melting glaciers, and tropical cyclones that originate in the Bay of Bengal, as well as water contamination and ecosystem destruction caused by rising sea levels.

The population of Bangladesh, which stands at 142 million today, is anticipated to increase by approximately 100 million people during the next few decades, even as the impact of climate change and other environmental factors steadily render the low-lying regions of the country uninhabitable. Many of the displaced will move inland, which will foment instability as the resettled population competes for already scarce resources with the established residents. Others will seek to migrate abroad, creating heightened political tension not only in South Asia, but in Europe and Southeast Asia as well.

Bangladeshi migrants will generate political tension as they traverse the region's many contested borders and territories, including between India, Pakistan, and China. The India-Bangladesh border is already a site of significant political friction, exemplified by the 2,100 mile, two-and-a-half meter high, iron border fence that India is in the process of building.

In Nepal, climate change is contributing to a phenomenon known as glacial lake outburst, in which violent flood waves reaching as high as 15 meters destroy downstream settlements, dams, bridges, and other infrastructure. Ultimately, this puts further stress on the already beleaguered country as it struggles to preserve a fragile peace and reintegrate tens of thousands of Maoist insurgents. Neighboring the entrenched conflict zone of Kashmir and the contested borders of China and India, an eruption of severe social or political turmoil in Nepal could have ramifications for the entire South Asian region.

Nigeria and East Africa

The impact of climate change-induced migration will be felt throughout Africa, but its effects on Nigeria and East Africa pose particularly acute geopolitical challenges. Migration will be both internal and international. The first domestic wave will likely be from agricultural regions to urban centers where more social services are available, and the risk of state failure will increase as central governments lose control over stretches of their territory and their borders.

Nigeria will suffer from climate-induced drought, desertification, and sea-level rise. Already, approximately 1,350 square miles of Nigerian land turns to desert each year, forcing both farmers and herdsmen to abandon their homes. Lagos, the capital, is one of the West African coastal megacities that the IPCC identifies as at risk from sea level rise by 2015. This, coupled with high population growth (Nigeria is the most populous nation in Africa, and three-fourths of the population is under the age of 30), will force significant migration and contribute to political and economic turmoil. It will, for instance, exacerbate the existing internal conflict over oil production in the Niger Delta. Nigeria is the world's eighth-largest oil exporter, Africa's single-largest, and the fifth-largest oil exporter to the United States, larger than any Middle Eastern country other than Saudi Arabia. This instability has an impact on the price of oil, and will have global strategic implications in the coming decades.

Europe

Some migration from South Asia and Africa will likely increase the number of Muslim immigrants to the European Union (EU), potentially exacerbating existing tensions and increasing the likelihood of radicalization among members of Europe's growing and often poorly assimilated Islamic communities. The majority of immigrants to most Western European countries are already Muslim. Muslims constitute approximately five percent of the European population, with the largest communities located in France, the Netherlands, Germany, and Denmark. Europe's Muslim population is already expected to double by 2025, and it will be much larger if climate change spurs additional migration from South Asia and Africa.

The degree of instability generated will depend on how successfully these immigrant populations are integrated into European society. Unfortunately, this process has not always gone well as articles by State Department analyst Timothy Savage in *The Washington Quarterly* and Robert Leiken in *Foreign Affairs* have discussed.

Although the influx of immigrants from Africa—Muslim and otherwise—will continue to be viewed by some as a potential catalyst for economic growth at a time when the EU has a very low fertility rate, the viability of the EU's loose border controls will be called into question, and the lack of a common immigration policy will invariably lead to internal political tension.

State failure

In addition to potentially exacerbating radicalization in Europe, climate change could contribute to terrorism by increasing weak and failing states. In poor economic and social conditions, a country's political direction can change quickly. For instance, the inability or perceived unwillingness of political leaders to stop the spread of disease or to provide adequate care for the afflicted would undermine support for the government. In countries with functioning democracies, this could lead to the election of new leaders with political agendas radically different from their predecessors. It could also breed greater support for populist candidates whose politics resonate in a society that believes that its economic and social hardships are due to neglect or mismanagement by the government. In countries with weak or non-democratic political foundations, there is a heightened risk that this will lead to civil war or a toppling of the government altogether.

Water-borne and vector-borne diseases such as malaria and dengue fever will be particularly prevalent in countries that experience significant additional rainfall due to climate change. Conversely, some air-borne diseases will thrive in precisely those areas which become more arid due to drought and higher temperatures, such as in parts of Brazil. Shortages of food or fresh drinking water will also render human populations more susceptible to illness and less capable of rapidly recovering.

Restrictions on the movement of goods in response could become a source of economic and political turmoil. Countries that depend on tourism could be economically devastated by even relatively small outbreaks. For example, the fear of Severe Accurate Respiratory Syndrome (SARS) sharply curtailed international travel to Thailand in 2003. Even without trade restrictions, the economic burden that disease will place on developing countries will be severe from factors such as added health care costs combined with a loss of worker productivity from worker absences.

The outbreak of disease can also lead a government to adopt policies that may be seen as discriminatory or politically motivated by segments of its own population. Treatment may be provided first, or exclusively, to a particular ethnic group, religious faction, or political party. This can provide anti-governmental groups with the opportunity to increase their popularity and legitimacy by providing those health services that the government does not.

The threat of state failure and a base for global terrorism may be highest in East Africa because of the potential number of weak or failing states, the numerous unresolved political disputes, and the severe impacts of climate change. Climate change will likely create large fluctuations in the amount of rainfall in East Africa during the next 30 years—a five to 20 percent increase in rainfall during the winter months will cause flooding and soil erosion, while a five to 10 percent decrease in the summer months will cause severe droughts. This will jeopardize the livelihood of millions of people in a region where 80 percent of the population earns a living from agriculture and it constitutes about 40 percent of GDP. Meanwhile, the entire Horn of Africa continues to be threatened by a failed Somalia and other weak states. Al Qaeda cells are active in the region, and there is a danger that this area could become a central breeding ground and safe haven for jihadists as climate change pushes more states toward the brink of collapse.

The risk is also high in South Asia, particularly Bangladesh, where hundreds of Taliban and jihadists already found safe haven in the wake of the U.S. invasion of Afghanistan. In his May/June 2007 *Foreign Affairs* article, "Al Qaeda Strikes Back," former National Security Council staffer and CIA analyst Bruce Riedel warns that Bangladesh is among the places most likely to become a new base of operations for al Qaeda. The combination of deteriorating socioeconomic conditions, radical Islamic political groups, and dire environmental insecurity brought on by climate change could prove a volatile mix with severe regional and potentially global consequences.

The U.S. response and the risk of desensitization

Although some of the emergencies created or exacerbated by climate change may ultimately be managed by the United Nations, the United States will often be sought as a global "first responder" in the immediate aftermath of a major natural disaster or humanitarian emergency. The larger and more logistically difficult the operation, the more urgent the appeal will be.

The U.S. military has already played a vital role in international relief efforts undertaken after the December 2004 Indian Ocean tsunami. Podesta and Ogden em-

phasize that there was simply no substitute for the more than 15,000 U.S. troops, two dozen U.S. ships, and one hundred U.S. aircraft that were dedicated to the operation. The performance of the U.S. military was resoundingly applauded by the international community. In Indonesia itself, the U.S. public image improved dramatically. A Pew Research Center poll conducted in the spring of 2005 found that 79 percent of Indonesians had a more favorable impression of the United States because of its disaster relief efforts. As a result, the overall U.S. favorability rating in Indonesia rose to 38 percent after having bottomed out at 15 percent in May 2003. U.S. Admiral Michael Mullen, chairman of the Joint Chiefs of Staff, was right to describe the military's response to the tsunami and the subsequent improvement of the U.S. image in the region as "one of the most defining moments of this new century." The question now is whether the tsunami response will be remembered in 30 years time as a defining case or an exception to the rule.

If and how to respond will be a recurring question for the United States, each time raising a difficult set of issues with important national security and foreign policy implications. How much financial assistance should the United States pledge and how quickly? With which other countries should the United States seek to coordinate its response, either operationally or diplomatically? Should the U.S. military participate directly, and, if so, in what capacity and on what scale?

Over time, it is possible that the United States will become reluctant to expend ever greater resources on overseas disaster relief, not to mention longer-term humanitarian and stabilization operations, as the impacts of climate change begin to be seen more frequently and felt more acutely at home. Natural disasters already cost the United States billions of dollars annually, and the IPCC projects that climate change will create an "extended period of high fire risk and large increases in area burned" in North America and particularly in the western United States. The United States will also have to meet rising health costs associated with more frequent heat waves, a deterioration of air quality, and an increase in water-borne disease.

We might have glimpsed a model of this future in the response to the 2005 Pakistani earthquake, which occurred within a year of the Indian Ocean tsunami and just two months after Hurricane Katrina. With time and resources devoted to the Gulf Coast, the United States may not have responded as quickly and effectively at it otherwise would have, and as a result, missed a rare opportunity to recast its image in a strategically critical country.

Over the next three decades, the spread and advancement of information and communication technologies will enable the public to follow these crises more closely, making it difficult to ignore the widening chasm between how the world's "haves" and "have-nots" are affected by climate change. Ironically, as noted in a recent report by the UK Ministry of Defense's Development, Concepts, and Doctrine Center, the very words and images that at first will catalyze action might eventually lose their impact: "Societies in the developed and developing worlds *may* become increasingly inured to stories of conflict, famine, and death in these areas and, to an extent, desensitized."

Ultimately, the threat of desensitization could prove one of the gravest threats of all, for it is clear that the national security and foreign policy challenges posed by climate change are tightly interwoven with the global leadership challenge of helping those least responsible to cope with its effects.

Climate change will present challenges to U.S. foreign policy and national security interests all over the globe over the next generation. While the greatest temperature changes will be observed toward the poles, the greatest threats are likely to be seen closer to the equator, where societies and governments are more fragile and less able to cope with the strains of climate change. These threats include water shortages in the Middle East, environmental damage and domestic instability in China, migration within South Asia and Africa as well as from those regions to Europe, and state weakness and failure particularly in Africa and South Asia. Ultimately, these threats are not simply environmental but would exacerbate the threat to U.S. national security from terrorism itself, both by exacerbating radicalization of Muslim communities in Europe, which may then seek harm to Western societies, and by providing a home for terrorist operational planning and training in increasingly strained countries in the generation ahead.

BIOGRAPHY FOR ALEXANDER T.J. LENNON

Alexander T. J. Lennon is the Editor-in-Chief of *The Washington Quarterly,* the Center for Strategic and International Studies's (CSIS) policy journal on global strategic issues. Dr. Lennon is also a fellow in the international security program covering the grand strategy, foreign and defense policy of the great powers—particu-

larly the United States, China, and India, but also Europe, Japan, and Russia—and on nuclear proliferation prevention strategy. He is also an adjunct professor in security studies at Georgetown University. His current research projects are on the national security implications of global climate change and the regional risks of proliferation, especially on Iran and North Korea.

Before assuming his current positions, Lennon was the Deputy Director of studies at CSIS. Before that, he received a Presidential Management Internship (PMI) and served at the U.S. Department of State as the political-military officer principally responsible for bilateral security relations with Israel. While at the State Department, Lennon was awarded both the Benjamin Franklin award and a State Department Certificate of Appreciation for his performance as the lead U.S. action officer for the semiannual Joint Political-Military Group (JPMG) with Israel. Prior to that, he worked in the political-military studies program at CSIS where he specialized in Northeast Asian security issues as well as nuclear doctrine and nonproliferation.

Alex has published articles in *The Washington Quarterly* (before he was Editor), *Internationale Politik: Global Edition, Strategic Review, The China Business Review, The Christian Science Monitor, The Boston Globe, Defense News,* and *Newsday,* among other publications. He has edited or co-edited five books: *Reshaping Rogue States* (Cambridge, MA: MIT Press, 2004); *The Battle for Hearts and Minds* (Cambridge, MA: MIT Press, 2003); *What Does the World Want from America?* (Cambridge, MA: MIT Press, 2002) *Contemporary Nuclear Debates* (Cambridge, MA: MIT Press, 2002); and (with Michael J. Mazarr) *Toward a Nuclear Peace: the Future of Nuclear Weapons After the Cold War* (New York: St. Martin's Press, 1994).

Lennon has been interviewed on dozens of radio programs and television news broadcasts, including BBC, Fox-News TV, CBC (the Canadian Broadcasting Company), and Feature News Service throughout Asia. He is a life member of the International Institute for Strategic Studies (IISS), the Council on Foreign Relations (CFR), and the Council for Security Cooperation in the Asia-Pacific (CSCAP).

Alex earned his Ph.D. in Policy Studies, part-time, at the University of Maryland where he wrote his dissertation on the role of transnational (track-2) security policy networks with other great powers in U.S. nuclear nonproliferation policy. He also holds a Master's degree in National Security Studies from Georgetown and an A.B. *cum laude* from Harvard, where he was the national intercollegiate policy debate (NDT) champion.

Ms. HOOLEY. Thank you. Certainly from a different perspective I think than we have——

Next we have Dr. Price-Smith.

STATEMENT OF DR. ANDREW T. PRICE-SMITH, ASSISTANT PROFESSOR, DEPARTMENT OF POLITICAL SCIENCE, COLORADO COLLEGE; DIRECTOR, PROJECT ON HEALTH, ENVIRONMENT, AND GLOBAL AFFAIRS, COLORADO COLLEGE/UNIVERSITY OF COLORADO–COLORADO SPRINGS; SENIOR ADVISOR, CENTER FOR HOMELAND SECURITY, UNIVERSITY OF COLORADO

Dr. PRICE-SMITH. Thank you, Madam Chairman. I will be discussing the impact of global climate change on infectious disease, its implications for economic and political instability, and for U.S. national security.

As you will see from the slides now presented to you, I will be discussing first the precipitation trends. This is IPCC data from, as you can see, 1900 to 2000. In my opinion it is the best global data set available. Period.

The effects of precipitation on infectious disease are going to be expressed through precipitation's effects on vectors, namely mosquitoes, flies, snails, and so forth. And, specifically, increased precipitation will lead to increasing prevalence of malaria, schistosomiasis, and perhaps other diseases as well.

Next slide, please. These are the annual temperature trends from 1976 to 2000. What we are likely to see here is an expansion of the ranges of disease-bearing vectors in terms of both latitude and alti-

tude, which means that diseases like malaria are expected to move from the tropics towards the Poles—so, from the tropical to the sub-tropical and temperate regions.

Furthermore, malaria and other vector-borne diseases may expand in terms of altitudinal range—in other words, moving up where it is up hills and mountainsides to affect cities like Nairobi in Kenya, which historically was free of malaria but is no longer so as a result of the warming trend in that region.

I must confess I came to this topic as a bit of a skeptic. It was at Kent's invitation to a conference for the TISS down in North Carolina. However, I have changed my views a bit on some of these issues.

Another thing that is interesting, if we could go back to the precipitation slide for a second, is the changes in aridity. All right. Arid environments are, in fact, inimical to certain pathogens, such as schistosomiasis, which is borne by snail vectors, specifically *oncomelania*. So you will see that in portions of Central Africa, right there indicated by the orange dots, those increasingly arid environments will actually see a decline in certain pathogens such as malaria and schistosomiasis because of their declining moisture.

So what I would like to state is that climate change generates winners and losers. It is contextual, and it depends upon both the pathogen in question and the vector.

Into the realm of economics—well, before we get there actually, let us discuss non-linearities. As Woolsey indicated—he brought this up this morning, I think—it is important to think in non-linear terms. All right. Diseases don't gradually increase. They expand geometrically once they attain a rate of expansion of over one within any given population.

So thinking that climate change is just going to generate linear, slow, incremental change in terms of disease prevalence may be the wrong way to go. All right. We may see exceptional explosions of diseases in certain areas and also rapid declines of disease in other regions. Again, it is contextual.

In the realm of economics now, health is the central driver of economic productivity. It has been rather established, I think. Conversely, disease erodes productivity, savings, and aggregate wealth in affected societies. Jeffrey Sachs has estimated that malaria alone generates 1.3 percent drag on GDP per capita growth in affected nations.

Furthermore, disease exhibits differential impacts on class. The burden of disease falls primarily on the poor and middle class and historically has exacerbated inequities between classes.

Politically, I think that, just in conclusion here—and I would be happy to answer more questions—pathogens should be thought of as stressors upon the state and upon societies and upon economies. It can exacerbate pre-existing conflicts between classes, ethnicities, religious factions, and between state and society. The destabilization is likely pathogen specific. And areas at risk in my opinion include South Asia, Southeast Asia, Sub-Saharan African, and portions of Latin America.

The effects on U.S. national security in my opinion will be primarily indirect, but disease can act as a stressor to: 1) weaken

states; 2) radicalize populations; and 3) thus facilitate radical and or terrorist activities, in my opinion.

So in sum, much more research is actually required in this domain. It is a very new domain of exploration, climate to disease to economic and political outcomes, and hopefully we can provide more information to you.

Thank you.

[The prepared statement of Dr. Price-Smith follows:]

PREPARED STATEMENT OF ANDREW T. PRICE-SMITH

On Climate Change and Infectious Disease: Implications for Political Destabilization and Conflict

Mr. Chairman and Members of the Science and Technology Committee, thank you for inviting me here today to share with you my views regarding the impact of Global Climate Change on Infectious Disease, its implications for economic and political instability, and for U.S. national security. I am the Director of the Project on Health, Environment, and Global Affairs, which is an inter-university research initiative between Colorado College and the University of Colorado, Colorado Springs, and Senior Advisor to the Center for Homeland Security at the University of Colorado. I serve as Assistant Professor of Political Science at Colorado College, and have held previous appointments at Columbia University and the University of South Florida. Over the years I have served as consultant or advisor to the U.S. Department of Energy, and Department of Defense, the World Bank, the United Nations Development Program, and the Council on Foreign Relations.

On Etiology and Emergence

In the twenty first century, novel pathogens are currently 'emerging' at the rate of approximately one new agent per annum. Emerging diseases often are the result of 'emergent properties' wherein antecedent variables (e.g., population density, speed of transport) combine in unusual and unforeseen ways that facilitate the emergence of a given pathogen which then becomes endogenized within the human ecology. The classic modern example of such emergent properties leading to viral proliferation is the SARS coronavirus which appeared in Guangzhou, China in late 2002, and subsequently spread throughout the Pacific Rim nations. In that particular case, this virulent coronavirus spread from its natural reservoir in east Asian bat populations, into palm civets. The variant of the virus that infected civets was transmissible among humans, amplified by elements of the human ecology such as the 'wet markets' of East Asia, the closed environments of modern hospitals which amplified degrees of infection, and modern jet airplane technology that facilitated the rapid spread of the virus throughout the Pacific theater. Individually these disparate variables would not predict the emergence of epidemic disease, however, when combined together the SARS contagion of 02–03 resulted.

The dynamics of contagion frequently exhibit such emergent properties,[1] and the relations between pathogen, human host, and vectors of transmission (e.g., mosquitoes) are central to both the transmissibility and lethality of any given manifestation of contagion. Furthermore, epidemics and pandemics exhibit non-linearities and threshold dynamics. For example, pathogens may simmer in a given population for some time, but once the rate of transmission passes from <1 to >1, the proliferation of the pathogen may then increase on an exponential scale. Diseases also exhibit high levels of interactivity, and the capacity for co-infection. The classic example is HIV which destroys the host's immune system, and thereby facilitates colonization by other pathogens (e.g., tuberculosis) that ultimately kill the host. What then is the relationship between climate change, infectious disease, prosperity, and political stability and security? The complexity of such interactions is enormous, and so we begin with the relations between climate and disease, focusing on malaria in particular.

[1] For an in-depth discussion see Andrew Price-Smith, *Contagion and Chaos,* MIT Press, forthcoming 2008.

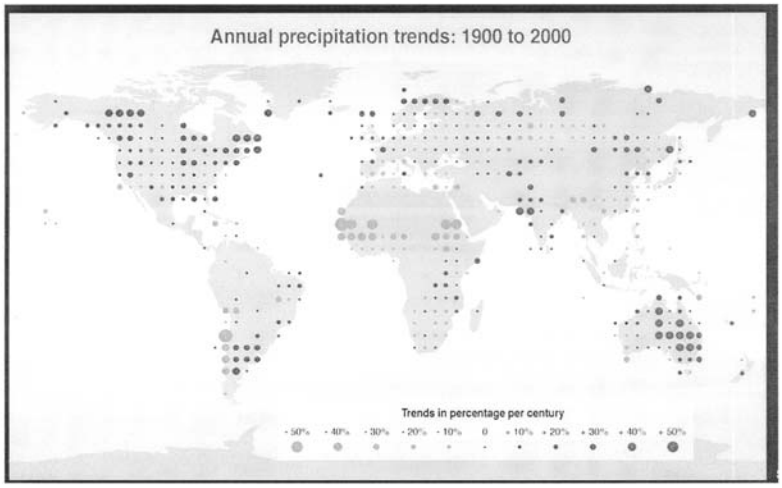

Figure 1

Source: Intergovernmental Panel on Climate Change (IPCC). 2006. Located at: http://www.ipcc.ch/. Last accessed on April 2007.

Data provided by the IPCC regarding changes in precipitation from 1900–2000 indicate enormous variance on a global scale. Certain regions, such as the arctic and sub-arctic regions of the northern hemisphere, the northeastern sector of south Asia, and Eastern Australia are clearly enjoying increased levels of precipitation. Certain vectors of disease, (such as mosquitoes and snails) thrive in wet environments. Consequently, increases in precipitation will induce the proliferation of vectors, and thereby increase the transmission rates of certain pathogens such as malaria and schistosomiasis.

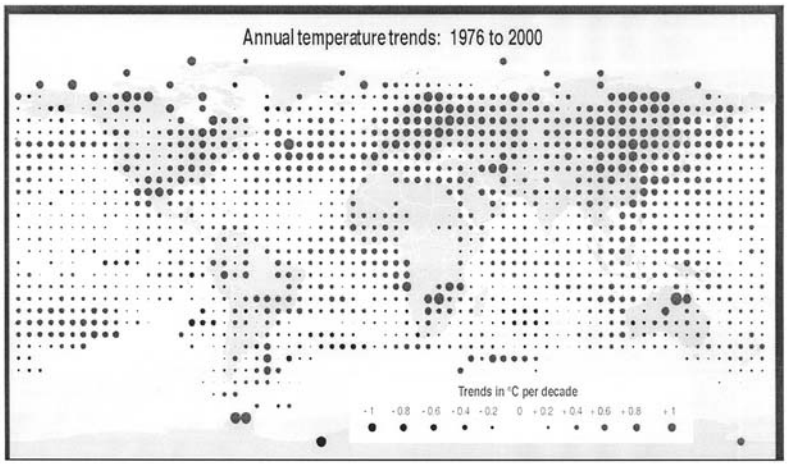

Figure 2

Source: Intergovernmental Panel on Climate Change (IPCC). 2006. Located at: http://www.ipcc.ch/. Last accessed on April 2007.

Pathogens and their vectors of transmission are often highly sensitive to changes in temperature as well. IPCC data from 1976–2000 clearly indicate increasing temperatures for much of the surface of the planet, with the greatest increases evident in the temperate to polar regions. As isotherms shift toward the polar regions, this will expand the latitudinal range of the vectors in question (i.e., anopheles mosquitoes) and thereby permit the expansion of malaria in previously non-malarious zones. Similarly, increasing surface temperatures permit the movement of malaria in higher altitudes than before. For example, Nairobi has historically been non-malarial due to its altitude, but in recent years increases in temperature have seen the pathogen moving into the region. The temperature-induced expansion of malaria is problematic because it exposes novel populations, who often lack any genetic or acquired immunity to the pathogen. Thus, the mortality and morbidity in such regions may be much higher than in zones where malaria is endemic.

Increasing temperatures also affect the biting rate of vectors. As temperatures rise, the vectors (mosquitoes) feed with greater frequency, and therefore increase the transmission rate of the *plasmodium* (the parasite) into human populations. Furthermore, increasing temperatures also affect the extrinsic incubation rate of the pathogen, such that it replicates within the gut of the vector at a greatly augmented rate. Thus, under conditions of higher temperatures, there are greater numbers of plasmodium within the vector, and the vector bites with much greater frequency.[2] On a macro level, all of this means that as temperatures increase, the burden of disease (e.g., malaria) is likely to increase to a significant degree. Precipitation and Sea Surface Temperatures (SST's) are strong predictors of malarial incidence.[3]

In the case of cholera, increasing SST's are highly correlated with the growth of algal blooms. The blooms move across oceans courtesy of dominant currents and winds, and function as vectors of transmission of the *vibrio.* Thus, we see a long-term empirical association between SST and the incidence of cholera. In the case of cholera we have also seen that incidence is responsive to the modulation of the El Niño Southern Oscillation (ENSO), with preliminary evidence from case studies carried out in Bangladesh (Rodo, 2002). There is also considerable evidence of thresholds and non-linearities, such that warming temperatures may produce minor

[2] See Reiter 2001, Kovats et al., 2001; Hunter, 2003; van Lieshout, 2004; Patz et al., 2005; McMichael, 2006.

[3] M.C. Thompson et al., 2005.

and linear increases in *vibrio* incidence until a threshold point is reached, after which the numbers of the pathogen increase at an exponential scale.[4]

Schistosomiasis is a frequently lethal disease induced by parasitic blood flukes, and it is prevalent in tropical and temperate zones. The vector of the parasite is the snail (*oncomelania*) which thrives under conditions of increased precipitation, and within the temperature range of 15.3 degrees C to an optimal temperature of 30 degrees C. The balance of available evidence suggests that global climate change (GCC) will shift the distribution of the vectors into new regions, and thereby afflict previously uninfected populations. A caveat however, the IPCC data clearly indicate that certain regions (e.g., West Africa) are becoming increasingly arid, which is inimical to the vector. Consequently, those zones that witness declining precipitation levels will see a decline in the incidence of schistosomiasis in their respective populations. In those regions that exhibit both increasing precipitation, coupled with increasing temperature, we are likely to witness augmented geographic zones of transmission, and increased frequency of transmission within those regions. Thus, GCC will result in winners and losers, dependent upon the particular pathogen in question, and its sensitivity to aridity and temperature.[5]

Economic Outcomes

The economic historian Robert Fogel won the Nobel Prize in economics in 1994 for his analysis of the hypothesis that population health was the central driver of economic productivity (NBER, 1994). If health promotes prosperity, then disease erodes productivity and wealth. At the micro-economic level disease erodes productivity through mechanisms such as the debilitation of workers, increased absenteeism, increased medical costs, reduced savings and investment, and the premature death of breadwinners. At the sectoral level, disease imposes a particular burden upon those sectors of the economy that are labor-intensive, such as agriculture, and resource-extraction, and thereby imposes a relatively greater effect upon the economies of the developing world.

The impact of malaria is illustrative at the macro-economic level. Sachs and Malaney estimate that for those countries where malaria is endemic, the pathogen generates a 1.3 percent drag on their GDP growth rate, per capita/per annum. Further, Gallup and Sachs estimated that a 10 percent decline in malaria incidence resulted in a 0.3 percent increase in the growth rate of GDP per capita/per annum. McCarthy estimated that malaria imposed a drag on the GDP growth rate of affected nations, at the level of 0.25 to 0.55 percent per annum.[6] In case studies of individual nations, malaria control has resulted in greater prosperity for the polity in question. For example, malaria control measures in Zambia resulted in a $7.1 billion increase to that nation's economy.[7]

The burden of infectious disease falls primarily upon the poor and middle classes, and therefore as the burden of disease increases in certain regions it will likely exacerbate both the perceived and real level of economic inequities between socioeconomic strata. Historically, such perceptions of inequity have led to periods of social and political destabilization.[8] On a global scale, GCC-induced increases in the burden of disease will exert a drag on the global economy, and the perpetuation of poverty within the LDCs.

Assessments of the economic burden of a given illness (e.g., malaria) are complicated by the lack of adequate surveillance infrastructure throughout much of the developing world where the disease is endemic.[9] Moreover, the complexity of measuring the economic impact of GCC-induced infectious diseases is augmented by the interactivity of various pathogens in a given population. For example, the population of country X may be increasingly beset by increased incidence of malaria, dengue fever, and schistosomiasis, and certain individuals may exhibit co-infection with one or more pathogens.

Pathogens may also erode the functionality and efficacy of the state as well. For example, disease-induced economic stagnation (or contraction) of the macro economy will consequently reduce tax-based revenues available to the state. Diminished revenues will in turn impede the state's capacity to provide public goods and services (e.g., education, law enforcement) to its population. This may in turn reduce the populace's perceptions of the legitimacy of the state. In the domain of human cap-

[4] See Xavier Rodo et al., 2002; J. Patz, 2002.

[5] See Nagasaki, 1960; Zhou et al., 2002; Yang et al., 2005; Steinmann et al., 2006; Guo-Jing Yang et al., 2007.

[6] D. McCarthy et al., NBER paper 7541, 2000.

[7] Utzinger et al., 2002.

[8] Price-Smith, Contagion and Chaos, MIT Press, 2008, forthcoming.

[9] Worral et al., 2004, 2005.

ital, disease may further erode state capacity by debilitating and/or killing trained and skilled personnel, thereby reducing institutional resilience and efficacy.[10]

On Poverty, Instability and Conflict

The association between poverty, political destabilization, and outright conflict is complex. In particular, there is an endogeneity issue regarding the direction of causality. However, we can make some preliminary observations at this point. First, various iterations of the State Failure Task Force conducted empirical investigations and determined that infant mortality (as a measure) is a strong empirical predictor of state failure.[11] Ted Gurr argued that increasing levels of poverty induced a psychological state of deprivation (perceived injustice) that often led to intra-state conflict.[12] This hypothesis that conditions of deprivation (both real and perceived) led to civil strife was supported by Deininger (2003), and low levels of the Human Development Index are associated with conflict in Indonesia (Malapit et al., 2003). Other political scientists have found that poverty combines with ethnic fragmentation to produce intra-state conflict (Easterly and Levine, 1997; Wilkinson, 2004; Korf, 2005). Charles Tilly has argued that inequities are directly associated with intrastate conflict (Tilly, 1998).[13] Further, there is empirical evidence that social polarization leads to conflict (Esteban and Ray, 1994, 1999; Boix, 2004), and that conflict may function as a 'coping strategy' for those populations confronted with extreme levels of economic deprivation (Humphreys and Wienstein, 2004; Verwimp, 2005). Convincing arguments take the form of the state weakness hypothesis wherein deprivation combines with a weakened state to offer both the motive and the opportunity for political violence, with evidence from numerous case studies (see Kahl, 2006; and Homer-Dixon, 1999). Political scientists (Singer, 2002) have also hypothesized that increased levels of infectious disease may lead to conflict between sovereign states. Although there is evidence that contagion leads to political acrimony and trade disputes between nations, there is no evidence that infectious disease results in war between nations (Price-Smith, 2008). Despite the proliferation of literature to support the hypothesis that economic deprivation generates political violence at the intra-state level, additional cross-national empirical analysis, using time-series data, is required. That said, the balance of existing evidence supports the hypothesis.

Conclusions

Pathogens function as stressors that impose burdens on both populations (i.e., society), and upon the structures of the state itself. Historical analysis of the stresses generated by epidemic disease demonstrate that pathogens have exacerbated preexisting conflicts between socioeconomic classes, between ethnicities, between those of different religious affiliations, and frequently induced conflicts between state and society.[14] Thus, the GCC-induced proliferation of disease may facilitate socio-political destabilization, particularly in the weak states and impoverished populations of the developing world. However, such destabilization is contingent upon several factors, it is pathogen-specific, and it depends upon existing socioeconomic and political cleavages within the polity in question. Areas at risk of such disease-induced destabilization include the sub-tropical to temperate zones, as tropical pathogens and their attendant vectors expand into these contiguous zones to affect immunologically naïve populations. Thus, we should be concerned about nations in South Asia, Central and East Asia, Southern Africa, and South America. Typically the effects of disease-induced destabilization upon the security of the United States will be *indirect,* however, in the post 9–11 era we now recognize that weak and failed states in the developing world may generate externalities (such as terrorism and political radicalization) that threaten the material interests of the dominant powers of the international system, including the United States.

In conclusion, further research is required to flesh out the complex chain of possible causation that I have detailed above. This will require the formation of interdisciplinary teams of both social and natural scientists who will then model the impacts of climate change upon disease, and the consequent effects upon the economic and political domains. This might involve the compilation of a time-series data set across a representative sample of countries. One obvious problem involves modeling

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[10] An expanded analysis of the pernicious effects of disease on the state can be found in Andrew Price-Smith, *The Health of Nations,* MIT Press, 2002.

[11] D. Esty et al., *State Failure Task Force I and II.*

[12] Gurr, 1970.

[13] Also see Stewart, 2000; Langer, 2004; Mancini, 2005.

[14] See Friedrich Prinzing, 1916; David Baldwin, 2004; Richard Evans, 2005; Alfred Crosby, 1986; William McNeill, 1976; Charles Rosenberg, 1987; Sheldon Watts, 1999; Terence Ranger and Paul Slack, 1996; and J.N. Hays, 1998.

the long-term processes of climate change, however we might use the ENSO effect to model how short-term changes in climate induce variance in disease incidence, and then observe the resulting economic and political impacts over the very short-term.

Thank you, Mr. Chairman, for providing me this opportunity to appear before you. I'm happy to respond to Members' questions.

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BIOGRAPHY FOR ANDREW T. PRICE-SMITH

Andrew T. Price-Smith is Director of the Project on Health, Environment, and Global Affairs, which is an inter-university research initiative between Colorado

College and the University of Colorado, Colorado Springs, and Senior Advisor to the Center for Homeland Security at the University of Colorado. He is also Assistant Professor of Political Science at Colorado College, and Adjunct Professor of Environmental Science. He received his Ph.D. in Political Science from the University of Toronto in 1999, where he also served as founding Director of the Project on Health and Global Affairs at the Munk Center for International Studies. From 1999–2000 he served as a post-doctoral Fellow in the Earth Institute and taught at the School of International and Public Affairs of Columbia University. Following that he taught at the University of South Florida in both the Department of Government, and the Environmental Science and Policy Program. He is author of *The Health of Nations* (MIT Press, 2002), which was short-listed for the Grawemeyer Award; co-author with John L. Daly of *Downward Spiral: HIV/AIDS, State Capacity and Political Conflict in Zimbabwe* (USIP Press, 2004), and editor of *Plagues and Politics: Infectious Disease and International Relations* (Palgrave, 2001) as well as various chapters, articles, papers and book reviews. Andrew is the Chair of the Section on Health and Population Studies for the International Studies Association–West, and serves as a member of the governing board of ISA–West as well. Dr. Price-Smith is a specialist in international health and economic development, and biosecurity issues.

Ms. HOOLEY. Thank you so much. Again, another interesting perspective, and I am glad that you told me about snails because I understood mosquitoes and flies but I thought, what do snails have to do with this? So thank you.

Next we have Dr. Butts. Welcome.

STATEMENT OF DR. KENT HUGHES BUTTS, PROFESSOR OF POLITICAL MILITARY STRATEGY; DIRECTOR, NATIONAL SECURITY ISSUES, CENTER FOR STRATEGIC LEADERSHIP, U.S. ARMY WAR COLLEGE

Dr. BUTTS. Thank you, Madam Chairman, for allowing me to contribute to the work of the Subcommittee on Investigations and Oversight.

The relationship between climate change and security is important and will play a major role in defining the future vitality of the United States. Today I will focus on the role of the Department of Defense in addressing climate change and security issues, and in particular highlight the value of involving the regional combatant commands in building sovereign nation capacity for mitigating and destabilizing climate change threats.

Before I begin, please allow me to note that I am appearing today on my own behalf, and my views do not represent the views of the U.S. Army War College or the United States Army or the Department of Defense or any other establishments with which I am associated.

While debate continues on the causes of climate change, significant consensus for addressing its security dimensions already exists, and it creates many opportunities for alliance and partner cooperation, building on issues of major significance to regional security. The security community is still coming to grips with soft security issues in general and climate change in particular. For years security studies focused on force-on-force issues and reflected the Cold War milieu. New definitions take time to build constituencies. Terms such as *environmental security, economic security, human security* have different stakeholders and require different approaches from the security community.

Climate change is an environmental security issue and should be considered in that context. Environmental security refers to a

"process whereby solutions to environmental problems contribute to national security objections." While the relationship of environmental issues to security was recognized previously, the end of the Cold War brought a new examination of the dimensions of security and the recognition that environmental issues could inflame existing tensions into conflict but could also serve as confidence-building measures to reduce tensions.

NATO's post-Cold War strategic concept made this clear. Risks to security are less likely to result from calculated aggression but rather from the adverse consequences of instabilities faced by many countries. Security and stability have political, economic, social, and environmental elements as well as the indispensable defense dimension. Climate change affects the management of these elements and is a threat multiplier for instability in most of the volatile nations of the world. In the post-Cold War era, then, instability is the chief threat to U.S. national security interests.

Soft security issues left untended have the potential to destabilize regions and become hard security issues which require the introduction of combat forces and threaten U.S. security interests.

The security dimensions of climate change could be characterized as having three levels: global, geopolitical, and regional. If you looked at the 2006 Quadrennial Defense Review of the Department of Defense, it states that the transformed DOD seeks to take preventative action so problems do not become crises. This should be the U.S. approach to climate change and security and involve all elements of national power.

Department of Defense as the military element of national power should support that effort. DOD can contribute to security dimensions at each level. DOD can reduce its energy consumption and carbon emissions. It can encourage technological research, development, and energy conservation, clean fuels, and alternative energy. It can prepare for military responses to new geopolitical realities such as competition for arctic resources. It can proactively build regional capabilities and alliances to create climate change resilience and preserve regional stability.

These missions make sense and will result in major source savings for energy, waste disposal, and combat arms deployments. However, DOD should not assume the climate change responsibilities of other agencies. These agencies should be properly resourced and directed to assume their climate change missions.

While the ongoing National Intelligence Estimate and Military Advisory Board summaries of the threat to security are pressing, we need to do more. The questions should be asked: Where is DOD possibly involved in solving environmental security issues? Where are U.S. national security threats evidence? What resources should be brought to bear? And how should the Department of Defense be working with other agencies to do that?

If we put those questions in our national security strategy, if we suggest answers to those questions and delineate which agencies will be involved, then DOD's strategic documents will address climate change, and we will have the best minds nationwide addressing the security dimension, and we will preserve the vitality of the United States.

Thank you very much.

[The prepared statement of Dr. Butts follows:]

PREPARED STATEMENT OF KENT HUGHES BUTTS

Climate Change and Security

I am pleased to be able to contribute to the work of the (Subcommittee on Investigations and Oversights) House Committee on Science & Technology on *"The National Security Implications of Climate Change."* The relationship between climate change and security is important and will play a major role in defining the future vitality of the United States (U.S.). Today, I will focus on the role of the Department of Defense (DOD) in addressing climate change security issues and, in particular, highlight the value of the regional combatant commands in building sovereign nation capacity for mitigating destabilizing climate change threats. Before I begin, please note that I am appearing today on my own behalf and my views do not represent the views of the United States Army, Department of Defense, or any other establishment with which I am associated.

CHANGE BRINGS OPPORTUNITY

Today we have an opportunity for addressing the security dimensions of climate change that did not previously exist. President Bush's recent leadership role on climate change issues and his decision to support the 33rd G8 Summit's effort to at least halve the global carbon dioxide emissions by 2050 was a watershed for the United States climate change policy.[1] It reflects a growing recognition in the United States of the importance of proactively addressing the issue of climate change and encourages research on its security dimensions.

In order to understand the way that the United States is approaching climate change one must consider many domestic variables. There is substantial movement on climate change in the United States that are now being recognized and changing the milieu in which the security dimensions of climate change are being considered.

The election of the 110th Congress is having a significant impact on how the United States approaches climate change. Congress is drawing governmental attention to environmental issues across many agencies often in a bipartisan way. The Amendment to the *Defense Appropriations Act* requiring the Department of Defense to consider climate change in its planning and operations was submitted by Senator Clinton but supported by some Republicans.[2] Senators Domenici and Bingaman recently co-authored a major paper on climate change regulating greenhouse gasses.[3]

The faith based community is a powerful force in U.S. politics from the local to the national level. President Bush has made clear the importance of his faith and this community. Recently leaders of the evangelical Christian community have entered the debate on environmental degradation and climate change. The National Association of Evangelicals has taken a pro environmental stance that reflects the concept of humankind being held accountable for what they do with the world God created.[4] Thus, within the religious conservative community, there is a re-examination of environmental issues and growing support for national efforts to mitigate activities that may contribute to climate change.

There are other political realities at play. Polls have noted a trend toward taking action on climate change variables among both political parties. In the last national presidential election, polls showed that a majority of Republican voters favored doing more to curb tailpipe admissions. Being against taking action to address climate change is no longer of value to candidates running for office in many states. This is an important trend.

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[1] Mr. James Gertenzang and Mr. Richard Simon, "Bush Offers to Take Climate Lead," *Los Angeles Times,* June 1, 2007 available at *http://www.latimes.com/news/nationworld/nation/la-na-bush1june01,1,27206787.story?track=crosspromo&col*; Fact Sheet: "A New International Climate Change Framework," The White House, President George W. Bush, Office of the Press Secretary, May 31, 2007.

[2] Press Release, United States Senate, Carl Levin, Michigan, Chairman, Committee on Armed Services, SR–228 Russell Senate Office Building, Washington, DC 20510, May 25th 2007.

[3] Senators Pete V. Domenici and Jeff Bingaman, Issue Paper "Design Elements of a Mandatory Market Based Greenhouse Gas" Regulatory System, February 2006.

[4] Ms. Barbara Bradley Hagerty, "Global Warming: Evangelical Leaders Urge Action on Climate Change," available at *http://www.npr.org/templates/story/story.php?storyId=5194527*; Mr. James Sherk, "Christians and Climate Change: Should Followers of Christ concern themselves with the threat of Global Warming?" Available at *http://www.evangelicalsociety.org/sherk/wwjdpf.html*

The private sector is becoming a powerful force for climate change regulation. The private sector is increasingly lining up behind taking action on greenhouse gas emissions. Faced with growing State and local legislation aimed at controlling emissions, the private sector is seeking a place at the table where this legislation is being crafted, particularly at the national level. The private sector would prefer one federal standard to which it could adapt production technology rather than varying standards across states and regions.

It is particularly important to remember that much environmental policy in the United States originates at the State and local level. The U.S. air and water quality standards were first developed at the State level. Because of its sizable economy, air quality standards in California drove the auto industry to drop opposition to emissions control and produce vehicles to meet that state's and federal requirements. However, it often takes years for State standards to become federal standards. It may appear that the United States is not moving forward on climate change mitigation, but in fact, the recent environmental policies implemented in California are already changing the national debate as other states consider similar legislation.[5] The impact of State climate change policies and recent U.S. Supreme Court decisions are being felt at the national level.

There are other key variables in the shift of public opinion on climate change. The Intergovernmental Panel on Climate Change (IPCC) report presented a strong case for mitigating climate change, providing previously lacking consensus among the scientific community on critical aspects of the debate.[6] Media coverage of obvious phenomena of climate warming, such as the melting of glaciers and polar ice caps, was highly influential, even among those unfamiliar with the technical dimensions of the climate change debate. Former Vice President Gore's movie, personal appearances, and their publicity reinforced the IPCC report and gave an abstract (to some) concept a clear image. Complementing these activities has been the growing understanding of the importance of climate change to the traditional national security objectives.

CLIMATE CHANGE AND SECURITY

Climate change is an Environmental Security issue and should be considered in that context. Environmental security refers to *"a process whereby solutions to environmental problems contribute to national security objectives."*[7] While the relationship of environmental issues to security was recognized previously, the end of the Cold War brought a new examination of the dimensions of security, and the recognition that environmental issues could inflame existing tensions into conflict, but could also serve as confidence building measures to reduce tensions. NATO's post Cold War Strategic Concept made this clear, *"Risks to Allied security are less likely to result from calculated aggression. . .but rather from the adverse consequences of instabilities. . .faced by many countries. . .security and stability have political, economic, social, and environmental elements as well as the indispensable defense dimension."*[8] Climate change affects the management of these elements and is a "threat multiplier for instability in some of the most volatile regions of the world."[9] In the Post Cold War era, instability is the chief threat to traditional U.S. national security interests.

The intelligence community has focused on environmental hot spots as potential sources of instability, but environmental issues also provide a valuable element of outreach and engagement, which may serve as confidence building measures between countries or regions of existing enmities. NATO used Environmental Security successfully to promote dialogue and cooperation with former East Bloc countries in the early 1990s. India, Pakistan, and China have cooperated on seismic disaster preparedness.[10] The Madrid Peace Process for the Middle East used water, migration, and other environmental issues as vehicles of multilateral engagement between

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[5] California Governor Arnold Schwarzenegger, Press Release, "Governor Schwarzenegger Applauds California Climate Action Registry for Joining First Multi-State Greenhouse Gas Tracking," May 8, 2007, available at *http://gov.ca.gov/index.php?/press-release/6165/*.

[6] Intergovernmental Panel on Climate Change Report, June 2007.

[7] Environmental Security, Strengthening National Security Through Environmental Protection, Washington DC, Environmental Protection Agency, September 1999, p. 1.

[8] "The Alliance New Strategic Concept," *NATO Press Service,* 1991, p. 3.

[9] The Military Advisory Board, National Security and the Threat of Climate Change, Alexandria, VA, CNA Corporation, 2007, p. 6.

[10] Professor B.F. Griffard, COL (Ret.) Art Bradshaw, and Professor Kent Hughes Butts, *Disaster Preparedness: Anticipating the Worst Case Scenario,* U.S. Pacific Command South Asia Seismic Disaster Preparedness Conference, 22–24 February 2005, Center for Strategic Leadership, U.S. Army War College.

Israel and regional states. Climate change creates new opportunities for environmental engagement, cooperation and tension reduction.

For the last 15 years, the United States has used an interagency approach in applying Environmental Security to promote national security and diplomatic objectives, encourage stability and multilateral cooperation, and prevent conflicts. The Department of State (DOS) has established Environmental Hubs in U.S. embassies around the world that use environmental diplomacy to create cooperation among regional states.[11] The Department of Defense and its regional Combatant Commanders use Environmental Security as an engagement vehicle and have worked closely with these Hubs to build cooperative relationships among regional states and Military Support for Civil Authority and democracy. DOD cooperation with partner countries has been regularly supported by agencies such as the: U.S. Agency for International Development (USAID); U.S. Geological Society; Environmental Protection Agency; and Department of the Interior. These build partner capacity and capabilities to address Environmental Security issues and promote stability. It is important to understand that this international interagency cooperation is ongoing and already addressing the security dimensions of many climate change issues.

The 9/11 terrorist attacks have drawn the attention of the security policy-making community to the underlying conditions of terrorism. As the 9/11 Report states, "When people lose hope, when societies break down, when countries fragment, the breeding grounds for terrorism are created."[12] The United States has found that attacking terrorists and their organizations is not sufficient to win the war on terror. New analysis of terrorism suggests that it should be treated as an insurgency with the people as the center of gravity, and highlights the importance of regional stability, good governance, and governmental legitimacy. Capable, stable regimes can address water and food security, health and disease management, sustainable development, energy requirements, and other needs of the people that constitute demands upon the political system. Doing so prevents social unrest and migration, humanitarian crisis, failed states, the spread of ungoverned territory, and the encroachment of terrorist ideology. As the two recent U.S. National Security Strategies make clear, terrorism has been the top, stated national security priority. The significant role of environmental issues in creating the underlying conditions terrorists seek to exploit has caused the security community to take notice; climate change can weaken political systems and exacerbate environmental threats.

In addition to the ongoing intelligence community National Intelligence Estimate, the well regarded Center for Naval Analysis Corporation (CNA) Report, *"National Security and the Threat of Climate Change,"* pointed out the major role climate change is playing in security. As the report states, climate change is a *"threat multiplier for instability in some of the most volatile regions of the world."*[13] While many of these regions are part of the terrorist equation, all are important to U.S. national security interests, such as: energy access; terrorism; strong market economies, and nonproliferation. Thus, variables that exacerbate a threat should be addressed by the security community and the elements of national power, including the military, but not necessarily in a lead role.

The President has authorized the establishment of the African Command (USAFRICOM) and its framing documents state that the deputy commander should be from the DOS and its focus is not war fighting but helping to build partner capacity and promote regional stability. Environmental Security issues determine stability in much of Africa and the effects of climate change will greatly affect this relationship and very likely the engagement strategies of other regional commands.[14]

While debate continues on the causes of climate change, significant consensus for addressing its security dimensions already exists in the United States and creates many opportunities for alliance and partner nation cooperation on issues of major significance to regional stability.

THE ROLE OF THE DEPARTMENT OF DEFENSE

Climate change may be characterized as affecting U.S. national security at three levels. At a global level, climate change affects moisture patterns and energy retention and will have a direct impact on the Earth, the U.S. and its possessions and

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[11] DOS *Environmental Diplomacy, The Environment and U.S. Foreign Policy,* April 1997, p. 31.

[12] *The 9/11 Commission Report; Final Report of the National Commission on Terrorist Attacks Upon the United States,* Official Government Edition, WW Norton & Company, July, 2004 and Mr. Byron York, "Al Qaeda, Iran, North Korea-and Global Warming," *National Review Online* 10 May 2007.

[13] Military Advisory Board, 2007, p. 6.

[14] Rear Admiral Robert Moeller, Executive Director, "U.S. Africa Command," June 7, 2007, available at *http://www.eucom.mil/africom/index/asp*

reduce the resources upon which humankind depends. More powerful storms, extended dry periods and droughts, periods of more intense flooding and increased migration may challenge the U.S. directly. At a *geopolitical level,* the melting icecaps, rising sea levels and loss of habitable space are creating new geopolitical areas of concern and complicate the ability of defense planners to project power, influence regional events and secure forward basing. At the *regional level,* changes in climate will threaten the survival of fragile states, create opportunities for extremist ideology and insurgencies, put at risk access to strategic fuel and non-fuel resources, and create instability that threatens U.S. national security interests.

The DOD has no overarching directive or policy guidance that directs DOD organizations to address the security threats of climate change or act to mitigate its effects. However, the nature of the military is such that once the Commander's intent is given, individual units may use their own initiative in accomplishing the mission. This is particularly valuable because of the "fog of war" which often prevents direct communication with the Commander and rewards units that may operate independently to accomplish the mission. This independent culture is evident in the approach of organizations within DOD that have recognized the need to address the economic and security of supply dimensions of energy, the environment and stability and have already undertaken significant activities in response to threats to U.S. national security interests relating to climatic disruption. The DOD Office of Net Assessment sponsored a study by Peter Schwartz and Doug Randall in 2003 that used scenarios to frame the potential national security implications of climate change. Although certainly not its first effort to come to grips with its security dimensions, this well publicized study generated much discussion, demonstrated the interest of the Department of Defense in Environmental Security issues and encouraged further climate change related activities at all three levels.

GLOBAL LEVEL

At the global level organizations within DOD have begun to address its carbon footprint through a variety of efforts to conserve energy and reduce environmental pollution. Perhaps the best example of these efforts is provided by the office of Mr. Tad Davis, the Deputy Assistant Secretary of the Army Environment, Safety and Occupational Health. His office has undertaken a sustainability program that is saving the Department of Defense millions of dollars and is mitigating such climate change issues as clean water generation, energy efficiency, and emissions, and waste reduction.

The Army is using the concept of sustainability to ensure the wise use of scarce resources and the ability to accomplish its mission now and in future years. Sustainability refers to, ". . .the ability of a system to continue functioning into the indefinite future without being forced into decline through the exhaustion or overloading of the key resources on which that system depends." [15] It is a functional approach that is being successfully used internationally by the Environmental Protection Agency, USAID and the DOS. Sustainable development seeks to ensure that resources are consumed at a rate that provides for future generations by addressing the social, economic and environmental dimensions of development. The Army has created its own triple bottom line of sustainability that includes mission, environment, and community.

Recognizing that the planet's life supporting resources are declining and rising population and economic growth are increasing the pattern of resource consumption, the Army is seeking to meet this threat and public concerns over this equation by changing its pattern of resource management to minimize resource consumption while ensuring mission accomplishment, or, "sustain the mission, secure the future." Given the vast land holdings of Army bases, the energy and water resources that Army forces consume and the environmental impacts of operating and maintaining Army weapon systems, the application of sustainability to the Army mission is doing much to reduce Army contributions to greenhouse gases and address the security dimensions of climate change at the global level. The Army's motivation is captured in the Army Environmental Strategy; A sustainable Army is, ". . .simultaneously meeting current as well as future mission requirements worldwide, safeguarding human health, improving quality of life, and enhancing the natural environment." [16]

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[15] Mr. Robert Gilman, "Background Paper on Sustainability for City Council Work Session," Context Institute, 8 September, 1999, available at *http://www.propertyrightsresearch.org/articles6/background_paper_on_sustainabili.htm*

[16] *Army Environmental Strategy for the Environment,* Army Environmental Policy Institute, 2004.

The Army began the application of sustainability at the base level using such important Army bases as Fort Bragg, North Carolina and Fort Lewis, Washington to apply the business transformation techniques of changed management, risk management, performance management, and professional development to challenge leaders in addressing triple bottom line elements. This holistic, bottom up approach was succeeded by an Army wide implementation of lessons learned about the benefits of sustainability and is now being applied at the international level to support the Combatant Command's work on stability. The focus has gone beyond leadership and management to address alternative energy, energy efficiency, clean water generation, and waste reduction technologies for both installations and theater operations. As a result, the Army has: made 48 percent of its non-tactical vehicles alternative fuel capable; reduced its energy consumption by over 25 percent from 1985 levels; committed to reduce base carbon dioxide emissions by 30 percent and energy use by 35 percent by 2010; and created a partnership with the private sector that funded $543 million in energy efficiency projects through Energy Savings Performance Contracts.[17]

Of particular value in reducing Army environmental expenditures is the application of sustainability and environmental variables to the Future Combat Systems (FCS) design and development. This approach minimizes life cycle costs by reducing energy consumption and hazardous materials generation while increasing efficiency and combat effectiveness. At Fort Leonard Wood, Missouri, the Army is testing alternative fuels for tactical vehicles, such as the light High Mobility Multi-Purpose Wheeled Vehicle, and at the motor pool where two thirds of vehicles now use alternative fuels. Given that in Iraq the U.S. is consuming approximately 56 million gallons of fuel per month, the benefits of these programs are significant and save lives.[18]

The Army's energy and water conservation program has developed five initiatives to reduce energy consumption, water pollution and costs. The drivers of this program are to eliminate energy waste, reduce dependence on fossil fuels, increase energy efficient buildings, conserve water resources, and improve energy security and resulted in solar energy based communities and the adoption of U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) silver standards for new military building construction. The Army sustainability program has been successful at the global level because it demonstrated its value to military commanders. Reduced energy costs at bases release more funding for operations, maintenance and training. Maintaining or restoring oxygen producing forests and wetlands ensures realistic training ranges and garners public support for base expansion. While many DOD energy projects are underpinned by rising energy costs and insecure sources of supply, the Army sustainability program adds another dimension, global resource conservation.

The Air Force has taken a similar direction in its efforts to deal with energy, security and the environment. In an address to the recent Southern Command (USSOUTHCOM) Environmental Security Conference in Miami, Kevin Billings, Deputy Assistant Secretary of the Air Force for Energy, Environment, Safety and Occupational Health, spoke at length about the way the Air Force is addressing environmental and ecological issues and seeking to reduce the $7.0 billion that the Air Force spends on energy resources each year. Like the Army, the Air Force is focused on building energy efficient LEED infrastructure and finding synthetic fuels to power its aircraft and ground equipment. In 2006, the Air Force consumption of renewable energy totaled approximately one million kilowatt hours. It is partnering with the Department of Energy's National Energy Technology Laboratory to improve carbon capture, sequestration and reuse technology, which will be necessary for coal conversion to synfuel, and to use biomass to power its synthetic fueled fleet. These programs and the base "greenway" concept which preserves forests and natural terrain, speak directly to reducing overall energy consumption, improving energy efficiency and mitigating the effects of greenhouse gases.[19]

There are two major DOD energy task forces nearing the completion of their work. The Defense Science Board Task Force on DOD Energy Strategy is examining DOD energy usage practices to determine technological opportunities for reducing

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[17] Institute of Land Warfare, Association of the United States Army, "Sustaining the Mission, Preserving the Environment, Securing the Future," *Torchbearer,* National Security Report, Washington DC, February 2007, p. 16.

[18] *Ibid,* p. 12. In a combat environment, reducing the energy consumption of military vehicles and weapons systems means less, highly vulnerable, energy convoys, fewer lucrative targets and reduced casualties.

[19] Mr. Kevin Billings, Address Deputy Assistant Secretary of the Air Force for Energy, Environment, Safety and Occupational Health to the USSOUTHCOM Environmental Security Conference, September 17, 2007, Miami, FL.

energy consumption while still achieving mission, force structure, and global posture objectives.[20] The DOD Energy Security Task Force, headed by the Director, Defense Research and Engineering, is defining an investment strategy to increase energy efficiency, reduce fossil fuel dependence, identify alternate energy sources and increase operational readiness.[21] Whether these reports will recommend a formalized DOD program for energy security remains to be seen but they have the potential to make significant contributions to reducing DOD's carbon footprint and providing economic incentives to the private sector to undertake climate change related science and technology research and development (RED). DOD is the Nation's largest single consumer of oil, with daily consumption of 340,000 barrels per day, or approximately 1.8 percent of U.S. total.[22]

GEOPOLITICAL LEVEL

At a geopolitical level, the Department of the Navy has partnered with other agencies to begin an analysis of the climate change related, security implications of greatly reduced ice sheets in the Arctic. The rapidly warming Arctic is an area of intense geopolitical interest to the U.S. and other world powers. Historically locked under a sheet of ice that denied resource access and economic development, and the passage of commercial or military surface ships, the warming of the climate has led to significant increases in the year round temperature of the region. The current rate of ice melt exceeds those predicted by the IPCC report published in June 2007 and portends an era of intense State activity to establish territorial control, resource access, and to come to grips with the geopolitical implications of significant environmental change.[23] The U.S. Navy has been encouraging this analysis.

In 2001, the Navy co-sponsored with the Arctic Research Commission the *Naval Operations in an Ice Free Arctic Symposium.* The symposium identified the operational implications of an ice free Arctic for naval operations, reviewing possible naval missions and future operational requirements. This salient event drew the attention of many naval stakeholders to such critical strategic issues as, the Seas of Oktotsk and Japan remaining ice free year round and the Canadian Archipelago, and the Russian coast being open to navigation by non-ice strengthened ships during the summer months. It also recognized the economic importance of greater Russian access to its substantial Arctic resources (energy, mineral, timber) and speculated on climate change affects on the Arctic hydrological processes and resultant sociological changes.[24] Of particular note, it pointed out such vulnerabilities as the U.S. having only three polar ice breakers, and the strategic importance of bilateral and multinational alliances in defining territorial boundaries, and interpreting the United Nations Convention on Law of the Sea (UNCLOS).[25]

The U.S. Navy conducted a second event in July 2007, *Symposium: On the Impact of and Ice-Diminishing Arctic on Naval and Maritime Operations.* This symposium extended the focus of the 2001 meeting and emphasized oil and gas exploration in response to heightened demand in Asia, the importance of collecting marine geology and geophysical data to support U.S. territorial claims and the strategic implications of commercial shipping. The persistence of elevated year round, Arctic temperature measurements, warmer water moving north through the Bering Strait over the last decade, and the unexpected retreat of Arctic ice at a rate exceeding most computer models added a sense of urgency to the deliberations.[26]

The importance of these naval sponsored exchanges to U.S. geopolitical interests was underscored in August when the Russian Antarctic Research Fleet flagship fol-

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[20] Mr. Kenneth Krieg, Office of the Under Secretary of Defense, "Memorandum for Chairman Defense Science Board, Subject Terms of Reference—Task Force on DOD Energy Strategy," Pentagon, Washington DC, May 2, 2006; Mr. Chris DiPetto, Power Point Presentation, "Defense Science Board," Task Force on DOD Energy Strategy, 27 June 2007.

[21] Mr. John J. Young, Director of Defense Research and Engineering, "Memorandum Subject: Power and Energy Alternatives and Efficiency," Pentagon, Washington, DC, 12 April 2006.

[22] Mrs. Mindy Montgomery, Deputy Director for Investment, Office of the Director, Defense Research and Engineering, Address to the USSOUTHCOM Environmental Security Conference, 18 September 2007.

[23] NSIDC Staff, "Models Underestimate Loss of Arctic Sea Ice," Security Innovator, University of Colorado, Boulder, May 1, 2007.

[24] Naval Operations in an Ice Free Arctic Symposium, April 17–18, 2001, Office of Naval Research, Washington, D.C.

[25] "Two Polar Icebreakers Needed to Project U.S. Presence and Protect Interests in Arctic and Antarctica," *The National Academies Report News Release,* September 26, 2006. Particularly striking is the fact that a Russian icebreaker had to be hired to resupply the U.S. McMurdo Sound research stations in Antarctica.

[26] Symposium: Impact of an Ice-Diminishing Arctic on Naval and Maritime Operations, July 10–12, 2007, U.S. Navy Memorial & Naval Heritage Center, Washington, D.C.; available at *http://www.orbit.nedis.noaa.gov*

lowed its nuclear powered ice breaker to the North Pole, where two Russian parliamentarians descended in a Russian mini-sub to the Arctic Sea floor. After leaving a titanium Russian flag staking Russia's claim to the Arctic, one of the Russians, Artur Chilingarov said, "we must prove the North Pole is an extension of the Russian Continental Shelf," and subsequently, "the Arctic has always been Russian."[27] Canada has been expeditious in registering its concern over Russian territorial ambitions, and for good reason. Some estimates by geologists posit that 25 percent of global oil and gas resources as well as significant non-fuel mineral resources may soon be accessible in the Arctic via the northern sea route.[28] Canadian Foreign Minister, Peter McKay, dismissed the Russian claim, but Canada is planning on building eight additional patrol ships. This climate change phenomenon may also intensify existing territorial arctic disagreements between Canada, Denmark, the U.S., Norway and Russia.[29]

Russia's geopolitical initiative is more worrisome when set in the context of its strategic plan to reestablish itself as a world power. Russia is realizing significant wealth from its sales of oil and natural gas and is bartering access to these resources for power and influence in both Europe and Asia. Moreover, Russia has initiated a geopolitical strategy for engagement in Asia based upon weapons sales to salient states and the reconstitution of its regional military forces and bases.

Russia was the leading arms exporter to Asia from 1998 to 2005, with $29 billion in sales. Key recipients include China, India, Iran, which agreed to acquire a $700 million air defense system in 2005, and Indonesia. Indonesia, which is a littoral state to the oil choke points of the Sunda and Malacca Straits, with a Muslim population of 200 million, signed a $1 billion arms agreement that includes quiet and efficient Kilo-class submarines. Revenues from resource and arms sales will contribute to Russia's stated plans of reconstituting its Far East forces and Pacific fleet. These plans include building six new aircraft carriers, three of which would be stationed in Asia, and refurbishing its submarine base on the Kamchatka Peninsula, which fronts the Bering Sea.[30,31]

Climate change has the potential to alter the geopolitical arena in which the quest for State power in the contested Arctic. The currently affected areas range from the Arctic to resource rich Africa, where China is aiding drought stricken states as a quid pro quo for resource supply, and to South Asia, where access to glacial melt waters is of vital importance. If IPCC predictions prove accurate, to project U.S. power overseas will require extensive reexamination.

REGIONAL LEVEL

At the regional level, the Department of Defense has taken action that addresses the destabilizing issues climate change can multiply. Department of Defense documents now stress the importance of proactively addressing destabilizing issues. The 2006 *Quadrennial Defense Review* (QDR) states that the transformed DOD seeks to undertake "preventive actions so problems do not become crises."[32] DOD Directive 3000.05, *Military Support for Stability, Security, Transition, and Reconstruction* (SSTR) *Operations,* stated that the immediate goal of stability operations, "is to provide the local populace with security, restore essential services, and meet humanitarian needs." Significantly, DOD Directive 3000.05 says, "stability operations are a core U.S. military mission. . .they shall be given priority comparable to combat operations."[33] These strategic level documents are important because they provide guidance to the Combatant Commands whose responsibility it is to translate policy into operations and planning at the regional level. Climate change makes a proactive regional security strategy essential.

The Combatant Commands should be thought of as the tip of the DOD spear, serving as they do as the military elements that execute DOD policy. They have two primary missions, war fighting and engagement. The operational plans that allow them to prepare for regional contingencies and be prepared to address operational

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[27] Mr. Barry Zellen, "The New Cold War: Global warming reveals hidden riches beneath the polar sea, causing Arctic resource conflicts to heat up," *Security Innovator,* August 17, 2007.

[28] *Ibid.*

[29] Mr. Paul Reynolds, "Russia ahead in Arctic 'gold rush'" *BBC News,* August 1, 2007. See also "McKay mocks Russia's "15th century" Arctic claim," *Reuters,* Yahoo News Canada, August 2, 2007.

[30] Mr. Donald Greenlees, "Russia arms old and new friends in Asia," *International Herald Tribune,* September 6, 2007, p. 1 and p. 8.

[31] Mr. Tim Johnston, "Russia to get Australian Uranium," *International Herald Tribune,* September 8, 2007, p. 3.

[32] United States Department of Defense, *Quadrennial Defense Review,* February 6, 2006.

[33] United States Department of Defense, Directive 3000.05, Military Support for Stability, Transition, and Reconstruction (SSTR) Operations, November, 2006.

threats to U.S. security interests are classified in nature. The engagement functions are generally unclassified and delineated in Theater Security Cooperation Plans (TSCP). The TSCP are designed to build good will and access with regional states, develop influence and partner military capabilities. The benefits of the TSCP programs are striking. General Tony Zinni, when serving as the Commander of the Central Command (USCENTCOM), often stated that if he did engagement right, he would not have to do war fighting. General Zinni proved that point when he interceded in the military conflict between India and Pakistan over Kashmir and encouraged a de-escalation of that conflict between the two nuclear powers.

A major function of the TSCP is to work with host nation militaries to build their capacity for and interest in supporting civilian authority. Because many developing countries have thinly staffed civilian agencies, the effectiveness of these agencies in protecting the vital resources of their countries and dealing with non-military threats is often limited. All too often, civilian agencies dealing with environmental security, resource conservation and climate change related threats are provided the least amount of governmental resources. However, the well-resourced, host nation militaries can provide substantial support to civil authority: good communication, presence on distant frontiers and in border areas, good transportation assets, technical expertise, security missions, and preparation for crises and disasters. They are usually the best funded of all government agencies. Dedicating a portion of military capabilities to supporting these civilian agencies as they seek to confront environmental security and climate change issues, may be the difference between their failure and success; it may also mean the difference between increased desertification and the loss of arable land, deforestation, the spread of water borne diseases and large scale destabilizing migration. Because the effects of climate change can enflame preexisting tensions and trigger conflict, it is an excellent preventive defense strategy to use the TSCP proactively to address these destabilizing environmental security issues. The Combatant Commands have active programs to build the necessary military supporting capabilities and encourage regional military capacities and capabilities to combat the effects of climate change.

The Combatant Commands have existing environmental security and disaster preparedness programs. New leadership at several of the Commands is renewing the priority of their environmental security programs at this opportune time of enhanced awareness of the link between climate change and security. At USSOUTHCOM, Admiral James Stavridis has directed his Command to reenergize its focus on environmental security. On September 17th and 18th, 2007 he opened USSOUTHCOM's the fifth major environmental security conference, which brought in critical regional allies and the U.S. interagency community to explore new ways to create effective partnerships in addressing climate change and other environmental security issues. The USSOUTHCOM program has been particularly successful. These major regional environmental security conferences have been attended by state presidents, vice presidents and ministers of defense and environment. In close cooperation with DOS Environmental Hubs in Brazilia and San Jose, the Command has built regional multilateral and interagency cooperation by conducting train the trainer workshops that brought together the police, civilian environmental managers and military forces for common training in addressing such climate change issues as fire fighting, deforestation and disaster preparedness. In a region where governments struggle with narco-terrorists, limited resource's category four or five hurricanes and maintaining governmental legitimacy of democratic states, the development of this capacity is a welcome contribution to regional stability.

The USCENTCOM, which began its environmental security program under General Tony Zinni, built environmental security programs for its three sub regional areas: the Central Asian States; the Arabian Gulf; and the Horn of Africa. These programs have been particularly valuable and credited by the USCENTOM Deputy Combatant Commander with improving U.S.-regional State relations in regions of critical importance to U.S. national security and the war on terrorism. During the ongoing Iraq War, the Command has focused on water, medical issues and disaster preparedness in conferences, workshops and exercises with the Arabian Gulf countries supporting U.S. war efforts. In the arid Central Asia States, the Command addressed such issues as scarce water resources, salt resistant agriculture and disaster preparedness. In the Horn of Africa where droughts, migration, flooding and failed states are regular issues, the Command was instrumental in creating a multinational Center of Excellence for Disaster Management training in Nairobi, Kenya. Praised by Kenya's Vice President at its opening for addressing regional humanitarian issues, the Center continues to train regional military and civilian crises managers able to direct regional resources against multiple climate change related threats. The arrival of former USPACOM Commander, Admiral William Fallon to USCENTCOM has resulted in reexamination of Command programs in light of the

restructuring of Combatant Command Area of Responsibility (AOR) and the loss of the Horn of Africa to the new Africa Command (USAFRICOM). The plans and policy directorate is actively exploring the use of environmental security and climate change to address the Command's evolving priorities.

In the Pacific Command environmental security has long been part of regional engagement efforts. Transnational issues, such as terrorism, and illegal logging and other trafficking activities play a major role in threatening U.S. interests in the region. USPACOM has used these issues to build multilateral cooperation, and overcome misperceptions of U.S. foreign policy. Responding to partner nation military requests, USPACOM has stressed non-kinetic approaches to addressing the terrorist threat. The Command has treated terrorism as an insurgency, in which the center of gravity is the population. Underlying conditions such as inadequate fresh water, poor disaster management, and the illegal exploitation of resources, threaten governmental legitimacy and invite the introduction of extremist ideology. In Southeast Asia, the Command cosponsored a series of conferences and workshops examining the role of these underlying environmental conditions in the growth of terrorism. These activities resulted in best practices workshops hosted by regional states in which the host countries educated other nations in the use of the military element of power to mitigate developmental issues such as poor soil fertility, reforestation, flood control and drought management to build governmental legitimacy and good will. On the Philippine Archipelago, Cholo and Basilan, the Pacific Special Operations Command (SOPAC) worked closely with the Philippine Armed Forces and local civilian authorities to successfully apply these lessons and defeat the terrorist threat.

In the vast USPACOM area of responsibility, changing climate patterns have affected monsoon intensity, giving rise to increased flooding and droughts. Other natural disasters, such as tsunamis, earthquakes and erupting volcanoes further challenge regional government efforts to address human security problems. Using its Multinational Planning Augmentation Team (MPAT), USPACOM facilitated the creation of a multilateral disaster response program and common standard operating procedures that have the capacity to deal with climate change effects and other disasters. The ability of USPACOM and its regional allies to successfully respond to these crises has paid large dividends. In Indonesia the effective response of the Indonesian and U.S. Armed Forces to the Aceh tsunami enhanced the legitimacy of the newly elected democratic government and resulted in a decrease of 20 percent in the popularity of the Al Qaeda franchise, Jamaah Islamiah, and a 30 percent increase in the popularity of the United States.[34] Recognizing the power of meeting these soft security threats, the new USPACOM Commander, Admiral Timothy Keating is including environmental security as a major topic in his October 2007 Chiefs of Defense Force Conference.

Newly created, USAFRICOM's mission is predominantly humanitarian assistance driven, encouraging stability in the fragile petroleum and minerals rich, but drought and flood plagued continent. The Command identifies the threats to stability in its region and works with host nation military, regional organizations, the U.S. interagency, and other non-governmental organizations to build the local capacity to mitigate those threats. It is currently holding a series of sustainability workshops in which all of these organizations provide their insights into theater security cooperation planning. Most of the threats to stability in the region are environmental in nature. For example, in the Sudan and Nigeria, tensions between different religious and cultural groups are erupting into violent conflict because of the persistent drought and competition between herders and farmers for increasingly scarce arable land and water. Other climate change related issues threatening stability include disease, decreasing marine resources, drought, flooding and soil erosion. While the Command will be responsible for military operations against the evolving terrorist threat in weak or failed states, its primary mission is to address the underlying humanitarian conditions and poverty that encourage the spread of terrorist ideology and threaten regional stability. The chronic weakness of many African states makes them particularly vulnerable to predicted climate change.

It may be useful to conceptualize the role of the Combatant Commands in addressing this destabilizing issue as creating climate change resilient communities. The National Oceanic and Atmospheric Administration (NOAA) was tasked by Congress in 1994 to assess tsunami awareness and preparedness for parts of the United States. As a result of their analysis and research, NOAA developed a concept for mitigating the damage of tsunamis: it is called Tsunami Resilient Communities and was created "to provide direction and coordination for tsunami mitigation activities

[34] Interview, Dr. Ermaya Suradinata, Governor, National Resilience Institute, Jakarta, Indonesia, June 21, 2005.

in the absence of a disaster."[35] Recognizing that no mitigation effort would be successful without the support of local communities, NOAA designed a plan to leverage planning, education and awareness to minimize losses and reduce fatalities and property damage. The seven (7) variables of resilient communities are designed to enhance national, State and local capabilities by: determining the threat; preparedness; timely and effective warnings; mitigation; public outreach and communication; research; and international coordination. This concept can easily be adapted to climate change and security.

CONCLUSIONS AND RECOMMENDATIONS

The Department of Defense is already doing much to address the security implications of climate change. However, much remains to be done.

Climate change is increasingly recognized as a multiplier effect for existing tensions and regional instabilities. It places additional stress on the state political system, complicating the ability of governments to meet the demands placed on the system by a suffering population, and reducing system resilience. This can lead to a loss of legitimacy, internal conflict, state failure and the growth of extremist ideology. Addressing the factors of sustainable development in a way designed to "sustain regional stability," by building the capacity of states and local communities to mitigate the effects of climate change, would enhance the resilience of the political system and reduce the likelihood of state failure. The military, through its Combatant Command TSCPs, in close cooperation with U.S. interagency and international organizations, could play a significant role in creating climate change resilient communities. By enhancing the capabilities of regional militaries to support civil authority in applying the seven variables of resilience to the unique climate change effects on their countries, threats to regional stability and security can be reduced. This concept, however, needs to be led by the regional and international organizations and other U.S. agencies in a synchronized and coordinated process.

While it may be a popular perception that DOD has been reluctant to support climate change mitigation strategies because of political issues, I contend that to be largely incorrect. It is only recently that the security dimensions of climate disruption have attained national prominence and overcome the focus of climate change debate on the causes of climate change. A more important barrier to establishing a DOD wide emphasis on addressing climate change, greenhouse gases and their security dimensions is the well reasoned argument that climate change and environmental security issues are soft security issues that should be addressed by civilian organizations with that primary function; the DOD is the only organization capable of fighting and winning the nations wars and dealing with hard security issues and conflict. The problem with this reasoning is that it is reactive in nature and dooms the U.S. to the expensive military solution of destabilizing regional conflicts that might have been prevented through proactive military intervention in its underlying causes.

Soft security issues left untended have the potential to destabilize regions and become hard security issues which require the introduction of combat forces and threaten U.S. security interests. The costly humanitarian relief efforts in Somalia, Rwanda and Haiti are a case in point. As the Provincial Reconstruction Teams (PRTs) demonstrate, until the U.S. adequately resources foreign assistance and agencies such as DOS and USAID, DOD will have no choice but to assume these stability missions. Concern over such "mission creep" is a barrier to enhanced DOD leadership in the climate change and security area. The active involvement of the regional Combatant Commanders in building partner military capacity to address destabilizing soft security issues such as the effects of climate change is a cost effective and proactive concept that should be reinforced by DOD priority and direct language in such influential documents such as the Global Employment of Forces (GEF) document.

As the security dimensions of climate change become recognized and debated, DOD should become more directly involved. At the global level, DOD can save millions of dollars and reduce its significant contribution to U.S. greenhouse emissions through such concepts as sustainability and incentivized energy efficiency programs. At the geopolitical level, DOD will realize new geopolitical vulnerabilities, revise its operational plans, determine possible new force structure adjustments, and order new weapons systems and capabilities such as ice strengthened naval vessels. At the regional level, climate change will exacerbate human security demands on fragile State political systems and present opportunities for Combatant Command regional capacity building to prevent failed states. Thus, for DOD, climate change

[35] "Tsunamis Tsunami Information": NOAA Watch: NOAA's All Hazard Monitor available at *http://noaawatch.gov/themes/tsunami.php*

brings opportunity and will become a driver for environmentally efficient and operationally less costly weapons systems, research and development and sustainable base management as well as heightened regional state interest in increased security cooperation. Certain events need to transpire in order to make this possible.

- It is time to move beyond debating the causes of climate change and recognize climate change as the threat to U.S. national security that it is.
- Appoint a DOD task force to define its roles and mission in addressing the climate change related threats to U.S. national security at the global, geopolitical and regional levels.
- While the ongoing National Intelligence Estimate and Military Advisory Board report are excellent first steps in coming to grips with the security dimension of climate change, more research needs to be done. Climatic Disruption has the potential to create multiple major disasters beyond the management capabilities of the national security community. Where are U.S. security interests threatened; how should these threats be addressed and by which organizations; and what resources will be required?
- DOD should direct the Combatant Commands (through its Global Employment of Forces (GEF) document) to consider climate change as a primary engagement issue. Good governance is the best defense against the destabilizing effects of climate change. Sustain stability by building climate change resilience.
- Appoint a senior DOD official to prioritize and synchronize DOD climate change activities.
- Because of its size, resources and capabilities, there is a danger that DOD may be seen as the "Mr. Fixit" of the U.S. climate change issue. This should not be DOD's role. DOD can reduce its energy consumption and carbon emissions; it can encourage technological research development in energy conservation, clean fuels, and alternative energy; it can prepare for military responses to new geopolitical realities; it can be proactive in building regional capabilities, and alliances to create climate change resilience and preserve regional stability. These missions make sense and will result in major sources of savings for energy, waste disposal and combat force deployments. However, DOD should not assume the climate change responsibilities of other agencies.
- The White House and Congress should insist on properly resourcing agencies such as the Department of State, USAID, USGS, EPA and NOAA so that they may properly execute these climate change missions. The current limitations of DOS and USAID in reconstruction and stabilization should not become a model for the DOD role in addressing climate change.

BIOGRAPHY FOR KENT HUGHES BUTTS

KENT HUGHES BUTTS is Professor of Political Military Strategy and the Director of the National Security Issues Group at the Center for Strategic Leadership, U.S. Army War College. He leads the Center's Combatant Command support efforts, focusing extensively on destabilizing environmental security issues. His prior positions include: Research Professor in the Strategic Studies Institute (SSI) of the Army War College, Associate Professor, Science Research Laboratory, U.S. Military Academy at West Point, and United States Defense and Army Attaché and Security Assistance Officer in Uganda, Tanzania and Malawi. A graduate of the U.S. Military Academy, he holds a Master's Degree in Business Administration from Boston University, an M.A. and Ph.D. in Geography from the University of Washington, and was a John M. Olin Post-Doctoral Fellow in National Security at the Center for International Affairs, Harvard University. He is a graduate of the Command and General Staff College at Fort Leavenworth and the U.S. Army War College, and formerly held the Army War College George C. Marshall Chair of Military Studies. Dr. Butts teaches the Army War College Environmental Security, Geography and National Security, Weapons of Mass Destruction, and Strategic Planning elective courses and has organized and conducted international conferences, workshops or games on environmental security in the Middle East, Europe, Asia and Latin America. He headed the U.S. delegation and co-chaired the NATO Environmental Security Pilot Study Meetings in Warsaw and Prague, and was a member of the U.S. delegation to the OSCE Economic Forum (Prague). He has been interviewed by the BBC, *Washington Post, Baltimore Sun* and other media on the topic of Climate Change and Security. Dr. Butts was appointed a principal member of TRADOC's Homeland Defense Council and was a member of the Chemical and Biological Defense Command, Nunn-Lugar, Biological Improved Response Task Force. He is au-

thor or editor of numerous national security publications, and co-author of the book, *Geopolitics of Southern Africa: South Africa as Regional Superpower*, published by Westview Press. His military awards include the Defense Superior Service Medal and the Legion of Merit.

DISCUSSION

Ms. HOOLEY. And thank you very much.

I do have some questions. Again, very interesting testimony. Would like to talk to you further about the work that you are doing.

ARE CURRENT MULTINATIONAL STRUCTURES SUFFICIENT?

First of all, this is a question to all three of you. Are the multinational structures for cooperation that we have in place adequate to meet the scope of the challenges. Are we facing a moment in the not-too-distant future when new institutions will be needed? Has the time come when we should be thinking about designing and creating them?

And you can go in any order you want, anyone that wants to answer first. Don't be bashful.

Dr. BUTTS. Madam Chairman.

Ms. HOOLEY. Yes. Dr. Butts. Yes.

Dr. BUTTS. I think we have the institutions in place that we need to work the problem. It is a matter of assigning a priority and resources. That is not to say that for all security issues we shouldn't have a re-architecturing of our security apparatus; but in terms of dealing with this issue from my perspective, I think we can go a long way towards solving many of these problems and promoting resilience and dealing with the stability aspects of this by creatively using the institutional resources that we have in place.

Dr. PRICE-SMITH. I will go next if that is fine, Alex. I would say in the realm of global public health, no. I don't think that global institutional structures and institutions are adequate to deal with the issue at this point in time, and the analogy would be looking at the global HIV/AIDS epidemic, which has ravaged much of the developing world over the last few years. It continues to expand.

In recent work I have done on the HIV/AIDS epidemic, UNAIDS has painted a very rosy picture for you. But in fact, when you take the data and crunch it and look at it, the epidemic continues to expand in South Asia, in East Asia, certainly in Russia and the former Soviet Republics, and other regions of the planet as well. So even though there has been some decline in HIV, it is not uniform. In fact, it continues to expand. Malaria is not under control whatsoever. Dengue fever is restricted right now by temperature radiance and vectors, but it may expand.

And I am very concerned about the lack of funding for the WHO, the World Health Organization. I am very concerned about the lack of human capital within that organization. I think that organization has suffered historically from some rather poor leadership in recent years. I know I am not going to be invited to their parties anymore for saying this, but I have my concerns.

And so I think that the United States in particular needs to truly reassess the WHO and try to augment its capacity to deal with some of the changes that I foresee.

Ms. HOOLEY. If you were king for a day—I just want to follow up on your answer—how would you organize it? What do you think we need to do?

Dr. PRICE-SMITH. Wow. Thank you, Madam Chairman. I would look at the politicization of that organization over the years, and I would try to address some of the things that have gone on there in terms of demoting key personnel for what I see as political reasons. I will give you one example.

Dr. David Heymann was in charge of the Polio Eradication Initiative for many, many years. He achieved spectacular successes, and yet because of his successes he was, I won't say demoted, but removed from that position. And of course, polio has exploded out of Sub-Saharan Africa back into South Asia, I believe largely as a result of that.

So I think that a study should be undertaken to look at that type of reorganization. And if the Congress was going to task us with something, we would be pleased to undertake that.

Ms. HOOLEY. Thank you. Dr. Lennon.

Dr. LENNON. Thank you, Madam Chairman. I come at this more from a geopolitical angle, and one of the things that has struck me in my brief analysis of climate change is how incredibly quickly this issue has jumped up on the international scene.

And I think about your question in two ways: institutions to address the causes of climate change and institutions to address the consequences of climate change. I think for most analysts, you hear the words "mitigation" and "adaptation" come up, and there is an increasing sense that some of both is going to be needed to address the challenge as it emerges and as it becomes clearer what we are dealing with over time.

On the front end of dealing with the causes of climate change, I think you are only beginning to see existing international institutions deal with the issue. You had it at the US–EU Summit in April, at the G–8 Summit in June, at the APEC meeting in September. You now have a new Major Emitters Conference today and tomorrow. All of this proliferation within existing institutions I think is probably the right way to manage the issues, as well as supplement it with new bilateral conversations.

To my knowledge there is no bilateral conversation with China, for example. The focus is exclusively on climate change as an issue. It is dealt with as a subset of the senior economic dialogue or as an energy issue exclusively rather than as the broader consequences that may be involved with climate change.

On the consequence side I think Dr. Butts is better equipped than I am to answer it. You have seen some initial cooperation in things like the response to the Indian Ocean Summit that has to jump up on a regional basis. But the pre-positioning of some form of, if not institutional cooperation, at least informal cooperation that could be drawn upon when a crisis emerges, could be beneficial to deal with future events like an Indian Ocean tsunami if they occur in the future.

DISEASE VECTORS

Ms. HOOLEY. Thank you. Dr. Price-Smith, in your written testimony you say the balance of available evidence indicates that glob-

al climate change will shift the distribution of disease vectors into new regions and thereby afflict previously uninfected populations. Can you state some cases in which this process is already underway or, given the existing trends in global warming, appears likely?

Dr. PRICE-SMITH. Yes, Madam Chairman. In fact, one of the best examples of this has been the expansion of mosquito-borne malaria into the city of Nairobi in Kenya, which epidemiologists that I am familiar with attribute directly to the increasing temperatures—nighttime temperatures in particular—of Nairobi, which have allowed the mosquitoes to thrive at that altitude.

There is not sufficient information across all types of pathogens, so we need to do greater studies. I can give you another: There is evidence that cholera is responsive to temperature. And cholera tends to be transported throughout the oceans in the form of algal blooms. So the cholera bacilli actually go into the algae blooms, and then they drift across the ocean currents. What tends to happen is that it is associated with non-linear progressions of sea-surface temperature. But as sea-surface temperature increases to a certain threshold point, you will suddenly see an explosion of algae, and that explosion of algae correlates with an explosion in cholera bacteria.

And so, again, we may see, you know, not a lot of cholera for some time, and then suddenly you will hit that threshold point, and you may see an explosion of it.

DOD THINKING ABOUT CLIMATE CHANGE

Ms. HOOLEY. Thank you. Dr. Butts, according to your written testimony the Defense Department has no overarching directive or policy guidance that directs DOD organizations to address the security threats of climate change or act to mitigate its effects. Does this mean that the Department has applied no strategic thinking to how it would deal with problems of climate change, that climate change may provoke? If so, what steps in your view could be taken to remedy this?

Dr. BUTTS. Well, this morning I think we heard General Sullivan address the fact that he thought that many of the leaders at Department of Defense were actively thinking about climate change and had undertaken activities that were related to it. And I would agree.

The results of that Defense Science Board study that Mr. Woolsey is on will demonstrate that there is much thinking going on in energy. You can look at the work of the Deputy Assistant Secretary of the Army for Installations and Environment, Mr. Tad Davis's work on sustainability and the ability there to reduce energy consumption and promote the use of scarce resources in an efficient fashion.

But most of these efforts have been driven by economics and national security, reduce dependence on unstable sources of energy supply, reduce our expenditures on energy, reduce the vulnerability of task forces that must carry supplies of fuel to the front.

What is missing is an overarching set of guidelines that tell all elements of the Department of Defense to examine the security dimensions of the climate change phenomenon and apply it to their

work. And if this were to reflect a national security strategy mention or directive to do so, then Department of Defense would address it through its own strategic documentation, and we could get a greater return on investment.

It is being done in a decentralized fashion. There are many things that are being done, but they haven't been coordinated. It hasn't been applied universally across all of our combatant commands, for example, and I think improvements can be made.

Ms. HOOLEY. Let me just ask a follow-up question to you. Is the Department of Defense—you talk about that they have done some things in terms of global climate change, but has there been sort of an overall directive in terms of, "Here are all the things that you can do to make your buildings more energy effective"? "When you build new buildings, this is what you need to do." I know the number of vehicles you have trying to cut down on clearly using oil, gas.

But is there a Department, or people at the top level, saying, "We have to do this"? Okay.

Dr. BUTTS. Not that I know of, Madam Chairman. And I think, though——

Ms. HOOLEY. But it would be a good idea?

Dr. BUTTS. Yes, ma'am. I agree, and I think that it takes a certain amount of time for these new strategic issues to take hold in the security community. Dr. Lennon pointed out that the focus on the security dimensions of climate change is rather recent.

Ms. HOOLEY. Right.

Dr. BUTTS. The CNA Military Advisory Report that General Sullivan shared was only brought out in June. The NIE on climate change and security hasn't been published yet. So these are drivers that bring the attention of people in key leadership positions so that they will begin to consider it and apply it across the board.

But at this point, to my knowledge there isn't anything that speaks to climate change in an overarching fashion at Department of Defense.

MORE ON THE IPCC REPORT

Ms. HOOLEY. Thank you. Dr. Lennon, the draft of the chapter by John Podesta and Peter Ogden, on which your testimony concentrates, declares inevitable the A1B greenhouse gas emission scenario of the Intergovernmental Panel on Climate Change. It is a scenario that includes massive food and water shortages, devastating natural disasters, and deadly disease outbreaks. The draft chapter further states that there is no foreseeable political or technological solution that will enable us to avert the majority of the climate impacts projected in the IPCC scenario.

If this is so, what are we to do, and where do we begin?

Dr. LENNON. As you mentioned, the work that John Podesta and Peter Ogden had done focuses in part on the consequences over the next 30 years, and in that time, in the generation from our interaction with scientists that work with the committee, one of the things that surprised me was their advice that essentially over that period of time we know what is likely to come about. It could be even worse than that if you get these negative, or "positive," feedback effects, ironically titled, that Jim Woolsey spoke about this morning.

I think it is likely that those will come about based on the science coming in. One of the sort of clashes at the communities that we found in our study was that a lot of the national security community was frustrated with how cautious the scientific community was—obviously, or somewhat ironically, because they wanted the scientific community to give more definitive answers, which someone in the position of government would require from their staff even in imperfect information, which is what the national security community is used to dealing with. The scientific community didn't have that pressure, so they didn't face that.

That, I think, was the presumption behind Podesta and Ogden's—I don't want to speak for them—but behind their assessment that it was inevitable and that it may be even worse than the IPCC assessment because of the natural cautiousness built into the scientific community in a consensus-driven process—as opposed to those in the national security community that are used to working with imperfect information and what to do about it.

Now, the answer to the question what to do about it frankly goes beyond the scope of what we did in the project. We essentially peeled off the front end of whether it is occurring from the back end of what to do about it. But it did raise consequences that brought concern to the national security community in a way that the project was designed, to try and raise the issues and what they should begin to be thinking about, rather than what to do about it as quickly as possible.

POLICY MEASURES TO REDUCE SPREAD OF DISEASE

Ms. HOOLEY. Dr. Price-Smith, are there policy measures besides those designed to arrest or reverse climate change itself that can help forestall or mitigate the effects of the changes in disease incidence and prevalence that are likely to result from that?

Dr. PRICE-SMITH. Thank you, Madam Chairman. Yeah. That is an interesting question: What can we do in terms of policy?

Before I answer that, if I can return to your prior question on evidence, and then we can proceed from there into the policy realm. I have been thinking about it a little bit more. In fact, there is considerable data now coming out of Bangladesh, and what the scientific, the epidemiologist, what the scientific community has been doing is using the El Niño Southern Oscillation effect to model long-term climate change, but to truncate it temporally and to measure the short-term changes and try to project from them the impacts on infectious disease.

And what Rodo and others have found is that in Bangladesh a lot of diseases, in fact, correlate very highly with El Niño Southern Oscillation changes. Similarly, in Peru there is evidence as well that diarrheal diseases and other intestinal diseases respond to changes in winter temperatures.

And, again, this is a very nascent field, and I am a political scientist, so it is unusual that I am speaking on those issues. But as the evidence accumulates, we will be able to provide you with far better answers as to how these things may be correlated.

Now, what I am actually proposing in terms of a policy measure is, we need to establish these empirical links. Are these empirical links, in fact, generalizable around the world? To do that, what

would need to happen is that Congress or another body might establish a task force on this issue, and we would actually go out and measure these changes in epidemiological indicators such as vectors and pathogens. And this would involve the formation of an inter-disciplinary team of researchers including epidemiologists, economists, political scientists, and so forth to see, all right, how do these changes occur and what are the consequences in a short span of time for those territories? And we could do that.

In terms of policy measures, once we have established that, in fact, these correlations hold over the globe, sure, there are some things we can do. We can, in fact, ask the WHO to reprioritize its budgetary expenditures—because for a long, long time the WHO has been fixated upon chronic illnesses and not necessarily upon infectious diseases. And so I suggest that we might approach the WHO and say: "Look, we would like you to target a little more funding towards areas X, Y, and Z in the realm of pathogens."

Additional policy measures: I think that funding USAID and its initiatives to deal with diseases like malaria, dengue, diarrheal diseases, and so forth is excellent but should continue perhaps at a greater level. So I would advocate that.

And in general, I think that the U.S. Federal Government needs to be more cognizant of the role that disease plays in instability throughout the developing world. If you look at a Mercator projection map of the planet, you will notice that most of the industrialized nations in the world happen to be in the temperate zones and not in the tropical regions. And as many historians of public health have argued, such as Alfred Crosby and William McNeill, there is a correlation between the burden of disease in the tropics and not only the economic underdevelopment of those societies, but also perhaps the political stability of those regions, or the political instability of those regions.

Thank you.

U.S. Assistance in Major Global Disasters and Emergencies

Ms. Hooley. Thank you very much. Dr. Lennon, in your written testimony you predicted that the United States will often be sought as a global first responder in the immediate aftermath of a major natural disaster or humanitarian emergency. What should be the limits of U.S. participation, and are there mechanisms either existing or yet to be created whereby such responsibility might be shared? Should the United States develop a policy regarding its fulfillment of this role, or is it inevitable that this will be determined on a case-by-case basis?

Dr. Lennon. Thank you. I think it is both inevitable that the U.S. will be sought for its assistance in response to a disaster, primarily because the U.S. military is the only one capable of pulling off the size of an operation that would be required in some of these cases, as it was after the tsunami in the Indian Ocean in 2004. But I also think that in some cases the United States will want to step up to that role in its position as a global leader.

There is no question that there are limits to what the United States should do. I would probably phrase those as guidelines that should guide U.S. responses. If there are incidents in some coun-

tries, not only may the U.S. not want to respond to it, but it may be the case that those countries wouldn't accept responses from the United States if there are particularly bad relations with that country. It may be an opportunity to improve relations with those countries, at least by offering assistance, but it is unlikely to be accepted for political reasons within those countries

And a couple of examples: Again, the institutions that exist, I think, are less formal and more—if not ad hoc, then they are more informal. In the Asian cases I think we have had the informal cooperation that was quickly sought from other countries—such as Japan, India, Australia, possibly South Korea—that could serve as an informal regional factor to be able to respond to the demands of any crisis in the region.

I think if something were to happen in Europe or the Middle East, the European Union would seek to respond sometimes by themselves, sometimes in cooperation with the U.S., depending on the demands.

But, and to directly answer your question, I think there is no question that some of the responses are going to have to be made up as we go along based on the severity of the consequences themselves. But we could go further in developing the types of guidelines to understand the size of the operations that would require U.S. help and the political benefits as well as risks of doing so in those cases.

Ms. HOOLEY. Yes. Dr. Butts.

Dr. BUTTS. I wondered if I might add to that.

Ms. HOOLEY. Absolutely.

Dr. BUTTS. The Department of Defense has security and cooperation programs through its regional combatant commanders to deal with the militaries in their regions and build their capacities. And their capacities quite often, as it relates to climate change and environmental security, has to do with the issue of disaster response and preparedness.

We quite often try to—we meaning Department of Defense or the military—try to reach out to regional security organizations, ASEAN—or the ASEAN Regional Forum, which is the military element of that—to see if they might take a leading role in encouraging that type of response. So that it doesn't require the United States to come back and be the lead agent in each instance.

So the Pacific command, for example, developed a Multinational Planning Augmentation Team, the MPAT, that worked with regional countries to draft a multinational disaster response SOP that deals with these types of issues. And then, through their exercises every year—Cobra Gold, for example, that is held in Thailand—they train against those new SOPs and reinforce that.

By focusing the guidance from Department of Defense to the regional combatant commanders on these types of issues, putting wording in there that encourages them to do more, we can strengthen those regional organizations and strengthen the military element of power within many of these developing countries—and use what is almost always the best-resourced agency within those governments to address that humanitarian dimension of climate change or other natural disasters.

MORE ON DISEASE VECTORS

Dr. PRICE-SMITH. I would like to buttress my comments to your further question. Or, sorry, your prior question.

And one thing that I think we might also do in terms of policy measures is that we might focus on social ingenuity and not necessarily technical ingenuity. Now, in this society we have a proclivity to focus on technological silver bullets and quick fixes and new vaccines and so forth. When the reality is dealing with infectious agents across the world, we might want to look at social relationships and changing patterns of behavior. Particularly in terms of dealing with viruses, the reason being that viruses don't respond to antibiotics, as we all know.

And so a great historical example comes from the 1918 influenza, which I have been doing a lot of work on recently, and one of the best ways of dealing with pandemic influenza is not to go hunting for a vaccine or to rely upon tamiflu but rather to engage in what we call "social distancing." In other words, people were told, "Don't go to movie theatres, do not go to ballgames," and so forth.

All right: Voluntary quarantine. And one of the best social measures that existed at the time was, in fact, the Civil Defense Associations that had been formed in response to the First World War. And those Civil Defense Associations went out and actually enabled communities to deal with that pandemic from a grassroots level.

Now, similarly, you might say, "Well, in terms of malaria we need bed nets, and we need various other forms of prophylaxes." But one thing that disturbs me is there is a perennial focus upon technical ingenuity and money when it comes to dealing with global health issues. And there is almost never a serious focus upon involving social measures and social scientists in terms of dealing with issues of contagion. And I think that really needs to be addressed.

Thank you.

Ms. HOOLEY. First of all, I want to thank all of our witnesses. You did a terrific job, and again, bringing us a little different perspective on global warming. Appreciate all of your comments.

Changes in arctic ice, drought in Africa, these are real, contemporary events that our witnesses suggest are a mere foreshadowing of what will come over the coming century.

The witnesses have articulated the threats very clearly. They have offered some suggestions for action that may contribute to the mitigation of global warming. But this is just a start. We need to be better, and we need to better understand the full range of global warming consequences.

We also need to work harder to build support for positive steps.

Again, thank you for your time. I hope you will continue to engage with the Committee and with Congress. I think you have a lot to offer, a lot to contribute, and hopefully we will see some changes made.

So, again, thank you very much for your time.

[Whereupon, at 1:50 p.m., the Subcommittee was adjourned.]

Appendix 1:

Answers to Post-Hearing Questions

ANSWERS TO POST-HEARING QUESTIONS

Responses by R. James Woolsey, Vice President, Booz Allen Hamilton

Questions submitted by Chairman Brad Miller

Q1. Are the multinational structures for cooperation that we have in place adequate to meet the scope of the challenges that you expect climate change will pose? Are we facing a moment in the not-too-distant future when new institutions will be needed? Do you have any suggestions for designing and creating them?

A1. The current multinational structures to meet climate change challenges are, in my view, inadequate. The most urgent need is to development international machinery that could manage a carbon cap-and-trade system. The European system has not worked well in the last few years and has produced a very low price for carbon dioxide, one that will have, at best, negligible effect on carbon emissions. Our own national system of cap-and-trade for certain sulfur emissions to deal with the problem of acid rain has worked much better, probably in part because it only applies to one country and those involved in the system can have confidence that other parties will fulfill their obligations.

Q2. Will government and business require new ways of working together in meeting the challenges of rebuilding and development that climate change may bring to some areas of the world? How do you see the two sectors' current roles and models for cooperation changing?

A2. We need to learn from the history of success, and there has been some, of international public and private cooperation benefiting the environment. For example, former Secretary of State George Shultz has written persuasively of the possibility of using the Montreal Protocol, which set up an international public-private system for dealing with chlorofluorocarbons, as a model for partnership to address climate change.

Q3. In your written testimony, you state: "We have to learn to think about phenomena the way they in fact occur—nature is not always going to behave in linear fashion because our minds tend to think that way." Can you provide some suggestions as to how our citizens and our policy-makers can go about learning this new way of thinking?

A3. This is a very difficult challenge. Perhaps seminars at universities and think tanks conducted by climatologists and other scientists (I would nominate Ray Kurzweil to be a leading figure) with journalists in attendance would be useful. We are mainly informed of these matters by the press and particularly those journalists who cover climate and related issues for major national publications. They should have priority in attending such seminars.

Questions submitted by Representative F. James Sensenbrenner, Jr.

Q1. Climate change is just one of many threats facing our nation today. Where does it stand as a priority in relation to other transnational threats such as terrorism, weapons proliferation, drug trafficking, smuggling, and organized crime?

A1. I believe that climate change (although a "malignant" as distinct from a "malevolent" threat as set out in my testimony) is an extraordinarily serious issue that can affect the lives of all of us, or at least our grandchildren. Thus I would put it more in the category of such threats as the proliferation of nuclear and biological weapons and large-scale terrorism, above the level of (still-serious) drug trafficking and organized crime. The key point, however, as my testimony sets out is that there are many things we can do that will address, and improve the resilience of our society to, both climate change and large-scale terrorism—particularly potential terrorist attacks on our energy systems. Thus if we are smart we may be able to deal with more than one major threat with each of a number of steps—for example, moving away from oil's monopoly on transportation fuel and moving both toward substantially greater energy efficiency and distributed generation and production of electricity and fuels.

Q2. What types of information are needed by national security officials to appropriately characterize the potential effects of climate change on national security, and prepare for how to respond to those challenges?

A2. It seems to me there are two types of relevant information. One is the likely effect on our and others' behavior and infrastructure insofar as it may require us to take steps to make our armed forces more effective. For example, we may need to take account in our design of our forces how to deal with refugee crises caused by increasing emigration out of nations whose water supply and crops become affected by climate change. Second, we may find that there are opportunities to build resilience into our military infrastructure—e.g., to make our military bases less vulnerable to terrorist assaults on our electricity grid—at the same time the military contributes to a reduction in CO_2 emissions by developing affordable and efficient methods of using renewables or small nuclear reactors for on-base power.

Q3. When you were the Director of Central Intelligence from 1993–1995 you presumably were tasked with establishing a budget for many of the intelligence agencies. Where did climate change fall as a priority within your budget? Where would you place it as a priority now? What types of other threats would you consider a higher priority? What types of other threats would you consider a lower priority?

A3. Between February 1993 and January 1995, the two years I was DCI, climate change was not a particular priority in the intelligence community; humanitarian crises such as those in Bosnia and Somalia were front and center. We also did our best to assess trends in proliferation, terrorism, and international organized crime. The exception was that we continued the evolution of using our national intelligence collection systems, such as reconnaissance satellites, to improve the country's knowledge of the environment. This was a matter of, principally, pulling together material that had been collected for other purposes or incidentally (a record of the shoreline of the Caspian Sea, e.g.). So what we were doing regarding climate change and related issues was unique and useful, but entailed very little additional budgetary cost. The priority I would assign today is set forth in answer to Question 1, above.

Q4. Many of the issues that climate change will exacerbate such as famine, disease, resource scarcity, and refugee migration are already issues that national security leaders have to deal with today. Would it be prudent to address these specific effects of climate change individually rather than in a generalized manner so that we can prioritize resources appropriately and direct resources to the issues that are more immediate or more threatening? Does an issue-by-issue "menu" approach give us more flexibility in responding to challenges than attempting an all-or-nothing approach to climate change as a whole?

A4. Intelligence collection, typically the most expensive part of the intelligence process by far, can rarely be prioritized in budget terms except by target. The choice of target is, in turn, affected by both the seriousness of the threat and the difficulty of penetrating it—e.g., we spend much more effort on collecting against Iran and North Korea than against less virulent and closed regimes, even ones that are somewhat hostile to us. Climate change, being a "malignant" as distinct from a "malevolent" threat typically presents no collection target such as a hostile and closed regime from which we need to steal secrets. Normally with respect to climate change one is simply taking information collected by the Intelligence Community for other purposes (such as the record of the shore line of the Caspian), adding to it publicly available information, and using it to assess both individual subjects (enhanced risk of mass emigrations) and the overall phenomenon (can we improve our judgment about when the tundra may begin to melt, release methane, and possibly speed up climate change in general). It seems to me it is important that both of these tasks be done, and the cost of emphasizing one over the other is largely just a matter of allocating the time of analysts, not a costly matter of allocating collection resources. But except for the ready access to the satellite data it is not a matter of certainty that the Intelligence Community need be the institution in government that does either or both analytical tasks. If, e.g., the Department of State had the analysts familiar with these issues and there were some reason to assign the tasks to them rather than to the Intelligence Community that could be a reasonable option.

ANSWERS TO POST-HEARING QUESTIONS

Responses by Alexander T.J. Lennon, Research Fellow, International Security Program, Center for Strategic and International Studies; Editor-in-Chief, The Washington Quarterly

In many cases, the answers to the questions are addressed in the longer report, released in early November, which I co-directed with Kurt Campbell, CEO from the Center for a New American Security (CNAS), and Julianne Smith, Director of the CSIS Europe program. These answers are drawn from *The Age of Consequences: The Foreign Policy and National Security Implications of Global Climate Change.*

Questions submitted by Chairman Brad Miller

Q1. In your testimony, you said that "the geopolitical significance of China and the water shortages, desertification, migration, and public unrest that it may face over the next 30 years could undermine any fragile progress in economic and political modernization in that country or Beijing's ability to act as a responsible stakeholder in the international system." Can you elaborate on this statement, perhaps sketching the path or paths you envision to either or both of the outcomes?

A1. The key to China's stable growth and ability to act as a responsible stakeholder in international affairs rests on both economic progress and domestic stability. As mentioned in the submitted testimony, John Podesta and Peter Ogden raised concerns about climate change causing water shortages, desertification, potentially drastic declines in crop yields, and migration exacerbating urbanization and crowding in China's cities. In the last few years, environmental concerns such as these have led to demonstrations in China which raise concerns about social stability, threatening their ability to act as a responsible stakeholder.

Q2. Much of your testimony focuses on the weaknesses that climate change may cause in other states. Are the effects that climate change may have on strong powers such as Russia likely to hold implications for U.S. national security as well?

A2. The principal national security concern raised, in my opinion, is that climate change will cause weakness in states which will threaten U.S. interests. Even though temperature changes will be greatest toward the poles, it is the weaker states that will not be able to adapt to even relatively milder changes in temperature. Kurt Campbell wrote in our study that, "A breakdown in state authority and capabilities is only one of the more alarming potential prospects of dramatic climate change. It is clear that large-scale migrations and movements of people will trigger deep insecurity in some communities, but it is far from clear whether these anxieties will trigger a traditional 'national security response.' Under certain scenarios, a well-armed nation experiencing the environmental ravages brought on by climate change might conceivably seize by force another country's milder, more fertile territory. Yet a broader range of potential problems, including disease, uncontrolled migration, and crop failure, are more likely to overwhelm the traditional instruments of national security (the military in particular) than cause them to be used [to acquire resources]."

On Russia specifically, Campbell wrote that "attention will inevitably turn to potential climate change 'winners' and 'losers,' and there may indeed be some early gains to be had. Some reports have suggested that Russia and Canada, among others, may emerge as the national winners in a world marked by a modest warming trend. Yet, our group determined that it is virtually impossible to predict genuine 'winners' over the medium- and long-term. Even if the most dramatic climate change effects are likely to be localized, in all probability, there will be cascading and reinforcing global implications. So, even if growing seasons increase in some areas or frozen seaways open to new maritime traffic in others, there are likely to be negative offsetting consequences—such as a collapse of ocean systems and with it global fisheries, massive species extinctions, and profound water shortages—that will easily mitigate any perceived local or national advantages. . .. In such a dynamic and unstable environment, it is the height of folly to be thinking in terms of 'winners.'"

Q3. Underlying all witnesses' testimony is a perceived need for the U.S. to continue as a global leader in helping countries and peoples deal with humanitarian crises, but in a future when these crises arise as a consequence of global warming. If we are the largest industrial country resisting aggressive action to reduce our

reliance on carbon, as well as mandatory targets for reducing carbon emissions, are we providing effective leadership on global warming in our time?

A3. Dealing with global warming will require both mitigation and adaptation strategies. As Podesta and Ogden wrote in our study, "While some of the emergencies created or worsened by climate change may ultimately be managed by the United Nations, the United States will be looked to as a 'first responder' in the immediate aftermath of a major natural disaster or humanitarian emergency. The larger and more logistically difficult the operation, the more urgent the appeal will be.

The question of if and how to respond will be a recurring one for the United States, each time raising a difficult set of questions with important national security and foreign policy implications: How much financial assistance should the United States pledge and how quickly? With which other countries should the United States seek to coordinate its response, either operationally or diplomatically? Should the U.S. military participate directly, and, if so, in what capacity and on what scale? . . .Ultimately, the threat of desensitization could prove one of the gravest threats of all, for it is clear that the national security and foreign policy challenges posed by climate change are tightly interwoven with the moral challenge of helping those least responsible to cope with its effects." U.S. leadership will be challenged over the next generation to continually provide assistance for those in need.

Q4. If national governments are unable to cope on their own with such massive and acute problems as shortages of food and water or mass migration, what will be the future of governance in regions heavily affected by climate change? Might nation-states give way to regional forms of government, or formal governmental functions be exercised by multilateral organizations?

A4. This is one of the key unknown aspects of our study. In the milder, expected scenario, Podesta and Ogden discussed the potential for international cooperation to increase to address the effects of climate change, bringing countries together to face a common security challenge. On the other hand, in the more extreme scenario, Leon Fuerth speculated that demands may become so constant that people and countries will become desensitized and retreat into isolationism, to fend for themselves. It is simply uncertain but, in either case, governance will change dramatically: either increasing cooperation or increasing isolationism and near anarchy.

Podesta and Ogden, discussing the milder scenario, wrote "the United Nations and other multinational organizations will be called on with increased frequency to help manage refugee flows, food aid distribution, disaster relief, and other emergencies." The European Union specifically would likely "cement its position as the most responsible and united regional organization on the issue of climate change."

Fuerth, analyzing a more extreme scenario, wrote that in that case, "alliance systems and multilateral institutions may collapse-among them, the UN, as the Security Council fractures beyond compromise or repair." He summarized that "the consequences of even relatively low-end global climate change include the loosening and disruption of societal networks. At higher ranges of the spectrum, chaos awaits. The question is whether a threat of this magnitude will dishearten humankind, or cause it to rally in a tremendous, generational struggle for survival and reconstruction. If that rally does not occur relatively early on, then chances increase that the world will be committed irrevocably to severe and permanent global climate change at profoundly disruptive levels."

ANSWERS TO POST-HEARING QUESTIONS

Responses by Andrew T. Price-Smith, Assistant Professor, Department of Political Science, Colorado College; Director, Project on Health, Environment, and Global Affairs, Colorado College/University of Colorado–Colorado Springs; Senior Advisor, Center for Homeland Security, University of Colorado

Questions submitted by Chairman Brad Miller

Q1. Which of the world's nations or regions do you see as most immediately vulnerable to the changes in disease prevalence that climate change can bring? How do you see their own security and that of other nations, including the U.S., being affected as a result of instability and other problems that climate change can cause?

A1. Those regions that exhibit the greatest level of vulnerability to GCC-induced disease prevalence are the tropical though temperate zones, particularly in those nations that lack established public health and medical infrastructure and/or access to health services. Thus, we should be concerned about South Asia (Pakistan and Northern India in particular), South-East and East Asia, sub-tropical regions of South America, and much of Sub-Saharan Africa.

Disease-induced poverty, and socio-political instability may undercut effective governance within affected polities, and contribute to macro-level political destabilization over the longer term. Failing or failed states may then generate externalities such as the destabilization of their contiguous neighbors, or may serve as bases of operations for radical organizations (i.e., terrorists) who may then pursue operations against the United States and her allies.

Q2. What public health risks will the U.S. face due to changing pathogen behavior in the next 30 years?

A2. Largely unknown, although we can speculate that we will see increasing levels of vector borne disease in Mexico and the Caribbean. Ergo the U.S. southern border regions will likely see increasing levels of malaria, dengue. The transmission of such pathogens will be enhanced by poverty, and the cross-border movement of peoples in the region.

Perhaps the most important concern is that climate change will combine with other facets of globalization (i.e., trade, migration) to result in the emergence of entirely novel pathogens, to which we have little or no natural immunity, nor vaccines or other forms of prophylaxis.

Q3. Are there diseases in addition to malaria or cholera whose incidence can be predicted from Sea Surface Temperatures or other phenomena affected by global climate change?

A3. Yes, apparently diarrhea (and presumably dysentery) is also highly correlated with Sea Surface Temperature, with preliminary evidence from Peru. Further investigation into the relationship between SST and other diseases is required.

Q4. Has climate change played a role in the emergence of new diseases, or have its effects to date been confined to augmenting and/or shifting the prevalence of existing diseases?

A4. GCC has not yet played a causal role in the emergence of new pathogens, rather it has generally resulted in shifting the burden of various vector-borne pathogens from the tropics towards the polar regions, or to higher altitudes.

Q5. Could extreme weather events, whose frequency seems to rise with global temperatures, become significant factors in the emergence and/or proliferation of vector borne diseases? Could new diseases emerge as a result of such events?

A5. Extreme weather events (particularly those involving exceptional precipitation) are correlated with the emergence of encephalitis within the United States. Certainly, they may contribute to other vector/pathogen combinations as well, although more study is required in this area. It is conceivable that extreme weather events could combine with other factors (i.e., population density) to result in the emergence of novel pathogens although this has not occurred to date.

Q6. What role can the U.S. play in combating the emergence and proliferation of new diseases, or old diseases given new energy by GCC?

A6. An enormous subject. Briefly, the U.S. must exhibit global leadership by acknowledging the threat posed by the GCC-induced spread of disease. Washington

must then provide R&D support for the investigation of the relationship between environmental change, disease proliferation, and the economic and political consequences of such changes. Such analyses will permit the development of concrete policy recommendations to inform Washington and the global community. In the short-term, the U.S. should take immediate action to slow the processes of GCC, preferably by reducing greenhouse gas emissions, and promoting renewable domestic sources of energy including wind power, biomass fuels, etc. Ultimately, the U.S. must provide a much greater level of global leadership on a range of environmental issues including GCC.

Q7. What will be the future of governance in regions heavily affected by climate change? Might nation states give way to regional forms of government, or formal governmental functions be exercised by multilateral organizations?

A7. Possibly, although the outcomes are likely dependent on state capacity and shared norms in affected regions. Given that the most affected states are developing nations with low levels of state capacity (i.e., resilience), a more likely outcome is that GCC will erode effective governance, with many states devolving into quasi-states or failed states (e.g., the Democratic Republic of Congo, Somalia). Such states will retain sovereignty in a de jure sense, but lack any de facto capacity for self-regulation. In some cases they may become wards of multilateral institutions such as the UN.

Q8. Are there neglected areas of technology that we should invest in to prepare for or avert problems related to climate change? Are there existing areas that are deserving of more emphasis?

A8. Again we should certainly invest greater resources in the generation of renewable energy on a domestic level, and with our allies (such as Canada). However, a central problem is our fixation upon technological ingenuity, while we typically neglect those advances that could be made through a focus on social ingenuity. Social ingenuity involves reconfiguring markets to accurately price the costs of fossil fuels (including externalities such as health costs, and defense expenditures), and reformulating structures of governance (both domestic and international) to permit greater levels of adaptation in the face of profound changes. Finally, we need to invest in training a new generation of policy-makers in consilient (interdisciplinary) modes of analysis that combine expertise in the natural and social sciences.

Q9. Are there relevant areas of scientific research that might merit increased federal support to prepare for, or avert, climate change?

A9. Averting GCC is ostensibly impossible at this point. Thus, the U.S. Federal Government should provide considerable support for those projects that seek to ameliorate (or limit) the damage generated by GCC. To that end, Congress and the Administration should focus on providing support to interdisciplinary research projects that combine the social and natural sciences, in an effort to augment the adaptive capacity of the U.S. and affected nations. The Project on Health, Environment, and Global Affairs which involves collaboration between Colorado College and the Center for Homeland Security at the University of Colorado, Colorado Springs is one such initiative. The U.S. government should also consider funding the construction of an interdisciplinary research network involving several major regional universities in order to generate solutions to such grave problems. An optimal network for applied research on the nexus between GCC, health, and security would involve (in addition to the Project detailed above); Columbia University, Colorado State University, the University of North Carolina–Chapel Hill, the University of South Florida, the University of California, and the University of Washington.

ANSWERS TO POST-HEARING QUESTIONS

Responses by Kent Hughes Butts, Professor of Political Military Strategy; Director, National Security Issues, Center for Strategic Leadership, U.S. Army War College

Questions submitted by Chairman Brad Miller

Q1. According to your testimony, DOD Directive 3000.05 declares that "stability operations are a core U.S. military mission. . .they shall be given priority comparable to combat operations." How long has this relationship of parity between stability operations and combat operations been the stated policy of the Department of Defense? With particular reference to the potential and actual problems associated with climate change, what has been its practical effect?

A1. The 2005 Report of the Defense Science Board Task Force on institutionalizing stability operations within the Department of Defense provided substantial impetus for DOD Directive 3000.05, which was published in 2006. It has been DOD's stated policy since that time. That stability operations were critical to the success of military operations and regional stability has been well known to the Special Operations Community and historians concerned with such previous conflicts as the Vietnam War. However, it was only with the detailed reviews of military operations in Iraq and Afghanistan that the broader military community became convinced that success depended upon well planned and resourced stability operations in pre- and post-conflict phases.

The practical effect of DOD Directive 3000.05 has been to involve an increasing number of Department of Defense organizations in stability operations doctrine and planning. The Army Action Plan for Stability Operations, for example, directs the Army service components for the combatant commands, the U.S. Army Forces Command, the U.S. Army Training and Doctrine Command, and even the U.S. Army Materiel Command to integrate support for stability operations into their missions. It also had the effect of encouraging those policy-makers and strategists in the Pentagon who believe that the Department of Defense should take a pro-active role in addressing stability and security issues in an effort to prevent conflict rather than restrict the U.S. military to more traditional war-fighting and crisis-response missions. While these actions facilitate the involvement of DOD organizations and military forces in addressing climate change issues that threaten regional stability, there is rarely any direct mention of climate change or the effects of global warming. A notable exception was the recent *"Strength of the Nation"* article by the Army Chief of Staff, General George W. Casey Jr. In it, General Casey characterized a future of persistent conflict fueled by emerging global trends such as climate change, natural disasters and resource demand that would promote violent confrontation by exacerbating existing frictions and tensions, "thus creating conditions ripe for exploitation by extremist groups attempting to undermine and destroy the societies and values we are attempting to nurture and sustain."

Q2. Can you give us any insights into the current state of U.S. strategic thinking or contingency planning focused on the Arctic?

A2. In December of 2004 President Bush issued an executive order establishing the Committee on Ocean Policy, chaired by the Council on Environmental Quality. This committee generated momentum and manages a series of subcommittees, interagency working groups and the Interagency Committee on Ocean Science and Resource Management Integration (ICOSRMI). This process has begun to examine offshore land and water issues and is developing a framework process and management regime. Although primarily domestically focused, the process has generated important action to improve U.S. security interests in the Arctic.

In 2007, the President urged Congress to act favorably on U.S. accession to the United Nations Convention on the Law of the Sea; this watershed action, when completed, will greatly enhance the position of the United States in negotiations for territory and resource access in the Arctic. In addition, the administration has undertaken a review process for United States Arctic policy. This process establishes a working group co-chaired by the Department of State and National Security Council, with representation from the U.S. Coast Guard, DOD, DOE, Interior, DOC and EPA, that recognizes that the changes in the Arctic environment during the next 20 years will alter human activity in the region and affect U.S. national security interests. The Arctic Policy Working Group will have four subgroups dedicated to: international governance, territorial and scientific issues; shipping, defense and national security issues; energy, environmental and economic issues; and identifying

government resources required for Arctic activity. This group will be closely associated with the ICOSRMI process and by January of 2008 should present a recommendations paper to an NSC PCC. It is thought that this will generate a new Arctic Policy NSPD that will replace the 1983 NSDD 90 document (U.S. Arctic Policy).

Q3. What limits would you place on the military's role in disaster relief? How would you divide up the various responsibilities involved between the military and other U.S. and multilateral entities?

A3. As a general rule, the military is used as a supplement to state and local civilian emergency management forces and police that have the primary responsibility for planning for and managing disasters, becoming involved when the capabilities of these forces are overwhelmed by the emergency. Reserve Component (RC) forces such as the National Guard, which can be called up by the state governors, would be the first military involved, with the active forces joining relief efforts if they had unique and critical capabilities or the scope of the disaster exceeded RC capabilities. This approach has the potential to work well if proper planning and rehearsals, and a clear chain of command, are given priority.

Internationally the role of the military in disaster preparedness varies with country; however, models similar to that of the United States are not uncommon. Disaster preparedness to manage natural or man-made disasters offers a valuable opportunity for multilateral cooperation and confidence building. The combatant commands have well-developed disaster preparedness programs that serve as security cooperation and engagement vehicles. Disaster preparedness offers an irresistible reason for working with the United States and allows U.S. forces to build critical capabilities and capacities in host-nation militaries that enable those forces to support civil authority, often at deterministic nodes when demands placed upon the political system could easily cause it to fail.

The value of having the military involved in disaster preparedness work was demonstrated in the aftermath of the December 2004 tsunami that cost over 130,000 Indonesian lives. When the United States and other donor countries and organizations responded to the massive devastation in the Aceh Province of Indonesia, it created goodwill and eroded support for the terrorist organization Jemaah Islamiah (JI), an Al Qaeda franchise. In fact, the spiritual leader of JI, Abu Bakar Bashir, said that as a result of the U.S. military relief effort, he was losing the battle for the hearts and minds of the people. In polls taken after the relief effort, the positive perception of the United States rose by over 30 percent, while the popularity of Al Qaeda dropped 20 percent. Although not a climate change disaster, the tsunami demonstrated the value of disaster preparedness in advancing U.S. foreign policy objectives.

In terms of limitations on the military's role in disaster relief, it is important to understand that the military, both domestically and internationally, should not be the lead organization. A civilian entity should be in charge. In both situations, before the military begins operations or enters a foreign country, an exit strategy should already be developed, with one of the objectives being to strengthen the capacities of local forces so that they may accrue legitimacy in the eyes of the population.

Q4. Underlying all witnesses' testimony is a perceived need for the U.S. to continue as a global leader in helping countries and peoples deal with humanitarian crises, but in a future when these crises arise as a consequence of global warming. If we are the largest industrial country resisting aggressive action to reduce our reliance on carbon, as well as mandatory targets for reducing carbon emissions, are we providing effective leadership on global warming in our own time?

A4. The international community believes the United States should provide strong leadership on climate change. As the country with the highest per capita consumption of energy resources and emissions of carbon, the decision of the United States not to press for mandatory targets in carbon emissions undermines its efforts to claim the moral high ground as it competes for influence in the world. Moreover, this provides an excuse for the largest carbon emitter, China, to refrain from making the reduction of carbon emissions a national priority at a time when its growing economy necessitates the building of a coal-fired power plant every week to ten days. More effective US leadership on a global effort to reduce dependence on carbon fuels and limit carbon emissions would facilitate greater cooperation between regionally influential countries and the United States on other issues critical to U.S. national security. Making this a priority would also contribute to the air quality in the United States and reduce a significant health threat, curtail the growing U.S. foreign exchange deficit, limit U.S. dependence on politically unstable sources of pe-

troleum supply, and slow the inflationary increase in resource commodity prices. It would also provide a much needed time period for energy exploration and alternative energy research and development.

Q5. If national governments were unable to cope on their own with such massive and acute problems as shortages of food and water or mass migration, what will be the future of governance in regions heavily affected by climate change? Might nation-states give weight to regional forms of government, or formal governmental functions be exercised by multilateral organizations?

A5. I do not see a trend away from state-centric regional governance to regional forms of government. Although there may be rare instances of the external administration of a failed state, I believe these would be ephemeral. U.S. foreign policy seeks to support regional organizations in addressing regional issues and promoting stability. However, many of these organizations are ineffectual and limited in their ability to develop consensus for regional policies and to enforce them. In Africa, where the effects of climate change are pronounced, the African Union continues to struggle. The Southern African Development Community lost much of its raison d'être with the end of apartheid in South Africa. While it does have some effective programs, it finds its unity challenged by such divisive issues as Zimbabwe and support for United States policies. Even the Economic Community of West African States, which has had some degree of success in dealing with regional security issues, turns on the stability and leadership of the increasingly troubled country of Nigeria. It is for good reason that U.S. foreign policy and the objectives of military organizations such as the new Africa Command continue to prioritize developing good governance and state capacity; for where go state legitimacy and effective governance, go regional stability and security.

Climate change will have some impact upon the global system of governance. Migration pressures on Europe could create a Fortress Europe at odds with and less willing to help the regional organizations, and split by divisiveness among allies. Moreover, natural disasters can erode the power of insurgent organizations, as was seen in Aceh, Indonesia, when the Free Aceh movement suffered severe losses in the tsunami and the Indonesian government's disaster response gained it legitimacy in the eyes of the Aceh people. One could also argue that it is far easier to influence the behavior and increase the capacity of a small group of regionally influential states than it is to build unanimity of purpose within regional organizations. For this reason, it is essential that organizations dedicated to strengthening nation-states and promoting stability, such the Department of State and its Office of the Coordinator for Reconstruction and Stabilization (S/RS) and USAID, be recognized as leaders in the deterministic struggle for regional stability and security and the protection of U.S. national security interests, and be adequately resourced by Congress and the Administration.

Q6. Are there neglected areas of technology that we should begin to invest in to prepare for or avert problems related to climate change? Are their existing areas that are deserving of more emphasis? Are there relevant areas of scientific research that might merit increased federal support to prepare for or avert climate change?

A6. There are numerous technologies that demonstrate great promise for dealing with elements of the climate change problem. It would be doing a disservice to the United States to take any of these off the table. However, there are several areas where priority makes sense. Petroleum was a significant factor in the strategic decisions of World War II. The OPEC oil embargo demonstrated the U.S.'s inability to meet domestic demand from U.S. sources of supply, its strategic vulnerability to political decisions, and instability in oil-producing countries. Knowing that in approximately two decades China's and India's petroleum imports will equal the current U.S. and Japanese petroleum imports, and that the price of oil is nearing $100 a barrel, it makes sense to begin reducing the hidden subsidies for fossil fuels and to change the rules of the Great Game by speeding the transition to alternative fuels. This effort would benefit from increased federal support. So too would reducing carbon emissions. Other areas where federal support is warranted include: carbon sequestration technology, concentrating solar-power technology, and hydrogen technology. Whether it is the Manhattan Project or NASA missions, the Federal Government has the capacity to jump-start technological development when it makes research a national priority.

Questions submitted by Representative F. James Sensenbrenner, Jr.

Q1. Climate change is just one of many threats facing our nation today. Where does it stand as a priority in relation to other transnational threats such as terrorism, weapons proliferation, drug trafficking, smuggling, and organized crime?

A1. The threats that you mention—terrorism, weapons proliferation, drug trafficking, smuggling, and organized crime—are transnational problems that the United States has been attempting to manage for many years. Many of these issues struggle for adequate leadership, priority and resources, in part because they are international in nature and the American people consistently demonstrate a relative lack of interest in and understanding of international affairs. Even terrorism, which is listed in the National Security Strategy as the Nation's number one national security threat, lacks a central point of leadership, dedicated financial resources and a process to synchronize all terrorism-combating activities. Climate change has a limited history of public acceptance as a security issue. And, while its constituency is growing as its perceived phenomena—such as the drought in the Southeast, large powerful storms, and reduced snowfall—begin to directly affect the American people, it will take some time before pressure mounts to make it the number one national security issue here as it is in Great Britain.

Q2. What types of information are needed by national security officials to appropriately characterize the potential effects of climate change on national security and to prepare for how to respond to those challenges?

A2. The chief impediment to making climate change a priority issue is its lingering role as a partisan issue. Characterizing climate change as a security issue that is currently threatening U.S. national security interests allows the United States to move beyond this barrier and take advantage of science that allows us to predict where climate change forces will stress weak and failing states and thereby threaten regional stability. Therefore, information that demonstrates the relationship between climate change phenomena and regional instability (the chief threat to U.S. national security), the underlying conditions of terrorism, natural disasters and the economic vitality of the United States would allow national security officials to characterize the importance of climate change to the American people and better identify concepts for dealing with the challenges.

Q3. Many of the issues that climate change will exacerbate such as famine, disease, resource scarcity, and refugee migration are already issues that national security leaders have to deal with today. Would it be prudent to address the specific effects of climate change individually rather than in a generalized manner so that we can prioritize resources appropriately and direct resources to the issues that are more immediate or more threatening? Does an issue-by-issue, "menu" approach give us more flexibility in responding to challenges than attempting an all-or-nothing approach to climate change as a whole?

A3. I believe both approaches are necessary if the United States is to have success in addressing the security elements of climate change in a timely fashion. Bundling all climate change-related security issues runs the risk of minimizing the individual contributions of the multiple organizations already actively involved in addressing these issues. Moreover, choosing a generalized approach could affect the interests of Congressional Committees and other stakeholders responsible for the various elements of the initiative and run the risk of incurring resistance—as we have seen with other national security priorities. The smaller the resources, the more intense the bureaucratic competition and the less likely there will be cooperation, coordination and synchronization among the U.S. agencies attempting to apply these scarce resources. Nevertheless, a generalized approach has benefits.

The point to which I alluded earlier concerning the lack of understanding among the American people for funding efforts to shape the international security milieu is salient and bears repeating. It is unlikely that meaningful resources, a sound strategy and a clear end-state for dealing with the security aspects of climate change will be forthcoming from the United States government until such time as the American people fully understand their importance and demand them. The resources with which to address the security dimensions of climate change are lightly funded and lack strong constituencies in the Congress. The foreign assistance account, security assistance funding, monitoring agencies (such as the Environmental Protection Agency and National Oceanic and Atmospheric Administration) and leadership agencies (such as the Department of State and the U.S. Agency for International Development) struggle for resources. A generalized approach to climate change and security should be undertaken, as it is an excellent first step in raising

awareness of climate change and security among the American people and among congressional and administration leaders in Washington, DC. A framing document for this effort could be a new, regionally based National Security Strategy that clearly articulates the security dimensions of climate change, identifies the resources necessary to successfully address these issues and makes agencies of the United States government responsible for them. However, until such time as this approach bears fruit, we should not forget the foot soldiers that are currently waging the fight and their need for increased resources.

Appendix 2:

Additional Material for the Record

EXECUTIVE SUMMARY

The purpose of this study is to examine the national security consequences of climate change. A dozen of the nation's most respected retired admirals and generals have served as a Military Advisory Board to study how climate change could affect our nation's security over the next 30 to 40 years—the time frame for developing new military capabilities.

The specific questions addressed in this report are:

1. What conditions are climate changes likely to produce around the world that would represent security risks to the United States?
2. What are the ways in which these conditions may affect America's national security interests?
3. What actions should the nation take to address the national security consequences of climate change?

The Military Advisory Board hopes these findings will contribute to the call President Bush made in his 2007 State of the Union address to "...help us to confront the serious challenge of global climate change" by contributing a new voice and perspective to the issue.

FINDINGS

Projected climate change poses a serious threat to America's national security.
The predicted effects of climate change over the coming decades include extreme weather events, drought, flooding, sea level rise, retreating glaciers, habitat shifts, and the increased spread of life-threatening diseases. These conditions have the potential to disrupt our way of life and to force changes in the way we keep ourselves safe and secure.

In the national and international security environment, climate change threatens to add new hostile and stressing factors. On the simplest level, it has the potential to create sustained natural and humanitarian disasters on a scale far beyond those we see today. The consequences will likely foster political instability where societal demands exceed the capacity of governments to cope.

Climate change acts as a threat multiplier for instability in some of the most volatile regions of the world. Projected climate change will seriously exacerbate already marginal living standards in many Asian, African, and Middle Eastern nations, causing widespread political instability and the likelihood of failed states.

Unlike most conventional security threats that involve a single entity acting in specific ways and points in time, climate change has the potential to result in multiple chronic conditions, occurring globally within the same time frame. Economic and environmental conditions in already fragile areas will further erode as food production declines, diseases increase, clean water becomes increasingly scarce, and large populations move in search of resources. Weakened and failing governments, with an already thin margin for survival, foster the conditions for internal conflicts, extremism, and movement toward increased authoritarianism and radical ideologies.

The U.S. may be drawn more frequently into these situations, either alone or with allies, to help provide stability before conditions worsen and are exploited by extremists. The U.S. may also be called upon to undertake stability and reconstruction efforts once a conflict has begun, to avert further disaster and reconstitute a stable environment.

Projected climate change will add to tensions even in stable regions of the world. The U.S. and Europe may experience mounting pressure to accept large numbers of immigrant and refugee populations as drought increases and food production declines in Latin America and Africa. Extreme weather events and natural disasters, as the U.S. experienced with Hurricane Katrina, may lead to increased missions for a number of U.S. agencies, including state and local governments, the Department of Homeland Security, and our already stretched military, including our Guard and Reserve forces.

Climate change, national security, and energy dependence are a related set of global challenges. As President Bush noted in his 2007 State of the Union speech, dependence on foreign oil leaves us more vulnerable to hostile regimes and terrorists, and clean domestic energy alternatives help us confront the serious challenge of global climate change. Because the issues are linked, solutions to one affect the other. Technologies that improve energy efficiency also reduce carbon intensity and carbon emissions.

RECOMMENDATIONS OF THE MILITARY ADVISORY BOARD:

1. The national security consequences of climate change should be fully integrated into national security and national defense strategies.

As military leaders, we know we cannot wait for certainty. Failing to act because a warning isn't precise enough is unacceptable. The intelligence community should incorporate climate consequences into its National Intelligence Estimate. The National Security Strategy should directly address the threat of climate change to our national security interests. The National Security Strategy and National Defense Strategy should include appropriate guidance to military planners to assess risks to current and future missions caused by projected climate change. The next Quadrennial Defense Review should examine the capabilities of the U.S. military to respond to the consequences of climate change, in particular, preparedness for natural disasters from extreme weather events, pandemic disease events, and other related missions.

2. The U.S. should commit to a stronger national and international role to help stabilize climate change at levels that will avoid significant disruption to global security and stability.

Managing the security impacts of climate change requires two approaches: mitigating the effects we can control and adapting to those we cannot. The U.S. should become a more constructive partner with the international community to help build and execute a plan to prevent destabilizing effects from climate change, including setting targets for long term reductions in greenhouse gas emissions.

3. The U.S. should commit to global partnerships that help less developed nations build the capacity and resiliency to better manage climate impacts.

As President Bush noted in his State of the Union speech, "Our work in the world is also based on a timeless truth: To whom much is given, much is required." Climate forecasts indicate countries least able to adapt to the consequences of climate change are those that will be the most affected. The U.S. government should use its many instruments of national influence, including its regional commanders, to assist nations at risk build the capacity and resiliency to better cope with the effects of climate change. Doing so now can help avert humanitarian disasters later.

4. The Department of Defense should enhance its operational capability by accelerating the adoption of improved business processes and innovative technologies that result in improved U.S. combat power through energy efficiency.

Numerous Department of Defense studies have found that combat forces would be more capable and less vulnerable by significantly reducing their fuel demand. Unfortunately, many of their recommendations have yet to be implemented. Doing so would have the added benefit of reducing greenhouse gas emissions.

5. The Department of Defense should conduct an assessment of the impact on U.S. military installations worldwide of rising sea levels, extreme weather events, and other projected climate change impacts over the next 30 to 40 years.

Many critical defense installations are located on the coast, and several strategically important ones are on low-lying Pacific islands. Sea level rise and storm surges will threaten these facilities. Planning and action can make these installations more resilient. Lack of planning can compromise them or cause them to be inundated, compromising military readiness and capability.

ABOUT THE REPORT

To better inform U.S. policymakers and the public about the threats to national security from global climate change, the CNA Corporation, a nonprofit national security analysis organization, convened a panel of retired senior military officers and national security experts and conducted an assessment of the national security implications of global climate change. In this context, we define national security to refer to the influence of climate change on geo-strategic balances and world events that could likely involve U.S. military forces or otherwise affect U.S. strategic interests anywhere in the world.

The Military Advisory Board consisted of retired flag and general officers from all four services, including service chiefs and some who served as regional combatant commanders (a regional combatant commander is a four-star officer who commands all U.S. forces in a given region of the world). The Military Advisory Board and the study team received briefings from the U.S. intelligence community, climate scientists, and business and state leaders. They also traveled to the United Kingdom to meet with high-level government and business leaders to learn what actions the United Kingdom is taking to address the threat of climate change. Members of the Military Advisory Board also presented their own views, based on experience, of the security effects of climate change on various regions of the world.

This report documents the results of that effort. We start with a discussion of the geo-strategic implications of climate change in the general sense—that is, how climate change can foster instability and affect international security. We then apply this background to address specific regional security challenges in Africa, Asia, the Middle East, Europe, and the Americas. That is followed by a discussion of the challenges from climate change that can have a direct impact on military systems and operations. We conclude with a set of findings and recommendations related to mitigation, adaptation, and preparation—specific actions the U.S. government should take in response to the challenges presented by climate change. Appendices provide background on members of the Military Advisory Board, and very briefly summarize the science of climate change and ways in which the earth's environment may potentially change.

CLIMATE CHANGE AND THE SCOPE OF THIS STUDY

Although there is a great deal of agreement among the world's climate scientists regarding the overall picture of a changing climate, there is also some disagreement about the extent of future changes.

Regardless of this continuing discussion, the board's view is quite clear: The potential consequences of climate change are so significant that the prudent course of action is to begin now to assess how these changes may potentially affect our national security, and what courses of action, if any, our nation should take.

This approach shows how a military leader's perspective often differs from the perspectives of scientists, policymakers, or the media. Military leaders see a range of estimates and tend not to see it as a stark disagreement, but as evidence of varying degrees of risk. They don't see the range of possibilities as justification for inaction. Risk is at the heart of their job: They

GENERAL GORDON R. SULLIVAN, USA (Ret.)

Chairman, Military Advisory Board | Former Chief of Staff, U.S. Army

ON RISK

Former U.S. Army Chief of Staff Gordon Sullivan enjoys a good debate. But he also knows there are times when debate must stop and action must begin. With respect to climate change, he says that time has arrived.

"We seem to be standing by and, frankly, asking for perfectness in science," Gen. Sullivan said. "People are saying they want to be convinced, perfectly. They want to know the climate science projections with 100 percent certainty. Well, we know a great deal, and even with that, there is still uncertainty. But the trend line is very clear."

"We never have 100 percent certainty," he said. "We never have it. If you wait until you have 100 percent certainty, something bad is going to happen on the battlefield. That's something we know. You have to act with incomplete information. You have to act based on the trend line. You have to act on your intuition sometimes."

"We never have 100 percent certainty. We never have it. If you wait until you have 100 percent certainty, something bad is going to happen on the battlefield."

In discussing how military leaders manage risk, Gen. Sullivan noted that significant attention is often given to the low probability/high consequence events. These events rarely occur but can have devastating consequences if they do. American families are familiar with these calculations. Serious injury in an auto accident is, for most families, a low probability/high consequence event. It may be unlikely, but we do all we can to avoid it.

During the Cold War, much of America's defense efforts focused on preventing a Soviet missile attack—the very definition of a low probability/high consequence event. Our effort to avoid such an unlikely event was a central organizing principle for our diplomatic and military strategies.

When asked to compare the risks of climate change with those of the Cold War, Gen. Sullivan said, "The Cold War was a specter, but climate change is inevitable. If we keep on with business as usual, we will reach a point where some of the worst effects are inevitable."

"If we don't act, this looks more like a high probability/high consequence scenario," he added.

Gen. Sullivan shifted from risk assessment to risk management.

"In the Cold War, there was a concerted effort by all leadership—political and military, national and international—to avoid a potential conflict," he said. "I think it was well known in military circles that we had to do everything in our power to create an environment where the national command authority—the president and his senior advisers—were not forced to make choices regarding the use of nuclear weapons.

"The situation, for much of the Cold War, was stable," Gen. Sullivan continued. "And the challenge was to keep it stable, to stop the catastrophic event from happening. We spent billions on that strategy.

"Climate change is exactly the opposite. We have a catastrophic event that appears to be inevitable. And the challenge is to stabilize things—to stabilize carbon in the atmosphere. Back then, the challenge was to stop a particular action. Now, the challenge is to inspire a particular action. We have to act if we're to avoid the worst effects."

assess and manage the many risks to America's security. Climate change, from the Military Advisory Board's perspective, presents significant risks to America's national security. Before explaining some of those risks, we touch on an important scientific point.

A global average temperature increase of 1.3°F (plus or minus 0.3°F) occurred over the twentieth century. But the temperature change on its own is not what shapes this security assessment. Rather, it is the impact that temperature increases can have on natural systems, including:

- Habitats
- Precipitation patterns
- Extreme weather events
- Ice cover
- Sea level

Throughout this report, we do not attempt to tie our findings regarding security implications to any one particular projection of future temperature changes, precipitation changes, or sea level rise whether due to ocean expansion or ice sheet breakup. Rather, our goal is to articulate the possible security implications of climate change and to consider mitigating steps the nation could take as part of an overall national security plan.

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