FACTORING ENVIRONMENTAL SECURITY ISSUES INTO NATIONAL SECURITY THREAT ASSESSMENTS: THE CASE OF GLOBAL WARMING

A Thesis

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SELECTED PUBLICATIONS

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- U.S. Department of Defense: Climate Change, Energy Efficiency and Ozone Protection: Protecting National Security and the Environment, U.S. Department of Defense Official Publication, Washington, D.C., 2000.
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Abstract

Evidence suggests that climate change is significantly detrimental to U.S. national security when measured against current intelligence assessment criteria. Two subsidiary questions follow from this hypothesis.

- Is global warming a suitable issue to be considered a threat to U.S. national security?
- Is an NIE a suitable format for assessing the security threat of global warming?

In the pages that follow, I seek to understand the extent to which environmental security issues could or should be incorporated into national security threat assessments such as the National Intelligence Estimate (NIE). The thesis answers the central question of whether the evidence I have collected suggests that global warming is detrimental to U.S. national security under the realist national security paradigm that forms the basis the intelligence community works from. Therefore, national security is the dependent variable and global warming is the independent variable.

In chapter one, I posit the national security paradigm currently used by the Bush Administration most closely resembles offensive (neo) realism. Next, I establish my operational definitions of national and environmental security and assert that they are compatible with that paradigm.

In chapter two I present data on global warming's direct impact on the United States. I used the heuristic device of breaking up the consequences between physical, strategic and political. Chapter three is composed of the Bangladesh, Mexico, Egypt case studies. These countries were chosen due to their regional diversity and potential that developments in these countries may have a strategic impact on U.S. interests.

Chapter four analyses the history and methods of estimative intelligence and their applicability to environmental security issues such as global warming. My methodology in this chapter included interviewing a range of current and former practitioners from a former Director of Central Intelligence to a junior analyst through a structured questionnaire designed to lead me to more sources and a deeper background understanding of the topic. I critique the NIE methodology pointing out ways in which in could be altered to better apply to the global warming.

The fifth chapter presents the findings from chapters two and three in a format recognizable by the intelligence community and the policymaker. In this chapter, I use the terminology and some of the methodology of the intelligence community to suggest whether global warming's threat to national security warrants an assessment such as the NIE. In the conclusion I find that I have amassed sufficient evidence that an NIE should be performed but that the NIE is not warranted based on physical impacts of global warming alone. It is the political and strategic impacts of global warming make this issue most worthy of consideration by the Intelligence Community.

Acknowledgements

I would first like to thank my parents, Michael and Pamela who prepared me well for the world. In addition to my committee at the Fletcher School I am also grateful to Professor Dennis Quinn, George Tenet, Doug Shaw and President Jack DeGioia of Georgetown University, my first alma mater and current employer. James Oliver Chapman Wilson lent a keen eye for proofreading. I am also grateful to Dean Steve Fetter and Prof. John McNeill for their comments on outlines and early drafts. My undergraduate students at The George Washington University were especially helpful critics of my ideas. Finally, I am deeply grateful to my new family Megan and Marcelle who displayed infinite patience with me while I worked on this dissertation for countless weekends.

Preface

On August 27, 2004 South Australian Prime Minister Mike Rann declared that climate change presented a greater threat to mankind than terrorism.[1] After reading his comments I was compelled to undertake this study because I was curious as to why this problem hasn't received as much attention in the U.S. as it has in other developed nations? Despite the fact that global warming is the most studied environmental issue, it has received little systematic analysis as a security issue. Therefore one of my early research goals is better understand how the Intelligence Community would go about examine the issue through the lens of strategic analysis.

One of the challenges of this study is that scientific basis including the current and future observable effects of global warming are uncertain at best. I deal with this problem by using the best consensus science I can find -- the midrange scenarios of the Intergovernmental Panel on Climate Change Fourth Assessment Report while assuming away more abrupt climate change scenarios.

Global warming is a vexing issue from another perspective as well. Changes in behavior made today such as the reduction of greenhouse gas emissions will not cause improvements in human health until many years in the future. It is clear that mankind needs drivers to prompt us to more pay attention to issues of intergenerational equity. If global warming can be legitimately cast as a national security issue it may provide the spark that will compel our current generation to take action.

[1] *Associated Press News Feed*, August 28, 2004.

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Chapter 1: Theory: Defining Global Warming's Role in National Security

Introduction:

In this chapter I will clarify the concept of security that I will use to measure the impacts of global warming against in my dissertation. I will locate this definition in the context of environmental and human security. My task is made more difficult by the fact that security studies in general and environmental security in particular, are fields in need of clarification. I will then compare and contrast my definition of national security with the view of national security practiced by the Bush Administration demonstrating that the two are compatible. My goal is to show that my findings would be recognizable and useful to the current national security decision makers. The sociologist Kevin Clements has proposed that security is "whatever national security elites say it is."[2] The first task is to articulate what the Bush Administration says it is.

The Bush Administration's Definition of National Security

The Bush Administration's Definition of Applied National Security

In this section I will argue that the Bush Administration adheres to a national security concept of offensive (neo) realism to use the jargon of international relations. This

[2] Kevin Clements, "Toward a Sociology of Security" (Conflict Research Consortium, University of Colorado at Boulder, July 1990.) Available at http://www.colorado.edu/conflict/full_text_search/AllCRCDocs/90-4.htm (Accessed on 3/1/08)

posture has been now been assumed against the backdrop of a tendency toward isolationism as the search for a new national security paradigm in the preceding decade**.**

Empirical evidence suggests that the Bush Administration subscribes to the national security paradigm of security studies as articulated by scholars such as Helga Haftendorn and Mearsheimer.[3] The national security paradigm is based the realist theory of international relations that recognizes the state as the primary actor. This paradigm, primarily an American construct, was developed after the Second World War to suit the needs of the victors and therefore favors the status quo.

Today, the national security establishment is not blind to the fact that the State is declining as the unit of analysis and that post-Cold War definitions of national security contain some new social, political and economic attributes. Since the end of the Cold War, the definition of national security has expanded to apply to new factors such as quality of life that are reflected in concepts such as human and environmental security described later in this chapter. The terrorist strikes of September 11, 2001 have been a formative event in the Administration's conception of national security. It is logical that the terrorist strikes may have mitigated the administration's state-centric view convincing them that a small number of sub-state actors can have a strategic impact. However it is the emergence of threats emanating from sub and transnational actors -- often based in failed states --that pulled the U.S. back from its trend toward other more global paradigms involving collective security measures.

[3] Helga Haftendorn, "The Security Puzzle: Theory-Building and Discipline-Building in International Security," *International Studies Quarterly*, Vol 35, No.1. (March 1991), 7.

As stated, the Bush Administration views national security from a fundamentally realist point of view. In the upcoming section on theory I will delve into the question of which theoretical type of realism the administration espouses. I will describe that although the Bush national security outlook is fundamentally realist has taken on some neorealist tendencies. This can be partially explained by the fact that the "Young Turks", particularly in appointive bodies within the bureaucracy such as the National Security Council, have no memory of the nuclear standoff that propagated the security dilemma described by theorists such as Robert Jervis. Younger leaders within the national security elite are heavily influenced by globalization, a phenomenon that goes largely untreated in the realist paradigm. Globalization is a key factor in the spread of terrorism. The President himself appears to be influenced most by the Cold War realist outlooks of advisors such as Vice President Cheney and Condoleezza Rice who served as his policy tutors. The experience gap between the young policy staff and a president has arguably never been as wide as it is today.[4]

The Theoretical Foundation of the Bush Administration's National Security Concept:

Let me begin by observing that security is a generally under-theorized concept. The concept is rarely defined even in course syllabi on the subject.[5] According to the Oxford Dictionary, national security as a noun is, "the safety of a nation and its people, institutions, etc., especially from military threat or from espionage, terrorism, etc.;

[4] Dafna Linzer, "The NSC's Sesame Street Generation," *Washington Post*, March 12, 2006.
[5] David Baldwin, "The Concept of Security," *Review of International Studies* 23:1 (1997), 5.

[national security] is frequently defined as part of the name of an organization, government department, etc., set up to maintain or manage a country's security."[6]

Jon Barnett further posits that in security studies, the entity to be secured can be referred to as the "who" or the referent whereas the particular risk can be referred to as the "what" or the object. Therefore a satisfying definition of national security must answer both "who and what". Furthermore, the majority of mainstream scholars in the field of security studies concur that it is the threat to use, or the actual use of, force that essentially demarcates the study and practice of security as a discipline that is distinct from the broader study and practice of international relations.[7]

Helga Haftendorn takes the view that national security can be most basically defined as "the absence of military threat or the protection of the nation from external overthrow or attack."[8] While remaining inflexible on the definition of national security itself, she suggests that a new national security paradigm reflecting today's realities must be multi-focused with no single level of analysis.[9]

A prominent textbook in the field of national security studies defines national security as the protection of the nation's people and territory against physical assault. The authors allow that the term also implies the protection through a variety of means, of vital

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[6] *The Oxford English Dictionary Online* Entry available at http://dictionary.oed.com/cgi/entry/00305579/00305579se24?single=1&query_type=word&queryword=National+Security&first=1&max_to_show=10&hilite=00305579se24 (Accessed 3/3/08)
[7] Terry Terriff, "Environmental Degradation and Security", *in Security Studies for the 21st Century*, ed. Richard H. Schultz, Jr. Roy Godson and George H. Quester. (Washington, DC, Brassey's, 1997.), 253.
[8] Haftendorn 7.
[9] Haftendorn, 8.

economic and political interests, the loss of which would threaten the fundamental values and vitality of the state.[10] While there could be some disagreement about what constitutes "fundamental values" I would contend that this is a blanket definition of national security that would be acceptable to the current national security elite as well as many scholars in the field of environmental security.

Buzan's simple yet appealing definition of national security may go a step to far. It defines national security as the absence of threats or danger to society's survival and acquired values. Society may have assumed the maintenance of a pristine environment as an "acquired value." This may not be a priority with of a high enough order to fit comfortably within the Administration's definition. In addition to maintaining the ability to deter or repel external threats, national security can be defined as the fulfillment of national interests including basic survival, and protecting the health and prosperity of the nations populace.

It is ironic that protection of acquired values could be interpreted as the preservation of the highly consumptive life as we have come to know. As applied to global warming from the U.S. perspective is about securing the very lifestyles and institutions that degrade the environment against the risks associated with the same degradation. (Barnett 89) From the perspective of national defense policy, preparing for war an essential part of national security is itself a cause of global warming because the Department of Defense is one of the world's largest single carbon emitters.

[10] Amos A. Jordan, William Taylor, Jr., and Michael J. Mazarr, *American National Security*, Johns Hopkins Press, 5th Edition, 1999, 3.

The Theoretical Argument for Realism

As stated, I would argue that the current national security paradigm of the U.S. government is based on the realist theory of international relations. Realist thinkers tend to divide state interests into those that are considered high politics such as security and survival and those that fall into the category of low politics such as trade, socio-economic policies and environment issues.[11]

The various branches of realist theory share the following common assumptions: First, that the international system is anarchic and no authority above the state capable of regulating its actions. Second, that sovereign state are the primary, but not necessarily the only, actors in the international system. Third, that states are rational and unitary actors each striving for its national interest so alliances are generally distrusted. Fourth, that survival is the overriding national interest. Fifth, that relations between states are determined by their comparative level of power derived essentially from military capabilities.[12] In a condition of pure realism, there are no universal principles that states can use to guide their actions.

Realism is based on the intellectual traditions of Niccolo Machiavelli who argued that the sole motivation of the Prince was to seek power and Thomas Hobbes who contributed to

[11] Eric Nathaniel Heller, *ACDIS Occasional Paper, Power Projection of the People's Republic of China: An Investigative Analysis of Defensive and Offensive Realism in Chinese Foreign Policy*, (University of Illinois at Urbana-Champaign, November 2003). (accessed on March 19, 2008) available at http://www.acdis.uiuc.edu/Research/OPs/Heller/contents/partone.html

[12] Jeffrey W. Taliaferro, "Security-Seeking Under Anarchy: Defensive Realism Reconsidered," *International Security*, 25: 3, Winter 2000/2001*:* 152. Available at http://www.ciaonet.org/isa/taj01/, (accessed on February 28, 2008)

realist theory through his concept of the nature of man in his book Leviathan. The European system fundamentally responsible for the development of the concept of national security in emerged from the Peace of Westphalia signaling the demise of the Church as the sole sovereign authority. Modern realism emerged as a reaction against the collective security arrangements that arguably lead to greater destruction during the First World War as more countries were drawn into the fray. Moving forward, current realist theory is a post-WWII construction developed within the context of mutually-assured nuclear destruction. Hans Morgenthau wrote in *Politics Among Nations (1950)* that security of the state is best achieved through the maximization of military resources. The fact that the world has not been destroyed by a nuclear conflagration lends credence to the realist assumption that States are rational actors.

Analysts such as Barnett and J. Matthews argue that idealist and liberal theories are now prevalent because traditional realist approaches are not adequate for managing complex international situations that have emerged particularly with the end of the Cold War and its nuclear standoff. It is my contention that the Bush Administration has been only marginally moved by these arguments and approaches national security through a realist or perhaps, neorealist framework. Although it does have a large amount of explanatory value, pure realism may not provide a satisfying enough framework to adequately evaluate the Bush Administration's national security policy.

The Theoretical Argument for Neorealism

Under neorealism, while assuming that the world is anarchic, the state nonetheless attempts to structure the shape of the world system by territorial, political or economic expansion. The state represents the dominant feature in the international system but it does not necessarily represent the only source of government.[13]

Contrary to realism, neorealism focuses more on an international system that shapes the political relationships taking place among its members. It searches for patterned relationships among states an anarchical system. Neorealism recognizes that states are increasingly seeking to extend their influence into the global economy rather than only to maintaining coercion of other states through military means. For example, the American neorealist might see the World Trade Organization (WTO) as a useful tool to service its long range goals whereas the orthodox theoretical realist may wish to abolish the WTO altogether seeing it as an erosion of state sovereignty.

Like realists, neorealists believe that the state is the principal actor. However they pay greater attention to structures that are above and or below the level of the state. Studies such as the Carnegie Commission on Preventing Deadly Conflict have found that most current conflict is currently at the sub-state level, so state-centric realism is of limited utility.[14] Unlike their realist counterparts, neorealists believe that international organizations such as the United Nations or the Bretton Woods Institutions are useful to

[13] Pfaltzgraff and Dougherty**,** *From Realist to Neorealist and Neoclassical Realist Theory, Theoretical Foundations,* in Contending Theories of International Relations, 5th Edition, 86.
[14] Carnegie Commission for the Prevention of Deadly Conflict *Preventing Deadly Conflict, Final Report,* 1994 (Available at http://wwics.si.edu/subsites/ccpdc/pubs/rept97/finfr.htm) Accessed on 3/4/08

the extent that they can be shaped into instruments that help to fulfill a particular national interest.

If viewed from this perspective, it can be argued that the Bush Administration's Foreign Policy has acquired neo-realist attributes. While shunning collective security arrangements such as the UN Security Council on a philosophical basis, the Administration has taken advantage of limited alliances or "coalitions of the willing" to conduct the wars in Iraq and Afghanistan. This tactic was undoubtedly influenced by the terrorist strikes of September 2001 and the ensuing Global War on Terror (GWOT). The terrorist strikes of September 11, 2001 were most significant in this context because they caused the Bush Administration to move away from what might have otherwise been an isolationist foreign policy to more substantially engage both national and sub national actors.

The *National Security Strategy of the United States,* the Administration's broadest articulation of national defense policy demonstrates some of these neorealist tendencies. The section entitled "Develop Agendas for Cooperative Action with other Main Centers of Global Power" refers not only to nations but other centers of global power. It cast the new interaction in a positive light contending that:

> The events of September 11, 2001, fundamentally changed the context for relations between the United States and other main centers of global power, and opened vast, new opportunities. With our long-standing allies in Europe and Asia,

> and with leaders in Russia, India, and China, we must develop active agendas of cooperation lest these relationships become routine and unproductive.[15]

Neorealism favors engagement. It proceeds from the assumption that a much higher degree of concrete and institutionalized cross disciplinary cooperation is required before essential progress can be made in our ability to analyze and, if possible, to predict political action processes of systems as complex as, for instance, the nation-state and the structurally essential subsystems.[16]

I have argued that the Bush Administration subscribes to a realist foreign policy (often with neorealist) tendencies. I will now devote attention to locating its position within the realist camp. In the case of offensive realism, states are either inherently aggressive or obsessed with regional security in the case of defensive realism.[17]

Defensive Realism

Defensive realism, also known as structural realism, is a concept closely associated with deterrence and the security dilemma. It holds that the international system provides incentives for expansion only under certain conditions. It builds on the writings of Kenneth Waltz and Robert Jervis. Defensive realism suggests that stronger states under most contingencies ought to strive for moderation in their military, diplomatic and economic strategies.

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[15] George Bush, *The National Security Strategy of the United States*, 2007 (Available at http://www.whitehouse.gov/nsc/nss.html (Accessed 3/27/08)

[16] Pfaltzgraff and Dougherty, *Contending Theories of International Relations, 5th Edition* From Realist to Neorealist and Neoclassical Realist Theory, Theoretical Foundations, 81.

[17] Pfaltzgraff, 68

Defensive realists seek refuge behind regional security arrangements and use force out of fear rather than hegemonic interests. Defensive realism is interested in securing offensive gains to control the area that constitutes its immediate defensive perimeter. Under this paradigm, aggression can be more attributable to domestic politics than to anarchy inherent to the system.[18]

The security dilemma is the core concept that unites all defensive realist theories of foreign policy and international relations. Anarchy creates the security dilemma. Simply stated, the dilemma is the situation whereby the tools that one state uses to increase its security decrease the security of other states. The defensive realist holds that while pairs of states may pursue purely security seeking strategies they inadvertently generate spirals of mutual hostility or conflict.[19]

According to Jeff Taliaferro of Tufts University, defensive realist theories of foreign policy and international relations share an assumption that distinguishes them from offensive realism. The assumption is that domestic politics both constrain national leaders' ability to mobilize societal resources and limit their ability to readjust foreign policy in response to external changes. When seen in this light, the defensive realist paradigm is not well suited to the Bush Administration.[20] The 2003 U.S. invasion of Iraq provides an example. The administration has not, for the most part, allowed domestic politics to constrain national security decision-making in the conduct of the war that has grown increasingly unpopular with the public at large.

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[18] *IR Theory Website* http://www.irtheory.com/know.htm see also John J. Mearsheimer, *Tragedy of Great Power Politics*, W.W. Norton, New York (2002).
[19] Ibid
[20] Taliaferro, Jeffrey W. "Security Seeking under Anarchy: Defensive Realism Revisited," *International Security* 25 3 (Winter 2000/01): 128.

Offensive Realism

Offensive realism is the term given to a bundle of theories that emphasize the hostile nature of the international systems as a major source of conflict. Offensive realists tend to believe that security is a finite zero-sum concept.[21] Offensive realism holds that the anarchic world system provides strong incentives for expansion. Within this system states strive to maximize their relative power because only the strongest states can guarantee their survival. These states rationally pursue expansionist policies. States face the continuous threat that other states will use force to harm or conquer them. This compels these states to opportunistically improve their relative power positions through expansionist policies. Under offensive realism, every state in the international system longs to become a regional hegemon.

Under offensive realism, membership in international organizations is minimized. The tendency to power project decreases the level of trust that other members of these organizations will place in the aggressive power. Because the U.S. is the world's only superpower and by definition strives for more than regional hegemony its posture does not perfectly fit this definition of offensive realism. I would assert, however, that global power projection in general is more consistent with offensive than defensive realism.

The Global War on Terror has created an alliance structure that partially rejects the offensive realist paradigm because the great powers have recognized the mutual interest of fighting terrorism as superior to their underlying conflicting interests. Even China,

[21] Heller 2.

which has been perceived by U.S. policymakers as the primary future strategic rival has been welcomed in the fold of nations with a common interest in fighting Islamic terror. However, it is the view that the United States could exploit the GWOT in order to advance democratization in the Middle East through the invasion of Iraq or possible Iran that I will ascribe to the neoconservatives as a classic example offensive realist thinking.

The difference between offensive and defensive realism can perhaps be best explained by the following quotation: "power under defensive realism works as an instrument or tool to obtain minimum policy objectives, whereas offensive realism holds power to be of supreme importance to furthering states' policy objectives to the fullest extent that capabilities permit."[22] Taking these factors into consideration, it comes as no surprise, then that a military superpower trends toward an offensive realist stance. A national defense strategy driven by offensive realism is the most effective countermeasure against a rising China.[23]

In sum then, defensive realism is more prone toward international cooperation. Offensive realists believe that there are sharper limitations about the extent to which conflict can be reduced by policies other than pure military confrontation. Defensive realists believe that action is more dependent on the severity of the security dilemma and the intentions of the actors.[24]

[22] Ibid.
[23] Heller, 5.
[24] Robert Jervis, "Realism, Neoliberalism, and Cooperation: Understanding the Debate," *International Security*, Vol. 24, No. 1 (Summer 1999), 62.

I propose that the United States has, on balance, behaved as an offensive realist since 2001. This is true despite the fact that research has indicated that Democracies tend to not be offensive realists because their leaders are driven by the desire for incumbency. Engagement in costly wars tends to diminish the prospects for reelection. The Bush Administration engagement in Iraq during the first term is largely an exception to this rule.

Despite the leadership trend toward an offensive realism, I propose that the designation of realist is of high yet limited utility because the management of transnational problems such as terrorism, Islamic fundamentalism, organized crime, disease, and specifically environmental degradation, have now made the need for international coordination more salient. Engagement with Al Qaeda may cause the Administration to recognize a neorealist paradigm at least as far as sub-state actors are concerned. U.S policy is then a hybrid concept that has undertaken some neorealist attributes but lies more toward realism on the conceptual spectrum. Offensive realism is a concept than can still operate from a neorealist platform. A state that seeks aggressive expansion through war and utilization of structural power in the systems could then be granted the title of an offensive neorealist.

The Role of Environmental Security Issues in the Bush Administration's National Security Paradigm

First I observe that only a small number of realist scholars have addressed environmental issues and therefore one would not expect the Bush Administration to have given this

subject a good deal of thought or attention.[25] Environmental issues have been lost in a muddle of concepts. On the rare occasions that national security planners have looked beyond "hard" security issues they have tended to put economic, trade and environmental issues into one basket. The 2004 tsunamis in Indonesia could have been a formative experience for the policymakers. While they did not have a direct effect on the U.S. homeland, the scale of the relief efforts probably gave national security planners an appreciation of the scale of humanitarian operations the U.S. would be called to participate in to respond to global disasters.

However during this administration, the overall effect of humanitarian and environmental issues on strategic thought has been nearly negligible. The position of "soft" environmental security issues on the menu of concerns has been largely lost unless a direct link to "hard" national security issues can be that resonates with the bona fide realists. I would argue that this type of link has been identified in the case of the Darfur genocide in Sudan. There is a suggested linkage there between global warming induced scarcity and ethnic violence.

I will describe in detail in a subsequent chapter how the Administration has abolished bureaucratic structures in the White House, Department of Defense, and the Central Intelligence Agency that had performed the environmental security mission. While the administration has failed to recognize environmental issues as urgent national security priorities, it can not help but notice that other allied countries such as the Europeans have done so.

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[25] Richard A Matthew, "Environmental Security: Demystifying the Concept, Clarifying the Stakes" *Environmental Change and Security Project,* Issue 1, Spring 1995, 18.

Conclusion

This chapter has concluded that the Bush Administration adheres to a philosophy that I would label offensive neo realism in the terms of international relations theory. This stance was predicated by a tendency toward isolationism and a widespread search for a new security paradigm that took root in the decade between the end of the Cold War and the terrorist attacks of September 11, 2001.

Toward an Operational Definition of U.S. Security

How to Define the Environment

In order to reach a suitable definition of environmental security, it is first necessary to define the term environment. At the broadest level of analysis, the environment can refer to almost anything that surrounds us. Proceeding from the most general definitions to the most specific, a commonly consulted online dictionary outlines the several dimensions environment as:

> "a complex of external factors that acts on a system and determines its course and form of existence. An environment may be thought of as a superset, of which there is a subset. An environment may have several parameters, physical or otherwise. The environment of a given system must necessarily interact with that system. In non-technical contexts, the term often refers to the natural environment that is part of the natural world and is deemed valuable or important to human beings for some reason. Its relative importance can then be a normative judgment as long as functions such as breathing are not at risk.[26]

[26] Word IQ online dictionary available at www.wordiq.com/definition/environment (accessed on 3/17/08)

From a more technical perspective, the term environment is often used by scientists to refer to physical and biological systems. Physical scientists use the term to distinguish these systems from political, economic or other social systems.[27]

Stephan Libiszewski of the Swiss Peace Foundation offers a more restrictive definition limiting environment to "phenomenon from which there are ecological feedbacks and equilibria."[28] According to this interpretation natural resources characterized by a fixed stock steadily depleted over time, or systems in which the feedbacks are strictly economic and not ecological, are not considered environmental. The utility of this definition is limited in my context because natural resources such as minerals are not part of this definition of the environment. However, this definition excludes recognition of the extent to which an environment contains the elements necessary for life, at least as we know it. Although non-living environmental components such as oil and minerals do not actually sustain life, they may sustain wars. It then appropriate that a significant amount of work on environment and security has considered oil and minerals to be "environmental resources"[29]

Terry Terriff presents a more generous definition. He defines environment as "all living things and nonliving components of the planet – the lithosphere, biosphere, atmosphere, and stratosphere."[30] He includes factors such as the implications of the terrain and

[27] Levy 38
[28] Stephan Libiszewski, Environment and Conflict Project: ENCOP Occasional Paper, 1992 (available at http://www.isn.ethz.ch/pubs/ph/details.cfm?lng=en&id=236 (Accessed 3/1/08)
[29] Levy 38.
[30] Terriff, 255.

vegetation cover for military tactics, and the influence of geography on strategic thought as an aspect of environmental security.[31]

For the purposes of my analysis, I follow Terriff's lead and define the environment as a wider concept that includes the totality of the physical space that humans live in. For example, sea level rise induced by global warming will displace individuals from their physical living space along American coastlines. Under my definition of the environment, this occurrence would be classified as a threat to "environmental security" despite the fact that this event could plausibly have a minimal impact on systems that provide ecological feedback.

To summarize then, for purposes of my analysis the environment is that which contains biological or physical systems characterized by either significant ecological feedbacks or by their importance to sustaining human life and the physical space people inhabit and that allows these systems to operate.

Environmental Security

Introduction

Until approximately the last decade, the environment has not been the recipient of a great amount of scholarly attention as a national security issue. From a historical perspective this posture is understandable because the environment itself has not appeared to be immediately relevant to either causing or winning any of the major confrontations of the last century such as either of the World Wars, the Vietnam War or the Cold War. The

[31] Terriff, 263.

environment has therefore not figured prominently in the minds of national security planners who have been absorbed with the task at hand. Threats that don't emanate from within a sovereign state have not fit into traditional national security thought.

The terminology and scope of the environmental security field remains somewhat ambiguous and contested. A survey of the last two decades of literature in the field of environmental security reveals several conceptual shortcomings that bring the analytical value of the concept into question. Skeptics continue to question whether environmental security is a useful concept at all.[32] The concept of environmental security has become increasingly popular but its exact meaning is by no means clear.[33] As a result of this confusion and other dynamics, the concept as currently constituted is not presented in a way that can easily inform the policymaker.

I would propose that the main problem with the concept of environmental security is that the definition is too broad. It risks falling into the same category as sustainable development a term that has been adopted by all sorts of parties in order to achieve all sorts of goals.[34]

A major area of contention centers on the question of whether environmental security is a new paradigm or part of an existing one. I suggest that environmental security is a hybrid that can easily exist within the confines of existing paradigms. Stated slightly differently,

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[32] See for example, Daniel Deudney, "Environment and Security: Muddled Thinking," *Bulletin of the Atomic Scientists*, Vol. 47, No3. April 1991.
[33] John Barnett, *The Meaning of Environmental Security*, Ecological Politics and Policy in the New Security Era, (New York, Zed Books, 2001) 1.
[34] Nina Graeger, "Review Essay: Environmental Security?" *Journal of Peace Research*, Vol. 33, no 1, 1996, 113.

environmental security can exist within the nation security paradigm and is not a new concept.[35] This assertion is supported by the work of Peter Gleick of the Pacific Institute who argues an understanding of environmental security does not require a new definition of national security but a better understanding of the links between environmental resource problems and state behavior.[36]

There remains a certain amount of doubt in the academic community as to whether a decade or more of research has produced sufficient results that prove the salience of this paradigm. I will assert that the concept of environmental security when presented in the proper formulation proves to be a useful analytical framework from which to proceed in this dissertation.

Environmental Security Chronology

There is ample historical precedent for climate change contributing to violent conflict. In Europe between 1783 and 1789 extreme weather events caused bad harvests and may have contributed to the unrest that triggered the French Revolution. Likewise, between 1840 and 1850 cold and wet summers in Europe caused famine in Ireland resulting in approximately 1 million deaths and provoked discontent that arguably contributed to revolutions in central Europe.[37]

[35] David A. Baldwin, "The Concept of Security," *Review of International Studies* 23:1 (1997): 5.
[36] Peter Gleick, Environment and Security, Clear Connections, *Bulletin of the Atomic Scientist*, April 1991, 17.
[37] Interview with Professor John McNeil, Georgetown University, Conducted on 9/15/08.

Environmental security, despite it relative youth as a field of study, is by all means a complex and possibly cluttered field. It builds on certain basic observed phenomenon such as the spread of disease, rapid demographic growth and the increased availability of small arms that were most accessibly identified in 1994 by Robert Kaplan in his book and article by the same name *The Coming Anarchy.* Kaplan is a journalist with a neomalthusian outlook whose writing has bridged the academic and policy worlds. This watershed article brought environmental security into the popular debate. President Clinton reportedly distributed a copy to U.S. Embassy staff around the world.[38] By the mid-1990s, recognition of the connection between environmental issues and conflict inspired then Secretary of State Warren Christopher to develop steps to integrate environmental security into the State Department's strategic diplomatic plan.[39] Lectures and course on environmental security were taught at the National War College and Defense Intelligence Agency starting at this time.

Despite the fact that Kaplan's work is widely regarded as sensationalistic, the book "played a catalytic role in bringing the environment-conflict thesis to the attention of the highest levels of the Clinton Administration and the larger policy community."[40] He posits that the factors mentioned above coupled with environmental degradation have lead to state failure in vulnerable locations such Somalia in the heart of Africa. Sub-Saharan African states have been especially prone to this pattern.

[38] Robert D. Kaplan, "The Coming Anarchy: How Scarcity, Crime, Overpopulation, and Disease are Rapidly Destroying the Social Fabric of Our Planet." *Atlantic Monthly*, February 1994: 44.
[39] Brian Shaw, "When are Environmental Issues Security Issues?", The Woodrow Wilson Center for Scholars, Spring 1996, 1(e).
[40] Barnett, 74.

The confluence of factors identified in the preceding paragraph inspired Professor Thomas A. Homer Dixon at the University of Toronto to conduct research published in 1994 in the form of a number of case studies. Homer Dixon found that environmental scarcity can – under certain conditions – lead to conflict and then state failure.[41] The capacities of societies to adapt are undermined by the scarcities themselves. Homer-Dixon argues that the violence will increase along with environmental security but these changes will often manifest themselves in obscure or indirect ways. In Homer-Dixon's case studies covering countries from Mexico to the Former Soviet Union, scarcity is not a sufficient, but is often a necessary, explanatory factor for state violence. He concludes that environmental scarcity in conjunction with other factors, may contribute to some violent conflicts. The political and demographic history of the nations in which the violence takes place must also be taken into account. Non-historical theories about the environmental collapse that do not take into account factors such as colonialism are found to be inadequate.[42] Homer-Dixon qualifies the type of violence caused by environmental degradation as being "chronic, diffuse, and sub national." This is the type of violence that has most bedeviled U.S. military institutions.

Homer-Dixon's thesis had some impact on the U.S. foreign policy community and he made several high profile presentations in Washington D.C. in venues such as the Departments of State and Defense.[43] Dixon's work inspired several analytically weak and inconclusive efforts to further define the relation between environmental scarcity and

[41] Environmental Scarcities and Violent Conflict cases available at http://www.library.utoronto.ca/pcs/evidence/evid1.htm (accessed 2/12/07)
[42] Matthews, 113
[43] See for example Nancy Peluso and Michael Watts *Violent Environments* (Cornell University Press, 2001).

violence such as a report called *Environmental Security in an International Context* published by NATO in 2001The environmental scarcity /conflict thesis which Homer-Dixon theory has come to be know is only part of a larger contextual debate surrounding about environmental security but a part that I would like to focus on.

In the policy realm the first post-Cold War security paradigm established by DoD was referred to as the strategic concept of 1991. It recognized a definition of environmental security that contained both political economic and social components.[44] This paradigm was articulated in works such as the book entitled Preventative Defense by William Perry and Aston Carter published in 1999. In the book, Perry outlined three basic tenets of a preventive strategy: keep threats from emerging; deter those that actually emerged; and if prevention and deterrence failed to defeat the threat with military force.[45]

Enactment of a conflict prevention strategy called for deeper analysis of national security. Writing in 1989 Jessica Tuchman Matthews noted that "global developments now suggest the need for another analogous, broadened definition of national security to include resource, environmental and economic issues."[46] Other theories such as liberal institutionalism that advocates a greater role for governments and international organizations were also gaining prominence during this timeframe albeit mostly outside of the United States.[47] It is against this background that environmental issues became more salient and nations began to cooperate in negotiating environmental treaties such as

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[44] NATO Committee on the Challenges of Modern Society, *Environment and Security in an International Context Final Report*, March 1999, Page 9.
[45] Official Biography of Secretary William Perry available at (http://www.defenselink.mil/specials/secdef_histories/bios/perry.htm)
[46] Jessica Tuchman Matthews, "Redefining Security," *Foreign Affairs* 68:2, 1989, 162.
[47] Kelly Kate S. Pease, *International Organizations: Perspective on Governance in the 21st Century*, (Upper Saddle River New Jersey: Prentice Hall, Second Edition 2003), Page 223.

the and the Montreal Protocol on Substances that Deplete the Ozone Layer (1989) United Nations Framework Convention on Global Climate Change (1992.)

On the link between environmental decline and instability she noted that "environmental decline occasionally leads directly to conflict, especially when scarce water resources must be shared. Generally, however, its impact on nations' security is felt on the downward pull on economic performance and, therefore, on political stability. The underlying cause of turmoil is then often ignored; instead governments address the poverty and instability that are its results."[48] It is worth noting that environmental degradation may also lead to cooperation according to scholars such as John Holdren of Harvard University.[49]

Globalization and its Impact on Environmental Security

Analysts such as Jessica Tuchman Matthews argue that the traditional realist approaches to international relations distort, misunderstand and ignore important aspects of global environmental problems which do not conform to territorial or political boundaries."[50] Putting it more bluntly, our accepted definitions of the limits of national sovereignty as coinciding with national borders are obsolete.

Building on existing trends prompted by globalization, Matthews observed that "environmental strains that transcend borders are already beginning to break down the

[48] Matthews, 166.
[49] Class Notes from *Energy and Society*, John F. Kennedy School of Government, March 20, 2000.
[50] Gleick 18

sacred boundaries of national sovereignty, previously rendered porous by information and communications revolutions."[51] She was one of the first scholars to point toward increasing population combined with environmental degradation as a primary threat to national security while probably coining the term environmental refugee.

Globalization is a process driven largely by technological innovation in the context of expanding capitalism and democracy that has empowered non-state actors in ways that have no precedent during the modern age of the state. Globalization is characterized in large measure by an enormous increase in the speed, density, and character of cross-border transactions that sovereign states have not been able to regulate or manage (e.g. information flows and sale of goods and service over the internet.[52] I will also propose that scholarly work on human and environmental security contributes strongly to a broader, important study of whether the effects are positive or negative and for whom? Environmental security can be seen as the study of the ecological effects of globalization.

Environmental Security: Ambiguous Approaches

Despite the efforts that I have outlined in the previous section, much of the work toward defining the environmental security field remains unfinished. It risks falling into the same category as sustainable development as a term that has been adopted by all sorts of parties in order to achieve all sorts of goals.[53] The basic problem with the concept of environmental security is that the definition remains too broad. One distinction that I

[51] Matthews, 162.
[52] Matthew, 118.
[53] Graeger, 113.

would like to draw at the onset is that I find environmental security to be distinct from human or ecological security because it makes the biosphere rather than humans the referent in national security. The entity that I seek to confine my definition to is the state.

From the perspective of the policymaker, the concept of environmental security warrants more definitional clarity in order to rationalize decision making about how to incorporate the environment into strategic thought ,. One significant limitation in the policy realm is the difficulty of isolating environmental problems from the underlying social, economic and social causes.

Barnett captured the breadth of the waterfront of ideas by identifying, the seven major areas comprising the environmental security agenda as: efforts to redefine security; theories about environmental factors in violent conflict; the environmental security of the nation; the linkages between military and environmental issues; the ecological security agenda; the environmental security of the people and the issue of securitization of the environment.[54]

In 2002, the recognition of "Increasingly adverse environmental conditions [ ] undermining the social and political stability of developing countries and regions around the world with important implications for U.S. and multilateral interests led the Foundation for Environmental Security and Sustainability to develop an Environmental

[54] Barnett, 9.

Assessment Framework.[55] It is necessary to construct a firm definition of the environmental security to develop this framework. The foundation defined environmental security as "the study of environmental factors that may contribute to national or regional instability and the development of policies and strategies to address the threats posed by these factors."[56]

Recognizing the need to explore the policy relevance of environmental security, the U.S. Army commissioned a study in 1998 that sought to measure the effects of the environment on military operations. The study found that "environmental security is the relative public safety from environmental dangers caused by natural or human processes due to ignorance, accident, or mismanagement, originating within or across borders.[57]" Further analysis by a group of outside experts found this definition unsatisfying because it does not contain specific reference to national, international and global types of security.[58] It also does not contemplate the use of the environment as a tool of war so it is not fully operation within the realist paradigm or relations between the states with a high expectation of violence. A more satisfying definition from the realist perspective that recognizes the state as the primary agent is the definition of environmental security

[55] The Foundation for Environmental Security and Sustainability (FESS) is a public policy organization established to advance knowledge and provide effective solutions to key environmental security concerns around the world.
[56] Foundation for Environmental Security and Sustainability—Draft Environmental Assessment Framework, 1.
[57] Molly Landholm, "Defining Environmental Security, Implications for the U.S. Army", Army Environmental Policy Institute, December 1998, Page 15.
[58] Jerome C. Glenn and Theodore J. Gordon, *State of the Future* (Washington D.C.: American Council for United Nations University, The Millennium Project 2002).

could be "proactive minimization of threats to the biosphere and its interdependent human component."[59]

In an alternative definition developed by the United Nations, environmental security has been described as the level of the environment's viability for life support. This definition has three sub elements that recognize either the international community or the state as the referent: preventing or repairing military damage to the environment; preventing or responding to environmentally caused conflicts; and protecting the environment due to the moral value of the environment itself.[60]

Terry Terriff identifies how environmental security can have both direct and indirect effects on the state. He explains that "one interpretation of 'environmental security' holds that environmental degradation and resource depletion can have an adverse influence on the security of a state. First, environmental change can be a source of conflict arising from such factors as direct disputes over degraded natural resources such as fresh water and fish stocks."[61] However "a broader view perceives that [global warming] could generate environmental effects that might contribute to economic decline, social turmoil, and political instability. Second these effects in turn might occasion conflict or even violence within a country or in neighboring countries which would then jeopardize the security of the state."[62] Both of the approaches to environmental security

[59] Landholm, 16.
[60] Glenn and Gordon, 89.
[61] Terriff 254
[62] Ibid

noted above are compatible with the either the traditional realist or quasi-neorealist paradigm that I ascribed to the Bush Administration earlier in this chapter.

Human Security as a Component of Environmental Security

The late 1980's and early 1990s brought a wave of thinking that sought to redefine security in terms of the individual's health and happiness. This concept of human security --which is closely entwined with environmental security--blossomed during this time. Human security is the broadest and deepest conception of security. It includes the ability to achieve a level of sustainable development. Much of the effort to focus and expand upon the concept of human security in subsequent years has been undertaken by scholars in the field of environmental security.[63]

Human security is the condition when individuals and communities have the options necessary to avoid or adapt to risks to their basic needs and rights; have the capacity and freedom to exercise these options; can active participate in attaining these options.[64] International organizations rather than national governments have become the main proponents of human security. For example, the United Nations Development Program (UNDP) uses the concept of human security to assist in the framing of development issues. It identifies seven domains of human security encapsulating environmental security within their framework. Those domains are: economic, food, health, environmental, personal, community and political.[65]

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[63] Matthews 117
[64] John Barnett and W. Neil Adger, *Climate Change, Human Security, and Violent Conflict, Global Environmental Change and Human Security News*, No 1., Spring 2006.
[65] Barnett and Adger 125

According to this definition, human security is not only the security of territory or the protection of national interests but it reflects the concerns of ordinary people who seek fulfillment in their daily lives.[66] My critique of this approach is that the UNDP definition presents too broad of a definition to be analytically useful. A more precise formulation is "safety from chronic threats such as hunger, disease and repression or protection from sudden hurtful disruptions in the daily pattern of life."[67]

In the book Ultimate Security (1983), Richard Ullman argued for an expansion of the definition of national security to include non-military, qualitative factors such as quality of life for the people within a state. National security relates to the quality of life as well as the number of policy choices available to the practitioner.[68]

The Global Environmental Change and Security Project at the University of Oslo (GECHS) has taken special interest in forging the link between human and environmental security. Their work has pointed out that "most definitions of human security are based on the concept of freedom from fear and freedom from want. The GECHS definition focuses specifically on freedom to take action on one's own behalf in response to changing environmental conditions. In particular, it focuses on the ways that environmental changes exacerbate pervasive threats and critical situations, while at the same time undermining national governments actually capacity to respond to these

[66] United Nations Development Program (UNDP), *Human Development Report: New Dimensions of Human Security* 1994 (Available at http://hdr.undp.org/en/reports/global/hdr1994/); (Accessed on March 10, 2007.) 22 E
[67] UNDP 23
[68] Richard Ullman, "Redefining Security". *International Security* Vol. 8 No. 1: (1983). 133-143.

threats. It interprets environmental change in the context of ongoing social changes, which together may affect the security of some individuals and communities."[69]

Realists, including those situated in the government bureaucracy, might consider human security an inherently subversive concept because it puts the needs of people above those of the nation state. This is the reason that I choose not to devote much effort to defining human security other than to illustrate its significant role in defining environmental security.

Furthermore, a survey of the current national security literature indicates that national security scholars are now retreating from the human security frenzy of the late 1980's and early 1990's propagated by such notable scholars such as Jessica Tuchman Matthews, and Richard Ullman, writers such as Robert Kaplan and even politicians such as Al Gore. Some authors such as Barnett see environmental security as a subset of human security. Humans may be the referent in either case. However, the state will remain my primary unit of analysis in the chapters ahead.

Synthesis: An Operational Definition of Environmental Security

A multilevel conceptual framework is necessary to reach a full definition of environmental security due to the number "stakeholders" and institutions involved. Consequently, no single definition of environmental security has been reached in the

[69] Lynn Rosentrater, *Global Environmental Change and Human Security (GECHS) News* available at http://www.gechs.org/human-security/ (accessed on 1/15/08)

debate. However in the coming chapters I will rely most heavily on the definition that is most succinctly expressed as the national government's prevention of the spread of conflict or instability based on environmental factors as well as the analysis of environmental phenomenon that have the potential to limit choices available to the policymakers. My research in this dissertation has indicated that global warming is link to cause and exacerbate instability in selected regions. Regional instability and conflict can both limit the choices available to the U.S. policymaker, the intended audience for strategic assessments.

Terriff and others have noted that confining the level of analysis related to the state when studying environmental security as a discipline is inadequate or misleading because world population distribution does not conform to political boundaries. In response to this critique I would assert that on the individual level "environmental security is the relative public safety from environmental dangers caused by natural or human processes due to ignorance, accident, or mismanagement, originating within or across borders.[70]" On the level of the State the definition is protecting the environment through the proactive minimization of threats to the biosphere and it interdependent human component [within the State.].[71] The "dangers" on "threats" to U.S. national security from global warming can be broken down into three categories: strategic; physical and political, through use of a heuristic device.

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[70] Landholm, 15.

[71] The United Nations Millennium Project, *Environmental Security: Emerging International Definitions, Perceptions and Foreign Policy Considerations, Executive Summary available at*: http://www.millennium-project.org/millennium/es-exsum.html

While I recognize the validity of analyzing the issues on several levels, the reason that I have focused my analysis of the environmental security issue on a state level is because outcome that will arguably have the greatest overall impact of the population in the limitation of policymakers choices. The audience for the writing of this dissertation is the current policy-making community. I hope that they could benefit from an analysis of the role of environmental security from the national perspective in order to situate it relative to the myriad of other historical and emergent national security threats that they must now confront.

My approach that focuses on the relationship between environment and conflict overcomes some of the lack of precision broader definitions. The narrow definition of environmental security facilitates rich case studies that will come later in the dissertation, which in turn can contribute to making the environmental dimension of security more empirical and therefore applicable to the policymaking community.

Simon Dalby identifies the type of research that I am undertaking as the third generation of environmental security research. The first generation alluded to overcoming the basic conceptual hurdles of the field, which despite my earlier argument many believe has not yet occurred. The second established plausible linkages between environmental change and conflict has Thomas Homer-Dixon lead the way in doing. This school has not necessarily predicted or quantified those linkages. In this dissertation, I am attempting

precisely to take step along the third path of research of predicting linkages between global warming and conflict/instability in the context of selected regional case studies.

An Operational Definition of National Security

For the purposes on this thesis, national security is the dependent variable in the analysis whereas the environmental impact of climate change is the independent variable. Building on my argument in the previous section, my operational definition of national security lends more weight to the threat of military force levied against the U.S. by national or sub-national actors as more of a baseline for determining the nature of a national security threat than the impact of the phenomenon in question on the individual.

While global warming has only been part of international politics since about 1992, ensuing international environmental negotiation processes such the Kyoto Protocol are putting pressure on national authority because the state apparatus may not be the best tool for managing the solutions to the environmental threats. I contend, however that the U.S. state apparatus is adequate to the task of to the task of perceiving and analyzing the security threats themselves.

According to Johannes Stripple "security is a concept supplied by politics that has an inter-subjective ontology." Climate change is often seen as being a threat to humanity in

general but rarely to a states or nations.[72] This way of framing the problem has made it more difficult for this country to form policy responses to the problem. Therefore, my national security definition approaches analysis of the issue from the other end of the telescope suggesting ways that global warming can be a threat to national integrity. The conception of national security can be broadened through a more "neorealist" perspective to include global warming induced non-military threats such as economic or political threats.

The analysis of the regional case studies reflects this approach. It examines how the effects of the impacts of global warming in these countries could cause the exportation of violence or an "invasion" of U.S. borders by environmental refugees. On the political level, the United States' disproportionate role in emitting greenhouse gases that cause global warming may contribute to a "blowback" effect that could case economic sanctions or political action against the U.S. Therefore it follows that what is required is "not so much a redefinition of international or national security, as some have called for; but a better understanding of the nature of certain threats to security, specifically the links between environmental and resource problems and international behavior."[73]

Taken in this light a threat to national security can be defined as an action or sequence of events that threatens drastically over a relatively brief period of time to 1.) Degrade the

[72] Johannes Stripple "Climate Change as a Security Issue" in *Human Security and the Environment: International Comparisons*, ed. Edward A. Page (Cheltenham, United Kingdom, Edward Elgar Publishing Limited, 2002), 106.
[73] Gleick, 17.

quality of life of the inhabitants of a state[74] or 2.) Significantly narrow the range of policy options available to the state or nongovernmental actors such as persons, groups, or corporations within a state.[75] The research presented in this dissertation indicates that global warming has the capacity to threaten both aspects of national security detailed above but it will have the most significant effect in the latter category.

My operational definition of national security is the lens through which I will view the collection of evidence of the effects of global warming on the United States and selected other nations to see if they rise to the level of a "national security threat." *Stated most succinctly national security is the protection of the State against a threat to the lives of its members and the reduction of options available to its policymakers.* This definition of national security recognizes that threats may originate from sources that are not traceable to either state or sub state actors. In fact, the natural phenomenon of climate change can take on "personality" under this definition.

The definition is compatible with both the perspectives of the realist view as articulated by Haftendorn and the humanist view of Tuchman Matthews. While fundamentally based on the realist paradigm -- because it retains the state rather than the individual as the principal agent among other factors -- it nonetheless recognizes that human security issues can collectively, under certain conditions, rise to the strategic level. In these cases the threat to the state triggers the threshold envisioned as a national security threat by the realist theorist.

[74] Ullman
[75] Levy, 40.

One credible example of at least a three step chain of events that demonstrates how a "human security" issue can rise to the strategic level could be as follows. An Islamist suicide bomber or hijacker may be an individual who hails from nations that have experienced state failure. The conditions that prevailed in the perpetrators state of origin -- perhaps Sudan for the sake of this example --may have been driven by environmental scarcity. However, the casual chain need not be this long and elaborate.

While conducting my research, I have not foreclosed the possibility that the effects of global warming could be manifest themselves as a threat in less than the three steps described above as measured from the perspective of the most strict realist definition forged at the height of the Cold War. Imagine a war with Russia over newly accessible oil reserves found beneath the Northern Sea Route revealed by the melting of Arctic ice as an example.

My case study on the United States itself will reveal a one-step process where global warming will have a direct physical impact on the U.S. Since the early 1990's American National security planners have recognized the need to protect what has been referred to as the national critical infrastructure. U.S. Homeland defense doctrine requires the protection of critical infrastructure including electric utilities, banking, telecommunications, transportation, and water-supply through the use of force if necessary. Some of these systems are likely to be disrupted by global warming. Taken a

step further my approach may suggest that other aspects of the environment have now assumed some of the characteristics of the definition of "critical infrastructure."

CONCLUSION:

While one school of thought contends if environmental security is even a field of study, the future utility of the concept in American foreign policy is unclear.[76] My corollary is that the meaning of environmental security somewhat ambiguous but its role is undoubtedly growing even more important in the security discourse. As global warming rises on the national security agenda nations must cooperate more closely to find solutions. A salient question then becomes whether environmental security will play a role -- perhaps along with other transnational phenomenon such as globalization and terrorism -- in the conceptual erosion of the national security paradigm pushing the U.S. toward an international security paradigm as the demise of sovereignty takes greater hold.

[76] Barnett, 90.

CHAPTER 2:

SCOPING CLIMATE CHANGE'S IMPACTS ON U.S. NATIONAL SECURITY: DOMESTIC TRENDS

Introduction

My hypothesis suggests that climate change, especially when viewed in concert with other factors, may have detrimental effects on U.S. national security. This is the case for many reasons, not the least of which is that key actors in the international system may blame the U.S. for their problems caused by the impact of global warming. This belief may be based on the United States' disproportionate contribution to global greenhouse gas emissions. Conversely, a relatively small number of the effects of climate change could strengthen U.S. national security in a sense because they may have a relatively deleterious effect on potential U.S. adversaries who have a lower adaptive capacity. The reader may find the tone of my findings in this section to be somewhat pessimistic because I have made the assumption in my scenarios that the USG will maintain the existing policy of not joining the Kyoto Protocol or other mandatory regimes to limit carbon emissions. Policy change in the U.S. could have a substantial mitigating effect on the worldwide severity of the problem and thus the accuracy of my estimates.

Use of a heuristic device can break the impacts of climate change on U.S. national security into three categories: strategic; physical and political. The strategic implications of climate change are perhaps the most significant in this context. Food shortages, lack

of water and losses in net agricultural production will likely lead to a measurable amount of destabilization of the worldwide geopolitical environment and wars over natural resources in areas that are important or vital to U.S. interests. This possibility will be treated in the next chapter through the analysis of regional case studies. In the atmosphere of scarcity fomented by global warming, less fortunate nations – especially those with existing enmities toward their neighbors – will likely initiate struggles to seize energy, clean water or food resources. Unlikely alliance structures may be formed as national priorities shift from religious or political ideology and nationalism to survival.

The physical impacts of global warming may include terrestrial threats such as the multi-billion dollar property damage caused by sea level rise, and public health problems created by increased disease vectors and heat-related illnesses leading toward premature deaths. Desertification in American urban centers could lead to the depletion of available drinking water in key urban centers.

The political effects of U.S. reaction to global warming are less tangible but could include some of the following reactions against the U.S. for non-participation in the Kyoto Protocol or other greenhouse gas reduction regimes. Behavior, such as certain allied nation's recalcitrance to cooperate in the Global War on Terror (GWOT), may be emblematic of this trend. Animosity against the U.S. may be manifest in other fora. Brazil has contemplated retaliation through the World Trade Organization (WTO) for alleged dumping of relatively cheap U.S. goods that compete against those produced in

the U.S. without the environmental constraints imposed by mandatory emissions reductions under the Protocol.

As I will describe in this chapter, global warming will also have direct effects on U.S. military operations. For example, it will increase the scope and intensity of military operations in the Arctic. In the arctic, it will open the Northern Sea Route (NSR) to commercial shipping and surface naval activity on a seasonal basis, and the question of the rights to maritime shipping and seabed resources is likely to arise among the littoral nations. Potential conflict could result from the fact that Canada and Russia essentially regard the NSR as internal waters.[77] The disagreement will be influenced by the whether the U.S. joins the United Nations Convention on the Law of the Sea (UNCLOS) as President Bush now favors. Finally, more military and regulatory resources may have to be dedicated to meet challenges posed by increased shipping.

Finally, the U.S. military may be called upon to engage in various operations other than war (OOTW) such as disaster relief and monitoring of environmental refugees to mitigate the effects of increased warming. The phenomenon of environmental refugees will be explored more in more depth in the next chapter that examines regional cases of scoping the effects of climate change on U.S. National Security. In the this chapter I am not attempting to argue that global warming is a necessary or sufficient cause for

[77] Elizabeth L. Chalecki, *Environmental Security*: *A Case Study of Climate Change*, (Oakland: Pacific Institute for Studies in Development, Environment and Security, 2003). See also, Oceanographer of the Navy, and the Arctic Research Commission, *Naval Operations in an Ice Free Arctic: Symposium Final Report*, April 2001. (Accessed May 17, 2007); available from http://www.natice.noaa.gov/icefree/FinalArcticReport.pdf.

international security problems but rather that it may play a decisive role in tipping the security balance in situations that are already rendered precarious by other factors.

Scoping the Impacts of Climate Change on U.S. National Security

"Like Al Qaeda, climate change may hit sooner and harder than some predict"
(David Stipp)

Overview

This chapter entitled "Scoping the National Security Impacts of Climate Change" is an attempt to survey many of the effects of global warming that could have a direct or indirect impact on U.S. national security. As a survey, it not intended to be comprehensive. I have found that as one researcher it is impossible to read, analyze and incorporate all of the studies and data that are relevant to the impacts of global warming on the U.S. The U.S. National Academies of Science alone has issued over two hundred reports on global warming. Therefore, I have attempted to seek out the most relevant and definitive international studies based on my observation that they are peer-reviewed science. Where possible I have relied primarily on the data from the Intergovernmental panel on Climate Change's IPCC Third Assessment Report of 2001.

What I intend to do in the following chapter is map out some effects of climate change that could plausibly become elements of a causal chain that could undermine U.S.

national security under certain scenarios. For example, the Pentagon report entitled: "An Abrupt Climate Change Scenario and its Implications for National Security," issued in October 2003, emphasizes the interlocking nature of a series of possible international crises sparked by climate change that could snowball in a non-linear fashion and ultimately result in an outcome as catastrophic as nuclear war. While my preliminary findings in the next two chapters are not as grim, they nonetheless point toward potentially significant levels of social instability triggered by global warming in several areas.

James Woolsey, former Director of the Central Intelligence Agency (1993-1995), has expounded upon unpredictable chain reactions and their relation to global warming science. His theory explains how even the most minor disturbances can have great and unintended consequences. This type of chaos theory that Woolsey has coined the "butterfly effect" can be applied to an explanation of the national security implications of global climate change. Drawing an analogy describing the global geopolitical implications of environmental refugees fleeing from a Bangladesh that had been flooded by climate change-induced sea level rise, he noted that a single tree that fell in Ohio in 2003 had the unpredictable effect caused nationwide blackouts. A refugee crisis in far away Bangladesh could balloon into a grave wider, regional, crisis for U.S. national security by the mid-century in a similar fashion.[78] Woolsey has noted that the damage that climate change has caused the U.S. is not just a random force of nature but is essentially malevolent in design. This is the case because while humankind may realize

[78] Woolsey, James "Remarks at the Climate Change and National Security Roundtable", World Affairs Council, Arlington Virginia, May 3 2005.

the potential negative environmental consequences of continuing greenhouse gas emissions at the current rate, it chooses to continue this behavior regardless of the mounting consequences. Chapter four will demonstrate the butterfly effect by casting light on how seemingly isolated regional effects of global warming could plausibly cascade into events of much greater consequence to U.S. national security. This chapter will demonstrate how seemingly small impacts of global warming can cascade into larger consequences in the U.S.

It is interesting to note that conflict and emigration associated with climate change has been an issue, even if it was unrecognized, for millennia. For example, the incursion of the Vikings from Europe to North America and subsequent departure provides a classic example. Warming climate conditions in North America around 1,000 AD enticed Vikings to travel to North America. When they arrived here, they found that the land was populated by people who both traded with and resisted against them. In the end, the combination of changing climate that turned cold again and a hostile reception forced the Vikings back out of North America.[79]

The United States: Survey of the Anticipated Changes in Temperature

An examination of the effects of a temperature increase in the United States seems like a reasonable place to begin my analysis of the impact of global warming because it is one of the most immediate noticeable phenomenon.

[79] James R. Lee, *The Vikings in North America: Long-Term Climate Change, Environment, Trade, and Conflict*, ICE Case Study, Number 86, June 2001. (Accessed April 17, 2007); available from http://www.american.edu/ted/ice/vineland.htm. Note that these events are also outlined in Jared Diamond's in his 2005 book entitled *Collapse*

At the time of this writing, the most complete current statistics related to average annual surface temperature came from the year 2004. In 2004, The National Atmospheric and Oceanographic Administration's (NOAA) National Climatic Data Center reported that global temperatures were .97°F above the long-term (1880-2003) average, ranking 2004 as the fourth warmest year on record. During the beginning of the past century, global surface temperatures increased at a rate near 1.1°F but this trend has increased to a rate of 3.1°F during the past 25 to 30 years. According to NOAA, temperatures increased during the period 1976 to 2005 at a rate comparable to that which is projected to occur during the next century taking into account the corresponding expected increases in anthropogenic greenhouse gas emissions. The fact that the years from 1995-2004 with the exception of 1996, are among the warmest 10 years on record provide supporting evidence of this warming trend.

Consistent with the worldwide trend, annual temperatures were above average across much of the contiguous United States and Alaska in 2004. Temperatures in these regions were anywhere from 3.6-7.2°F above the 1961-1990 global average. The year 2004 also ranked as the 6th wettest year on record for the contiguous United States. Consistent with higher temperatures in Alaska, Arctic sea ice extent was extremely low this year, ranking as the second lowest extent since reliable records began in the 1950s. The NOAA report stated that while natural variability is generally responsible for year-to-year variations in sea ice extent. However, the findings of three extreme minimum extent

years along with evidence of continuous thinning of the ice pack suggest that the sea ice system is experiencing changes not solely related to natural variability.[80]

In 2007 the Union of Concerned Scientists and a team of independent researchers conducted by the most recent regional assessment of the impacts of climate change in the United States. Their *Northeast Climate Impact Assessment* finds that if emissions remain at historical levels that average temperatures across the Northeast U.S. temperatures are projected to rise another 2.2° to 4°F in winter and another 1.5° to 3.5°F in summer over the next several decades. If emissions remain high, average temperatures are projected to rise 8° F to 12° F above historic levels in the winter and 6°-14°F degrees in the summer. Major cities could then average 30 days per year above 100°F.[81]

A 2005 study by the Oxford University Climate Modeling Group indicates that global temperatures could rise between 2-11 °C (3.6-19.8 °F) in the next century due to increases in greenhouse gas concentrations.[82] The Oxford model is run as a distributed computing project that harnesses the power of individual computers working together. Over 95,000 people from 150 countries are now taking part in the experiment to explore the possible impact of global warming. Under this system, each computer runs a slightly different climate scenario and the data are then sent back to the group. The top end of the predictions is double estimates produced so far by other climate modeling groups.[83]

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[80] U.S. Department of Commerce, National Climate Data Center, *Climate of 2004:2004 In Historical Perspective*, January 13, 2005 (accessed March 18, 2007); Available from http://www.ncdc.noaa.gov/oa/climate/research/2004/ann/ann04.html.

[81] Northeast Climate Impact Assessment, Confronting Climate Change in the Northeast: Science, Impacts and Solutions, Union of Concerned Scientists, July 2007, Page 1.

[82] Catherine Brahic, "Temperature 'Could Rise By 11 Degrees', Says Study," Science and Development Network, January 27 2005.

[83] Ibid.

While its impact was not felt specifically within the U.S., unusual meteorological conditions were blamed for the extremely hot, dry 2003 European summer. Human generated greenhouse gas emissions, at least doubled the risk of this unusual event.[84] Across Europe, more than 27,000 people died from the heat wave while 14,000 mostly-elderly people perished in France alone. Heat-related agricultural losses totaled more than $12 billion. Stott and his colleagues estimated that as much as three-quarters of the current risk of a heat wave is due to human influence on climate. According to Stott, "If we carry on as usual with emissions, our predictions indicate that every other year will be as hot as 2003 by the middle of the century."[85] It is plausible to assume that the U.S. will experience heat waves that will result in as many casualties as those 2003 events in France. In fact, the average number of years with temperatures exceeding 90° has doubled in the last 45 in the in Northeast United States. Looking forward, the number of days per summer over 100°F could increase between 14 and 28 days under the higher of the two emissions scenarios presented in the study.[86] The implications of this rise for health

In the years 1993 to 2003 death associated with excessive heat has been the leading weather-related killer in the U.S. From 1999 to 2003, 3,442 heat related deaths were reported. In 1995 a five day heat wave with temperatures up to 104 degrees caused an

[84] Reuters, *Global Warming Model Shows Fossil Fuels Raising the Risk*, December 1 2004. (Accessed March 5, 2007); Available from http://www.msnbc.msn.com/id/6629271/.
[85] Kerry Emanuel, "Increasing Destructiveness of Tropical Cyclones Over the Past 30 Years," *Nature*, 436, (2005)
[86] UCS, 8.

estimated 700 deaths.[87] America's rapidly growing elderly population will become more vulnerable as temperatures increase

Hurricane Intensity

The frequency and intensity of hurricanes has been rising over the last 30-35 years. There is a growing consensus on the correlation between hurricanes and global warming. The exact ties between hurricane frequency and global warming remain uncertain**.** It is generally agreed that more frequent storms bearing an increased amount of precipitation are likely in the northern hemisphere.

National Security Implications of Global Warming's Impacts on U.S. Arctic Territory

The U.S. Arctic territory is a logical area to begin an analysis of the national security effects of global warming because the effects are arguably more pronounced in there than any other region in the world. The Arctic has been described by various observers including Senator John McCain (R-Arizona) as, "the canary in the mineshaft," of the issue of global warming. Global warming's effects on the Arctic region is, of course, not entirely a domestic issue because eight nations: Norway, Sweden, Finland, Denmark, Iceland, Canada, Russia, and the United States, possess territory in the region. International concern is also piqued by the fact that the Arctic region contains the largest remaining wilderness in the Northern Hemisphere.

[87] UCS, 92.

It is interesting to note that with a population of about 4 million people, the Arctic region itself does not contribute substantially to carbon emissions that cause climate change. Yet, the global climate models used by the UN's Intergovernmental Panel on Climate Change (IPCC) project a stronger warming over the Arctic Ocean than any other area of the Northern Hemisphere. Therefore it is not surprising that global warming is the issue of primary importance to Arctic countries according to remarks by Norwegian Foreign Minister Jan Petersen.[88]

Although they are low in number, local Arctic populations are highly dependent on a fragile natural resource base that is highly sensitive to the effects of global warming. This fragility is reflected nowhere more than in the shrinkage of Arctic ice flows. According to the U.S. Navy data collected from submarines, the volume of Arctic sea ice has diminished by 40% since the 1960s. Passive microwave data collected from U.S. satellites since the 1970s demonstrates a decrease in sea ice extent of approximately 3% per decade. Model data suggests a sea ice thickness decrease of 30% and an ice volume decrease between 15% and 40% by 2050.[89]

According to NOAA data, summer sea ice that normally reaches its minimum extent in September has also been markedly reduced by warming. September 2002 set a new record low for coverage of ice at 15 percent below average. This low was closely followed by September 2003 and 2004. As of this writing, 2005 is shaping up to be

[88] Petersen, Jan "Remarks at a Transatlantic Symposium Meeting the Climate Challenge in the Arctic Region," Dirksen Senate Office Building Washington D.C., June 9, 2005.
[89] Oceanographer of the Navy, and the Arctic Research Commission, *Naval Operations in an Ice Free Arctic: Symposium Final Report*, April 2001. (Accessed May 17, 2007); available from http://www.natice.noaa.gov/icefree/FinalArcticReport.pdf

another record-low sea ice year in the Arctic.[90] The melting of sea ice speeds up the process of global change by decreasing the total amount of reflective surfaces on the face of the earth. This allows the planet to absorb more heat, thus accelerating the effects of global warming.

Hearings and seminars held during the 109th Congressional session in 2005 showed evidence that U.S. policymakers have become more aware of the potential implications of global warming on the Arctic region. This awareness may have been sparked by the fact that in 2004, Senator John McCain led a group of five U.S. Senators including 2008 Presidential candidate Hillary Clinton to Svalbard, Norway on a mission to better understand the global warming-induced environmental challenges facing the Arctic.[91] It was during this visit that McCain first referred to the Arctic region as the "canary in the mineshaft," indicating that the region will experience the effects of climate change before the rest of the world.[92]

Findings of the Arctic Climate Impact Assessment (ACIA)

A major development in the study of artic environmental change was the 2005 release of the Arctic Climate Impact Assessment (ACIA) by The Arctic Council. This high-level international organization is composed of representatives of the eight countries that possess territory in the region. Written by a team of over 25 scientists from its member nations, the ACIA is the most comprehensive, independently-reviewed evaluation of

[90] The latest imagery is available at http://earthobservatory.nasa.gov/Newsroom/NewImages/images.php3?img_id=16978
[91] Becker, Emily, *Report from "A Transatlantic Symposium- Meeting the Climate Challenge in the Arctic Region*" Washington D.C., June 9, 2005, 3. .
[92] Ibid

Arctic climate change and its global impacts. The conclusions of the ACIA are largely supported by approximately fifteen currently operating climate models covering the Arctic region.[93]

Arguably, the most shocking finding of the ACIA was that global warming is causing the Arctic ice-cap to melt at such an unprecedented rate that by the summer of 2070 there may be no ice left at all.[94] Some of the currently operating climate change models concur that the ice will disappear entirely by 2080.[95] The study finds that glacial retreat is global warming's most noticeable effect in the arctic. Evidence suggests that glacial melting in Alaska alone represents half of the overall retreat of world glaciers at this time.[96] This phenomenon is significant due to the substantial contribution it makes to overall world sea-level rise.

The ACIA study also contained significant conclusions regarding potential temperature rise in the region. The ACIA found that the Arctic is warming almost twice as fast as the rest of the planet due to greenhouse gas buildup and that the trend is likely to continue at this rate.[97] The ACIA concluded that over the last 50 years annual average temperatures have risen by 2-3 degrees celsius in Alaska and the Canadian Yukon and that temperatures in Alaska from June to August 2004 were nearly 5% above the 1970-2001 historic mean.[98]

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[93] The Arctic Council, *Impacts of a Warming Arctic: Arctic Climate Impact Assessment*. Cambridge University Press. 2004, 19.
[94] Jamie Wilson, "Global Warming Will Leave Arctic Ice-free" *The Guardian*, November 3, 2004.
[95] Elizabeth Kolbert, "The Climate of Man Part I," *The New Yorker*, April 25 2005, 10.
[96] Kolbert
[97] Arctic Council, 3.
[98] Arctic Council 119.

Impacts of Global Warming in Alaska

Like the canary in the mineshaft, inhabitants of the nation's only Arctic territory, Alaska, and its citizens may be the first Americans to experience effects of global warming to the degree of being national security concerns. One significant factor is that global warming will likely change storm patterns leading to more severe erosion of high populated coastal lands.

Indigenous Peoples

Overall, indigenous people make up about 10 percent of the Artic population but nearly half of Canada's entire population so the ramification of the plight of these people are especially salient in the Canadian security context. (chk) Perhaps the most significant effect of global warming on Alaskan residents is its direct impact on housing. Global warming's impact on native Alaskan homesteads is potentially devastating. According to the findings of the ACIA, several Inuit villages and some industrial plants have already been forced to move inland to avoid being overtaken by sea-level rise. In addition to the associated costs, relocation removes these villages from the natural resources that they have traditionally relied upon. According to the views of some anthropologists, this relocation may represent a significant step in the demise of indigenous Alaskan culture. The costs of remediation are steep. In a recent symposium held in the U.S. Congress, Donald Goldberg of the Center for International Environmental Law estimated the cost of moving one Alaskan Village actually scheduled for relocation at over $500 million.[99] According to a Government Accountability Office (GAO) study, approximately 180

[99] Donald Goldberg, Remarks at the *Transatlantic Symposium- Meeting the Climate Challenge in the Arctic Region*, Dirksen Senate Office Building, June 9, 2005.

Alaskan villages are situated in dangerous, coastal, areas and will likely have to be relocated. The GAO report did not calculate the exact cost of the relocation effort but it is thought to be in the 100s of millions of dollars for a single village called Shishmaref.[100] Dozens of communities in arctic rural Alaska are located near the ocean. Nearly 90% of the state's 213 native villages could be facing the same question within the next few years, due to the repeated effects of floods and erosion.

As stated, many Native Alaskan peoples depend on natural resources. Polar bears, walrus, caribou, reindeer and fish are a subsistence source of food as well as a basis of their cultural identity. The ACIA report finds that reduced sea ice will contribute to species extinctions that could have devastating consequences for local people who are dependent on these animals as a food source. If, for example, the Arctic Ocean remains relatively ice free for even a short number of consecutive summers as predicted, the polar bear is likely to become extinct because the ice flows they hunt seal on will disappear. Thinning ice has also endangered the lives of Inuit hunters who travel across the ice pack. Many have perished. Unsafe ice conditions have already undoubtedly contributed to some premature deaths this year.

Arguably the species that carries the most cultural significance for Native Alaskan people is the caribou. Named for the major river in its range, the approximately 120,000 member Porcupine Caribou Herd is especially vulnerable to climatic conditions and has already begun to experience significant species depletion based on environmental factors. Global warming has already created a condition causing the Mackenzie River to no

[100] Becker 15.

longer be frozen when the herd reaches the river crossing during its annual migration. Newborn calves are now forced to wade across the river in increasing numbers and thousands of calves are perishing. The Gwich'in tribe of Alaska is particularly vulnerable because they are located in this region and rely on the Porcupine Heard as their primary means of subsistence.

Human Health Consequences

The human health consequences of Arctic global warming are significant in part because the phenomenon has brought several previously unknown diseases to the region. In 2003, the State of Alaska was forced to initiate a West Nile Virus surveillance program for the first time. A sudden influx of flies and mosquitoes raised the possibility of this vector-borne illness previously known only to warmer climates [101] Health risks will continue to increase as species potentially bearing new diseases move into the region.

Elevated ultraviolet radiation levels due to effects of GHG's on stratospheric temperatures are also expected to have a detrimental, but still largely unexplored, impact on human health in the region. The current residents of Alaska are expected to endure a lifetime dose of ultraviolet radiation 30% higher than any previous generation. Doses among the Inuit people may be significantly higher. The true effects of this exposure remain to be seen. Ultra-violet radiation is a widely documented cause of cancer and immune system disorders.[102] Non-Hodgkin's Lymphoma, multiple sclerosis and viral disease all increase with increased exposure to ultra violet radiation.

[101] Becker 17.
[102] Becker 17.

Survey of Economic Impacts of Global Warming in Alaska

Impacts on the Alaskan Oil Industry:

The Arctic contains as much as 40% of the world's oil reserves.[103] Given current trends, it seems clear that the pace of oil exploration in the Arctic will increase with or without climate change. The increase will be due to expected increases in prices and declining production of other regions in the world and the U.S. policy trend of reducing reliance on foreign oil. Global warming's impact on the Alaskan based-oil industry will present a mixed-bag of consequences. The ACIA study finds that global warming will provide some, mostly short-term, advantages for the industry. Previous hidden by the ice, oil and gas deposits will become more accessible. New routes for maritime transportation and oil exploration will be free due to the receding ice line off of Alaska's Northern Slope. It is ironic that the reduction in ice-cover associated with global warming will, in turn, facilitate the oil exploration process because it is in-part caused by the burning of fossil fuels that will make global warming worse.

However, these positive implications are largely outweighed by other negative implications for the oil industry. For example, ice that has broken away from the melting polar ice packs will likely interfere with oil tanker navigation in the Arctic seas. This could lead to a catastrophic oil spill. Break away ice may also threaten drilling rigs and

[103] Chalecki 7.

offshore pipeline. An increase in mudslides and avalanches caused by deteriorating soil conditions are also likely to take their toll on pipeline infrastructure. Oil companies conduct most of their exploration from ice roads and ice pads that are costly to build. Due to global warming, however, these ice roads will be passable fewer days per year and have now become more unstable than ever**.** The impassability of these roads is manifest by the fact that the permafrost melting is causing the ground to subside by 16-33 feet in parts of Alaska.[104] The government's concern over the damage caused by thawing permafrost has reduced by 50% (or 100 days) the time the Alaska Department of Natural Resources will allow annual oil exploration and repair activities to take place statewide. The Alaska state standards are designed to protect the tundra from being damaged by the heavy equipment. Taken as a whole, the increasingly soupy condition of the Alaskan tundra will have a negative impact on the security of oil supplies and will likely have consequences for Alaska's economic well-being. These impacts must be viewed in light of the fact that oil revenues currently account for an overwhelming 84% of Alaska's tax base.[105]

Global Warming's Implications for Regional Military Bases

As stated, thawing associated with a phenomenon known as "settling" of the tundra when the permafrost begins to melt will put much of Alaska's building and pipeline infrastructure at risk by the middle of the century. This will also have significant ramifications for regional military installations. Runways, radar installations and roads at

[104] Arctic Council, 86.
[105] Sherri Wall, *The Economic Impacts of a Shortened Winter Exploration Season on the North Slope of Alaska*, University of Alaska Fairbanks Presented at the ACIA symposium on climate change in the Arctic, Reykjavik Iceland, November 12, 2004.

the major military bases in Alaska will be certainly be damaged by tundra settling. Fort Wainright, one of the Army's largest training areas, and Fort Richardson, a key Alaskan base, will require additional large additional annual expenditures for maintenance. These damaging weather conditions are affecting facilities already under examination by the Department of Defense Base Reduction and Closure Commission (BRAC), could encourage decisions by that body to abandon these facilities. In addition to creating significant job losses this move could would leave the U.S. northern frontier more vulnerable to attack at a time when the geostrategic military balance in the Arctic may be changing. The complicated new security environment represented by the opening of the Northwest Passage will necessitate the development of expense new weapons systems. This new equipment will mean significant new expenditure by the Pentagon in facilities, equipment and training for new Arctic missions. Government services, including the military, represent the second largest share of the Alaskan economy after oil. If the military were to reduce its presence in Alaska, loss of this revenue will ultimately have a significant detrimental effect on the local economy, harm U.S. national security, and comprise the federal government's ability to defend Alaskan territory.

Forest Fires

There is overwhelming evidence that, as elsewhere, increased temperatures are elevating the risk and extent of forest fires in Alaska. The global warming trend has also exacerbated other forest health problems that contribute to wildfires and are now widespread in the Alaskan region. Insects, fire and tree stress have all been associated

with mild winters and increasing temperatures.[106] The increasing numbers of spruce trees killed by beetles coupled with high temperatures and a dry climate created ideal fire conditions this year in Alaska. Scientists have tied all of these phenomena to climate change.

A disturbing trend may be marked by the fact that May 2005 witnessed the first major fire on the Alaskan Kenai Peninsula in years. Statewide, an insufficient number of trained firemen were prepared to combat it. Consequently, the State of Alaska was forced look to the lower 48 states for assistance in combating the fire. This development represents another growing trend. The area burned annually by forest fires over Western North America has increased by 50% over the last 30 years. The annual increase in forest fires is expected to reach 80% over the next 100 years due primarily to drought accelerated by global warming.[107]

Fisheries

Due the complicated modeling processes involving ocean currents, temperature and other factors it is difficult to assess the impacts on fisheries of climate change. The likely northward shift in fish species due to migration to cold waters will create additional hardships for the fishermen who need to pursue abundant fish stocks into more dangerous waters. Alaskan fisherman may find that their already dangerous occupation will grow even more so.

[106] Wall, 120.
[107] Wall, 72

Ocean acidification caused by higher concentrations of CO^2 is likely to have unpredictable consequences for Alaska's ecosystem and fish population. The world's oceans have already absorbed about half of the CO^2 produced by humans, mainly in the burning of fossil fuels, over the past 200 years increasing the acidity of the world's oceans to a level that is irreversible in our lifetimes. Changes in ocean chemistry will reduce their ability to absorb CO^2 from the atmosphere, which in turn will further accelerate the rate of global warming.[108] On the strategic level it is likely that depleted Arctic fish stocks could increase tensions between the U.S. and Canada who compete for resources on both the Atlantic and Pacific coasts.

Human Rights Issues

In a development especially interesting to legal scholars, global warming in the Arctic has become an international legal issue. Due to the actions of some committed environmentalists, the U.S. government may incur legal liability for global warming's impact on Arctic populations. This issue may have first come to the international limelight during the Ninth Conference of the Parties to the Framework Convention on Climate Change held on December 10, 2003 in Milan, Italy. At that conference, Sheila Watt-Cloutier, a Nobel Prize nominated Canadian woman who served as Chair of the Inuit Circumpolar Conference (ICC), a group of 155,000 indigenous people living in the Arctic, announced that she was considering filing a claim with the Inter-American Commission on Human Rights, an arm of the Organization of American States, against

[108] Larry Rohter, "Antarctic, Warming, Looks Ever More Vulnerable," *The New York Times*, January 25, 2005. (Accessed on March 4, 2007); Available at http://www.nytimes.com/2005/01/25/science/earth/25ice.html?ex=1107667322&ei=1&en=13daa4955fada982

the United States for the harm global warming is causing to the Inuit. The claim was first expected to be filed in the fall of 2005, would allege that, by failing to curtail its greenhouse gas emissions, the United States has violated the Intuits' basically recognized international human rights, including their rights to property, culture, and subsistence. It is notable that all prior claims before this court have involved a much smaller group of plaintiffs.[109]

This year the ICC made good on their promise when, under the leadership of Watts-Cloutier, they took their case to the Inter-American Human Rights Commission on March 1, 2007. In her testimony, Watts-Cloutier based claims that the Inuit's human rights had been violated through erosion of the food supply and on the fact that several hunters had lost their lives by falling through the ice.[110] This lawsuit is of potential strategic significance because it represents a first-order political embarrassment that could undermine the Bush administration's support for the principle of universal rights as the U.S. confronts other nations about their human rights records. Watts-Cloutier's testimony was also aimed to gain the sympathy of Andean countries such as Ecuador that rely on water from shrinking glaciers for their populations' basic needs.[111] The case also set a dangerous precedent if countries such as Bangladesh or small island nations threatened by inundation threaten to follow suit.

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[109] Center for International Environmental Law, *Inuit Circumpolar Conference Plans Human Rights Action against US for Damage to the Arctic Caused by Global Warming,* (Accessed on March 28, 2007);. Available at http://www.ciel.org/Climate/ICC_Arctic_23Dec03.html

[110] Watt-Cloutier's testimony to the Inter American Commission on Human Rights (accessed March 9, 2009); available at http://www.sophieprize.org/Articles/220.html

[111] Ibid.

A Northern Sea Route and Its National Security Implications

Perhaps the most significant strategic consequence of the melting of the northern icecap is the almost certain potential for increased Arctic navigation and the opening of a new Northwest Passage envisioned by so many previous maritime explorers. The ice in the area of Northwest Passage has melted 35% in the last 40 years.[112] The polar thaw may lead to what would be the most transformational maritime development related to commerce in world history since the Panama Canal: a year round navigable northern sea route (NSR). A navigable NSR would be truly revolutionary because it would shorten the shipping distance between Europe and Asia by about 9,000 miles. Several studies show that the time it takes for a merchant vessel traveling from Europe to Asia to navigate over the North Pole is an average of one week of sailing time shorter than traditional routes through the Panama and Suez canals. This is an especially significant and somewhat fortunate development for the maritime industry since the tonnage of individual ships continues to grow to the point where these large ships are less likely to fit through the Panama Canal in any case.[113]

The various climate models predictions of exactly when this may happen vary, but a fully navigable Arctic may emerge in as soon as a decade depending the rate of natural melting and the level of available maritime technology.[114] Other models predict that rather than in a decade, the route will be a reality by 2050.

[112] Interview with Professor Michael Byers of the University of British Columbia, Conducted at Georgetown University, Washington, D.C., February 8, 2007.
[113] Ibid.
[114] Scott Borgeson, "Breaking the Ice Up North" *The New York Times*, October 19, 2005.

Beside it strategic significance as a trade route, Canada's northern archipelago contains substantial oil and gas resources, as well as valuable mineral deposits on the ocean floor. For this reason, the opening of NSR increases the potential for regional mischief by rivals to U.S. or Canadian sea power and perhaps opens the door to increased international conflict. The U.S. military itself has identified increased security needs resulting from the emerging opportunity of potential adversaries to exploit the waters of the Arctic in ways that are counter to U.S. national security interests. Likewise, the Canadian government and armed forces are addressing profound and lingering questions over regional sovereignty in the face of the anticipated increased in regional shipping traffic.

Under customary law, the juridical status of the Northwest Passage has long been a point of dispute between Canada and the US. Under international law, Canada claims extensive rights and responsibilities regarding the Northwest Passage that are not always recognized by other littoral countries. Most legal analysts agree that the Canadian position is best interpreted as asserting the claim of outright sovereignty over the passage as an internal waterway, whereas the U.S. has asserted the right of "mare liberum" or freedom of navigation over the sea.[115] To buttress its claims to the region, Canada has announced several military plans including: the construction of a deepwater port for submarines on Baffin Island near Iqaluitto; the construction of three military icebreakers; and the installation of additional underwater sensors in Arctic waters to detect foreign submarines. Furthermore the Canadians have deployed unmanned aerial vehicles and

[115] Chalecki 4.

more aircraft in Yellowknife, the capital of the Yukon Territories, to carry out increased regular surveillance of the northern region.[116]

Like Canada, Russia also asserts claims holding the navigable straits of the NSR and the Northwest Passage under its exclusive jurisdiction. The Russian claims are based on the argument that the NSR constitutes a historic waterway or bay, closed by straight baselines making the body of water an internal Russian waterway under international law. However, the U.S. supports the claim of freedom of the seas by holding that parts of the NSR are actually international waters. Although it has certainly been exacerbated by global warming and the future probability that the arctic seas will be ice free, the legal status of the NSR has been a dormant yet highly contentious political issues in US–Soviet, now Russian-Arctic relations.[117] On the practical level, the Russian Federation has a certain strategic advantage now because the straits are currently made navigable through the assistance of an aging nuclear and non-nuclear icebreaker fleet of 16 ships stationed in the Russia port of Murmansk. Russia's recent establishment of complex rules for obtaining an escort from this icebreaking fleet is indicative of its attempts to assert control of regional navigation. Despite the rapid rate of global warming, it remains unclear how soon reinforced commercial ships will be able to navigate along the NSR on a year-round basis without the assistance of at least some Russian icebreakers. Partially in order to weaken Russian superiority in this area, the U.S. Commission on Ocean Policy last year recommended the refurbishment or replacement of U.S. Coast Guard

[116] Paul Robinson, "Arctic arms race" *The Spectator* (Canada), February 11, 2006.
[117] Oceanographer of the Navy, 11.

icebreakers as a high national security priority. This move was seen as a priority in recognition of the potential impact of the NSR on U.S. national security.[118]

The Role of the UN Convention on the Law of the Sea

As of the fall of 2007, President Bush urged Congress to ratify the UN Convention on the Law of Sea (UNCLOS). This push came amidst growing anxieties in Washington over Russian and Canadian posturing over Arctic territory. The requirements for defining the extent of coastal territory under (UNCLOS) have inspired Russia to press this claim. Under the agreement that the U.S. signed under Bill Clinton but has not ratified, a state is given control and resource extraction rights over an area spanning approximately 200 nautical miles from its coast. This boundary can be pushed even further if a party can prove that its continental shelf is geographically linked to the Arctic seabed.[119] In August 2007, the Russians sent a submarine expedition to the Arctic for the purposes of determining how far the Russian landmass extends toward the North Pole. During the expedition, they planted a titanium flag on the sea floor under the North Pole. This development has galvanized other Arctic nations into action. Denmark has announced that it plans to submit its own claim (through Greenland) and Canada has announced it will build eight armed ships capable of cutting through the ice.[120] From a national security standpoint, the U.S. wishes to minimize other littoral states ability to claim territory but without being a member of UNCLOS it difficult for the U.S. to find a forum

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[118] Borgeson

[119] PINR Power and Interest News Report ‘‘Intelligence Brief: Arctic Scramble Leads Washington to Reconsider Law of the Sea" (Available at http://www.pinr.com/report.php?ac=view_report&report_id=708&language_id=1**)**;accessed on 1/15/08)

[120] Andrian Bloomfield, “Russia Claims North Pole with Arctic Flag Stunt, The Telegraph, UK., 3/08/07 (Available at http://www.telegraph.co.uk/news/main.jhtml?xml=/news/2007/08/01/wpole101.xml); Accessed on 3/21/07

under which to dispute these claims. The U.S. also has an important dispute with Canada over territory underlying the Beaufort Sea. Because the U.S. may have a weaker claim to this territory under the UNCLOS regime it would put itself at a disadvantage by signing UNCLOS. Still this consideration is likely not as important as the other strategic gains the U.S. would gain through ratification of the Agreement.

The existing underlying dispute between the U.S. and Russia will naturally be exacerbated by the fact that U.S. naval ships will have increasing access to the Arctic waters north of Russia due to ice depletion. If the United States moves to take advantage of this increased mobility it could elevate tensions with Russia. Another complication is represented by the fact that in addition to Russian claims to the area Denmark has occasionally asserted some claims of sovereignty to one area. In short, increased commercial access to the NSR will increase the scope and intensity of military operations in the Arctic including various actors.

To support U.S. power projection in the region, the Navy in particular will be forced to shift its procurement strategy. The U.S. has not recently designed any surface combat ships, other than three Coast Guard ice breakers, to operate in an Arctic environment. In addition to the need for new Coast Guard cutters, the new strategic situation brought about by the ice depletion, will mean that Naval planners will have to reconfigure surface weapons systems and platforms in order to better adapt them to Arctic use.[121] According to analysis conducted by the Navy, costly upgrades will also have to be made to existing command, control, communications, computers, intelligence surveillance, and

[121] USARC, 11

reconnaissance (C4ISR) infrastructure to adapt to Arctic operations. One U.S. Naval study suggests a new Arctic concept of operations will necessitate additional integration with costly satellite systems that are currently not designed to cover the northern latitudes. In sum, it is clear that much more long range systems acquisitions planning and financial resources will have to be dedicated to meet the new challenges posed by U.S. Naval operations in the Arctic. The additional taxpayer costs will ultimate reach into the tens of billions of dollars.[122]

Arctic military operations may also have implications for the overall U.S. Naval or Joint Command Structure. A Navy study suggested that the creation of a regional commander in chief for artic operations should be established. The proposed regional Commander in Chief for the Arctic (CINCARCTIC) regional command organization will become increasingly important and demand more resources for operations in the area. Finally, planning resources necessary to include Arctic operations in the detailed combined national defense plan known as the national security strategy will also be required. It is clear that long-range planning and financial resources will have to be increased by an order of magnitude to meet the new challenges posed by Naval operations in the Arctic brought about by global warming and the opening of the NSR. These projects will have to compete with other regional security priorities, such as protection of the shipping lanes in the Persian Gulf or humanitarian operations for a share of scarce military budget resources.

Environmental, Regulatory and Law Enforcement Oversight Challenges

[122] Oceanographer of the Navy, and the Arctic Research Commission.

More maritime traffic in the Arctic region will also demand increased emergency response as well as environmental and regulatory oversight of U.S. territorial waters.[123] Oil spills resulting from iceberg-related collisions of tanker ships and damage to fragile Arctic ecosystems are examples of costly risks that would accompany increased maritime access to the region.[124] In the next few decades, the United States and other littoral states will find it necessary to develop policies and measures to regulate commercial shipping traffic and mitigate future oil spills in the region. The Exxon Valdez incident, that caused over 11 million gallons of oil to be spilled in Alaska's Prince William Sound in 1989, could be small in comparison to future environmental disasters in the region in the likely scenario that the NSR becomes the transshipment route for petroleum bound for Asia.

Furthermore, there is a vast supply of potential indigenous resources. The U.S. Geological survey has determined 25% of the world's unrecovered fossil fuel lies at the bottom of the Arctic Ocean.[125] These resources would be most exploitable if the NSR were to open. The negative environmental consequence is an increased potential for major oil spills. And, the standard practice of emptying ballast tanks used by large craft such as oil tankers before entering the narrowest part of the straits could release organisms such as invasive species that may upset the fragile Arctic ecosystem. Opening the NSR would present an increased need for of both domestic law enforcement and possible revision of international treaties including the United Nations Convention on

[123] Arctic Council, 84.
[124] Note that while supertankers can't navigate the narrowest sections of the passage regular capacity ships can easily pass through.
[125] Interview with Professor Michael Byers of the University of British Columbia, Georgetown University, Washington, D.C., February 8, 2007.

Law of the Sea (UNCLOS). The U.S. or Canada would also have to dedicate significant resources to counter-drug operations, and anti migrant-smuggling operations because the NSR will present a new pathway for contraband into both countries. This situation will have a particularly acute impact on national security. Military forces have unique capabilities, at least in the short term, would be needed to support the civilian law enforcement authorities taking away focus from the military's primary role as war fighting.[126]

Competition for Fishing and Seabed Resources

As stated, another national security related dimension of the opening of the NSR is the potential for conflict over the question of rights to seabed resources such as oil deposits. The Arctic lacks a comprehensive international legal framework governing natural resource extraction calling for a possible revision of the UNCLOS. Surprisingly perhaps, the 1961 Antarctic Treaty which regulates access to the seabed resources of that continent has no companion agreement concerning the Arctic. One scenario that impacts U.S. national security may be the following: as the icepack melts, fishing becomes more significant industry in the arctic region causing tension between Canadian, Russian, Japanese and U.S. fishing fleets that are operating in a legally contested a potentially unregulated environment. This situation might lead to confrontations similar to the Cod Wars between the UK and Iceland during the 1950's and 1970's when Iceland unilaterally extended its Exclusive Economic Zone into international cod fisheries.

[126] Oceanographer of the Navy, and the Arctic Research Commission.

Conclusion

According to the preponderance of scientific evidence, the Arctic is likely to be ice free within a century, a condition that hasn't happened in at least 1 million years. There is increasing evidence that changes such as glacial melting witnessed in the Arctic are beginning to accelerate at a much higher rate than scientists had anticipated as positive "feedback loops" begin to develop. The Arctic warrants significant attention because it is likely to be a harbinger of future impacts of global warming. The physical changes experienced first in the Arctic are likely to extend toward and have a ripple effect on other regions and ecosystems.

In the previous chapter I have outlined several global warming related changes in the Arctic that are likely to have some effect on U.S. national security. For example, changing terrestrial conditions brought about by settling of the tundra make it much more costly for large oil companies and the military to maintain their existing Alaskan infrastructure. A decline in fisheries brought by changing migration patterns related to warmer waters will affect the livelihoods of Arctic fisherman. Aside from the concern for the loss of human life, human rights lawsuits against the U.S. brought by the Inuits are a potential source of political embarrassment.

I have explained the claim that the potential opening of the NSR is one of the most important geostrategic events in modern history since the construction of the Panama Canal. The imminent emergence of the NSR presents a new and complex package of homeland and national security issues such as the commissioning of new ships. This

situation will in turn lead to zero-sum choices about national security as well as a significant burden to the American taxpayer. The emergence of an NSR alone is likely to have a profound effect on U.S. national security strategy and homeland defense expenditures in the coming decades.

The Impact of Sea Level Rise on U.S. Territory:

Introduction:

A sea level rise of 8-10 inches has been observed globally since 1901.[127] Projecting into the future estimates by the mainstream scientific community vary from 4 inches this century to 10 inches if greenhouse gas emissions are held at 2000 levels.[128] The Intergovernmental Panel on Climate Changes 2007 Fourth Assessment Report 4 AR projects a rise of 7.09 to 23 inches over the same according to which of seven projected greenhouse gas emissions scenarios is most likely to occur. Given current government policy and consumption rates the most likely scenario is that greenhouse gas emissions profiles will not been held at 2000 rates and that one of the IPCC 4 AR mid-range scenarios will occur.

Under one scenario, the sea level is expected to rise by 50 cm or approximately 20 inches by 2100.[129] A study by the University of Potsdam in Germany calculates that by 2100,

[127] Camille Parmesan, Hector Galbraith, *Observed Impacts of Global Climate Change in the U.S.*, Pew Center on Climate Change, November 2004. 30.
[128] Camille Parmesan, Hector Galbraith, ii.
[129] John Roach, National Geographic News, December 14, 2006 (available at http://news.nationalgeographic.com/news/2006/12/12/061214):; accessed on November 7, 2008.

sea level will rise between 4 and 35 inches or 19-88cm higher that it was in 1990.[130] More recent work than the IPCC TAR using newer greenhouse gas emissions scenarios shows a higher rate of sea level rise. By the end of the century an expected two to fivefold increase in the rates of sea level rise reflected in the various scenarios could lead to the inundation of low-lying U.S. coastal regions including wetlands, more frequent flooding due to storm surges and worsening beach erosion.[131]

On the regional level, the Northeast Climate Impact Assessment (NECIA) projects that by the end of the century global sea level is expected to rise 7-14 inches under the lower emissions scenario used in the study and 10 to 23 inches in the higher.[132] Several types of evidence suggest that these estimates may be too moderate because another more ominous factor may be at play. Evidence suggests that the massive West Antarctic ice sheet might be disintegrating at a higher rate than previously believed. If this event happened completely, it would raise sea levels around the world by 16 feet. Melting of Arctic ice has also accelerated at an unforeseen pace. NASA and the University of Kentucky published a joint study in the summer of 2006 in the journal *Science* demonstrating that the rate of loss of ice in Greenland doubled between 1996 and 2005 and that the glaciers flowed faster into the Ocean. More specifically the study determined that total ice loss from the Greenland ice sheet increased from 96 cubic kilometers in 1996 to 220 cubic kilometers in 2005. A cubic kilometer is one trillion liters or approximately 264 billion gallons of water. This amount is about one quarter of

[130] Intergovernmental Panel on Climate Change, *Climate Change 2001: Synthesis Report Summary for Policymakers*, (available from http://www.ipcc.ch/ipccreports/tar/vol4/english/index.htm)
[131] NASA "Greenland Ice Melting Faster Than Thought" (available from http://www.physorg.com/printnews.php?newsid=10948); accessed on June 28, 2008.
[132] NECIA, 15.

the daily water consumption of Los Angeles.[133] A second study found that the Greenland ice sheet which is the world's second largest icecap may be melting at rates three times faster than indicated by previous measurements. The sheet shrank at a rate of about 239 cubic kilometers per year from April 2002 until November 2005.[134]

In the U.S., at risk coastal zones represent a potentially enormous economic and safety threat. The major metropolitan areas of New York City and Los Angeles fall within this zone. Notably, the U.S. coastal population is expected to grow by 25 million over the next 30 years.[135] The land area of coastal counties comprises about 25% of the total land mass of the U.S. including 53% of the population.[136] American coastal populations are expected to grow by 25 million during the next 30 years. The most vulnerable coastal areas are the mid Atlantic, south Atlantic states as well as the Gulf Coast because they contain low-lying plains.

Sea Level Rise will have a variety of impacts. The IPCC suggests that a generic national assessment of the potential damages caused by sea level rise should reflect at least five categories of impacts: inundation and erosion of property; inundation of wetlands; effects on recreation; effects on drinking water quality and quantity and effects on port infrastructure.[137] All of these specific impacts would apply in the American scenario.

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[133] Kelly Young, "Greenland Ice Cap May be Melting at Triple Speed," *New Scientist.com News Service*, (Available at http://www.physorg.com/printnews.php?newsid=10948); Accessed August 29, 2006.
[134] Ibid.
[135] Nils Gilman, Peter Schwartz, Doug Randall, "*Impacts of Climate Change, A System Vulnerability Approach to Consider the Potential Impacts to 2050 of a Mid-Upper Greenhouse Gas Emissions Scenario*" Global Business Network/Monitor, March 2007, Page 15.
[136] James E. Neuman, et al., *Sea-Level Rise and Global Climate Change: A Review of Impact to the U.S. Coast*, Pew Center on Global Climate Change, February 2000, Page 1..
[137] Neuman, iii

Physical Impacts

The major physical impacts of sea level rise in the U.S. could be summarized in the following way:

- Erosion of beaches, bay shores and river deltas.
- Permanent inundation or wetland colonization of low-lying uplands.
- Increased flooding and erosion of marshes; wetlands and tidal flats.
- Increased flooding and storm damage in low-lying areas as episodic storm surges. and destructive waves penetrate further inland
- Increased salinity in estuaries, marshes, coastal rivers, and coastal aquifers.[138]

These primary phenomenons will trigger other spin-off effects such as damage to buildings and coastal infrastructure such as ports, ships and channels and bridges. Episodic storm surges are likely to cause the greatest damage**.**

Economic Costs

As stated, major regions of the U.S will experience a wide variety of potential variety of economic impacts associated with sea-level rise. The cost of overall U.S. adaptation to a .5 meter sea level rise has been estimated at $20 to $138 billion.[139] This estimate appears to be low because the study seems to have left of the fact that sea level rise will also have primary and secondary economic effects. An example of this might be that damage to a beach would cause someone to incur the expense of mitigating coastal erosion. Secondary effects such as the harm the beach erosion causes to the local tourism industry do no seem to be accounted for in the study. The total economic value of beach visits to the U.S. economy has been calculated at over $3 billion.

[138] Neuman iii
[139] William E. Easterling III, Coping With Global Climate Change, The Role of Adaptation in the U.S., The Pew Center on Global Climate Change, June 2004, Page 3.

In addition to being vulnerable to hurricanes, the Louisiana Delta is the most susceptible region in the U.S. to sea level rise. The Louisiana wetlands support sealife with an estimate commercial value of over $1 billion annually. Louisiana has 40% of the coastal wetlands in the United States.[140]

In the early 1990s, several studies examined the cost of sea-level rise in the United States. A series of nationwide studies in other countries followed essentially the same methodological approaches. For example, in 1996 Yohe *et al* analyzed the economic cost of sea-level rise for developed property in the United States. The studies reached a cumulative figure of US $20.4 billion in damages using (1990 USD as a baseline). The studies have not considered the costs of mitigation plans such as the construction of shore protection works.[141]

In terms of personal property, The Heinz Center (2000) estimates that roughly 1,500 homes in the United States are susceptible to full destruction resulting from coastal erosion each year at a cost to property owners of US $530 million year.[1]

Most of the losses over the next 60 years will be in low-lying areas that also are subject to flooding. Some damage, however, will be found along eroding bluffs or cliffs. West *et al.* (2001) estimate that the increase in storm related damage because of sea-level rise increases the direct damages of sea-level rise from erosion of the shoreline only by a factor of 5%. Storm damage may constitute as much as 20% of other damages attributed

[140] Easterling 22.
[141] Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2001, Working Group II: Impacts, Adaptation and Vulnerability*, 2001 (Available at http://www.grida.no/climate/ipcc_tar/wg2/298.htm#652http://www.grida.no/climate/ipcc_tar/wg2/298.htm#652); Accessed on March 3, 2007.

to this phenomenon. West et al has also developed a method for evaluating the effects of investor decisions to repair storm damage on the net economic impacts of sea level in the United States. Neumann *et al.* (2000) have estimated that a 0.5-m sea-level rise by 2100 could cause cumulative impacts to U.S. coastal property of US $20 billion to US $150 billion with the higher end of the spectrum the more likely result.[142]

Perhaps the most economically significant yet understudied effect of sea level rise would be destruction of major port facilities across the U.S. In the case of Boston alone the total property damage due to sea level rise over the next hundred years could range from $20 to $94 Billion if there are no adaptive responses except rebuilding after floods.[143] The facilities may have to install major renovations such as new docks and seawalls. The government may be compelled to underwrite such projects at significant tax-payer expense because insurers may consider the projects to be too risky.

One prominent national security analyst has even suggested that this condition could lead to the decline of the modern shipping industry and increase the isolation of nations in the world economy having a deleterious effect on poorer countries.[144]

Sea level rise carries potential geopolitical ramifications. One aspect of sea level rise's impact on national security that has received very little attention is the submergence of atolls, rocks and small rocky islands. While the submergence of atolls -- particularly if they are unpopulated -- may seem benign there is another dimension to the problem,

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[142] Neumann, 23..
[143] Tufts University Civil and Environmental Engineering Department, Climate's Long Term Impacts on Metro Boston: CLIMB Final Report, August 13, 2004
[144] Professor Leon Fuerth, Notes related to a forthcoming study on national security and climate change by the Center for Strategic and International Studies (CSIS).

economics. The economic question relates to the effects that this change in the ocean's geography will have on the Exclusive Economic Zones (EEZ's) of maritime states and their claims to fishing grounds and seabed resources such as polymetalic nodules. For example a country such as Indonesia may base its maritime claims on Archipelagic baselines as is the custom under international law. (find cite UNCLOS) If the island or atoll upon which these claims are based were to sink, the EEZ would then be effectively invalid under existing international law. Bringing this rather abstract example closer to the purpose of the dissertation, a reconfiguration of the U.S. EEZ in this manner could erode this country's claim on the Northeast fishing banks off the coast of Maine and possibly other locations. This situation would lead to economic losses as well as the potential for violent conflicts with rival fishing nations. It is worth looking at selected regional examples to build an estimate of global warming's total economic impact.

New York City

The effect of climate change on the U.S. mainland will be particularly noticeable in the coastal urban centers. The effects of sea level rise will be especially pronounced in New York City because Manhattan is situated on an island only a few feet above sea level. Large cities in the U.S. are at the forefront of climate change vulnerability. Climate change may put the ultimate stress on a city where the dense population already puts tremendous demands on land and water resources. The Metropolitan East Coast Regional Assessment (MEC) is one of the regional components of the U.S. National Assessment of the Potential Consequences of Climate Variability and Change. This study was coordinated by the U.S. Global Change Research Program. The purpose of this

study was to identify sectors that are most vulnerable to additional stresses that climate change and increased climate vulnerability will introduce and to examine feasible adaptation strategies. The results of the MEC indicate that biophysical and societal impacts of the projected climate change will be highly detrimental over the long term in the New York City Area.

According to the study given the projected climate change, sea levels in the MEC region may rise 4.3-11.7 inches by the 2020s and 9.5 to 42.5 inches by the 2080s.[145] The beaches in the area surrounding New York City are currently maintained by the U.S. Army Corps of Engineers by replenishing sand in an activity referred to as beach nourishment. This activity has cost a cumulative total of $2.4 billion nationally and $884 million within the New York City tri-state region since the 1920s.[146] The MEC report estimates that losses from a single devastating storm could be to $100 Billion or 10% of the metropolitan region's aggregate annual gross productivity.

Climate change may have unanticipated effects in the area of human health. Sea level rise will increase the salinity of the Hudson River. The resulting "salt front" of suspend matter could reach the municipal water intake values in the Chelsea Pump Station located upstream on the Hudson River south of the town of Poughkeepsie. The resulting salinity could eventually render the cities water supply undrinkable

[145] Columbia University, *Climate Change and a Global City: The Potential Consequences of Climate Variability and Change*, July 2001, Page 3.
[146] Columbia University, 37.

Demand for electricity will grow. A warming climate will increase the demand for air conditioning which in turn drives energy demand in the New York Metropolitan Area which has already endured seasonal blackouts. Because peak electricity demand already exceeds supply, more blackouts and brownouts will certainly occur unless substantial improvements are made to the grid infrastructure. These changes, in turn, will cost the local economy billions of dollars. Critical infrastructure will have to be serviced by expensive redundant generating capacity in order to ensure reliability.[147]

In the area of human health, global warming is projected to increase the smog-related death in NYC by 4.5% as diminished air quality combines with higher temperatures. Harvard Medical School issued a report in November 2005 report outlining two types of public health crisis related scenarios for extreme weather events.

As stated in the previous section, some impacts of sea level rise have a direct effect on income. Those with direct monetary impact like the loss of agricultural production are referred to as market impacts because they directly affect goods traded in the economic market place as opposed to causing only property damage.[148] The effects of global warming on the NYC area alone represent a significant impact on the overall U.S. economy.

[147] IPCC
[148] Joel B. Smith, *A Synthesis of Potential U.S. Climate Change Impacts*, The Pew Center on Climate Change, 2004, 26.

Various Estimates of the Economic Impact of Sea Level Rise on the U.S.

Study	**Cline** (1992)	**Fankhauser** (1995)	**Nordhaus** (1991)	**Titus** (1992)	**Tol** (1995)
Climate Change Scenario	+2.5 C	+2.5 C	+3 C	+4 C	+2.5 C
Est. damage/ sea level rise, (Billions)	$9.9	$12.7	$17.2	$8.0	$12.0

I believe that the estimated damages in this figure are low when compared to more recent data. The reason for this may be that this analysis takes into account property damage caused by global warming but not the costs of remediation efforts. The John Heinz III Center for Science Economics and the Environment, for example, has developed a methodology for assessing the total impacts of sea level rise to include economic, environmental and regulatory risks.[149] (look for the estimate)

Global Warming has been implicated in Arizona's now decade-long drought. The drought has had a strong impact on the State's economy costing cattle-related industries $2.8 billion in 2002. Today the Colorado River, a large source of drinking water for Arizona is less that five percent of its original size and the river rarely reaches the Gulf of California.[150]

One of the most profound impacts of global warming in the American West has been its contribution to glacier loss. The surface of the 62-acre Arapaho Glacier along the

[149] The John Heinz III Center for Science Economics and the Environment *Human Links to Coastal Disasters*, Washington, D.C., (available at http://www.heinzctr.org/NEW_WEB/PDF/Full_report_human_links.pdf); accessed on March 10,2006)
[150] *Colorado Basin Ecosystem Assessment Case Study Description*, The Sonoran Institute, Tucson, November 7, 2006.

Continental Divide has dropped 100 to 130 feet since 1960, according to recent university reports. While the reports do not state definitively that global climate change is the cause of the decline, many feel that it is likely playing a role.

During the past 40 years, the total volume of mountain glaciers around the globe has declined by about 10 percent causing a disruption in freshwater supply to communities in the Andes that are outside the immediate scope of this dissertation but that may have significant implications for U.S. national security.

Global Warming's Effect on U.S. Species

The Wildlife Society undertook a comprehensive assessment of the impact of climate change on wildlife in North America. It indicates that global warming has already altered migration routes and breeding habits of animals and plants across the continent. In some cases species have separated from one another disrupting a natural balance that existed for decades. One example from the study illustrates how several types of warblers have been migrating north near the U.S.- Canada border, leaving the spruce budworms they used to consume freer to attack local fir trees. Predictably, the forests have now been depleted as well.

Likewise, a report by the Pew Center for Global Climate Change summarizes the results of more than 40 scientific studies linking climate change with ecological changes now observable throughout the US. Of the forty studies on individual species reviewed, about twenty show strong evidence that depletion is due to local climate change. Examples of

such changes include the fact that Spring is arriving about two weeks earlier throughout the United States; tree swallows are nesting nine days earlier than they did 40 years ago; red fox habitat has shifted northward encroaching on the Arctic fox's range; southern, warm-water fish are shifting to waters off of California previously dominated by colder-water species; and net release of CO^2 and methane into the air from the Alaskan tundra because warmer winters are causing stored plant matter to decompose. Release of these gases is in turn accelerating global warming at an unprecedented pace. Overall this study illustrates that U.S. ecosystems are much more sensitive to climate change than believed a decade ago.[151]

Global Warming's Impact on Disease Rates in the U.S.

Warmer temperatures will increase the area of penetration of several diseases. Since 1990, incidents of malaria have occurred in Texas, Florida, Georgia, Michigan, New Jersey, New York and as far north as Toronto Canada. It has been projected that by the end of the 21st century, ongoing warming will have enlarged the zone of malaria transmission from 45% of the world to 60% including much of the U.S.[152] Dengue fever, a tropical disease, has made it to Buenos Aires north to Taxco Mexico but thus far not to the U.S. It appears as though it is only a short amount of time before it spreads to the U.S. across the Mexican border possibly carried by human vectors. Evidence also suggests that the 1999 West Nile Virus outbreak may have been caused by global warming-induced weather fluctuations. Furthermore, it is possible that antavirus, a rodent-borne

[151] Jeff Nesmith, "Global Warming Study Finds Real Change in America" Cox News Service, Tuesday November 9, 2004. (Available at http://seattlepi.nwsource.com/national/198840_climate09.html); Accessed on October 20, 2006.
[152] Paul Epstein, *Is Global Warming Harmful to the Health*?, Scientific American.com, August 2000.

illness now found in the U.S. has been caused by global warming. Surprisingly, droughts caused by global warming actually accelerate waterborne illness by concentrating the water supply. This concentrates contaminants in the small pools of water that might otherwise remain dilute allow them to be transported by vectors.

Strategic Impacts of Climate Change on U.S. National Security

Overview

> "U.S. opposition to the Kyoto Protocol complicates forward basing and power projection; generates discord among NATO Allies; and generates increased tension between Northern and Southern nations."[153]

While it has been traditionally ignored at home, Climate change is a very important issue in the "court of world public opinion". For example, a recent survey conducted in eleven countries, both poor and industrialized, showed that most people think that global warming is a bigger risk to their personal security than terrorism. The countries surveyed were Brazil, South Africa, U.S. Canada and Russia and Japan.[154]

Growing evidence suggests that unhappiness about the U.S. government's policy position on climate change, particularly non-participation in the Kyoto regime, may be manifesting itself in various forms of trade warfare against the U.S. Interviews with senior members of the Brazilian government suggest that there is a possibility that Brazil is considering bringing a climate change related case against the U.S. in the World Trade Organization (WTO). The case would be based on the grounds that the U.S. is dumping

[153] Presentation by Lt. Col. Dave Peters, U.S. Department of Defense 2000.
[154] Hanneke Brooymans, "Global Warming Top Public Priority: 11 Nation Study Shows it's a Bigger Concern than Terrorism", *The Edmonton Journal*, May 3, 2002.

goods on the world market. The logic of this claim reasons that the Brazilian industry is being harmed because U.S. goods are cheaper due to the lack of carbon constraints mandated compliance with the Kyoto regime by its member states.[155]

The Strategic Implications of Fossil Fuel Use and Global Warming's Impact on Battlefield Readiness

In addition to its effects on the perceptions of our allies, global warming carries operational implications for the warfighter. By way of background it is useful to consider the fact that the Department of Defense (DoD) is the world's largest energy user. In 1999, Federal energy use stood at 1.05% of U.S. total energy consumption. DoD's delivered energy use stood at a staggering 80% of the U.S. federal government's total.[156] Among the services, the Air Force was the largest user followed by the Navy and then the Army.

As is the case with other sectors, global warming has driven an increase in energy use by the military due to the need to cool facilities, and air condition equipment both on and off the battlefield. Perhaps more significantly, global warming presents the military with the need to respond to worldwide contingency operations cause by a changing climate.

Excess spending on fuel also puts other military priorities at risk. From a military perspective, climate pattern change can greatly increase energy consumption that can result in large and unexpected budgetary deficits and windfalls within a given

[155] Interview with Marcelo Rocha of the Brazilian Ministry of Foreign Affairs, conducted March 15, 2005
[156] *Presentation, National Security Fuel Use: DoD Consumption Patterns,* 2000.

appropriations year. Therefore, unforeseen energy usage variation can result in inefficient overall execution of discretionary budgets by the Department of Defense. A military policy of reduction of fossil fuel use will significantly improve the environment through reduction emissions. It is notable that over reliance on fossil fuel not only causes environmental damage but also has operational implications on the battlefield. For example, inefficient use of fuel not only creates environmental damage but can affect the fundamental success of the pursuit of war based on the principles of mobility, force and mass made famous by the Prussian General Baron Von Clausewitz. Higher energy efficiency is beneficial to the warfighter because it reduces the length of the "logistical tail" required to move supplies to combatants in the field and weapons on the battlefield itself. According to some estimates, 60-70% of the Army's logistical efforts consist of moving fuels forward to the front or battle area.[157] DoD estimates that it costs $15 to deliver one gallon of fuel from the supplier to the forward edge of the battlefield and about $26 to deliver a gallon from an airborne tanker.[158] New military missions in collapsed states are only likely to increase these logistical costs.

The current conflict in Iraq provides an example. Significant combat forces must be dedicated to guarding fuel convoys and protecting fuel supply lines and depots. As a response, the Army has established a "Power Surety Task Force" to help bases near the front lines use there fuel more efficiently.[159] The commanders of the bases have

[157] Lt Col. Dave Peters, Presentation, *DOD's Role in Global Climate Change*, 2000.
[158] CNA, National Security and the Threat of Climate Change, April 2007, 39
[159] CNA, 39.

responded by implementing energy efficient technologies and energy conservation policies.[160]

Improved fuel efficiency reduces greenhouse gas emissions and supports successful military outcomes by improving conditions necessary to apply the fundamental Clausewitzian principles of war in the areas of surprise, mass, maneuver, and efficiency. The following concepts will come into play in an interrelated fashion:

Surprise: The use of hybrid vehicles on the battlefield will become relevant for two reasons. In addition to zero or low emissions hybrid or low emission vehicles have no exhaust "foot print". They feature increased stealth capabilities due to lack of exhaust fumes or infrared signatures that can be readily detected by enemy forces.

Mass: Better fuel efficiency provides the opportunity for increased loiter time over the target area for aircraft thus increasing overall kill capability. Greater fuel efficiency increases the military's ability to quickly assemble an overpowering force in the battlefield and increases the overall flexibility of that force to strike at the enemy's weakest point as Clausewitz directed.

Maneuver: Increased fuel efficiency allows the military to travel further and faster with enhanced agility.

[160] Ibid

Simplicity: Simplicity is another important consideration due to the principle of friction. Especially in Air Force Operations, fuel efficiency decreases complexity, frequency, and or the number of rendezvous between combatant aircraft and tankers.

Due to the factors mentioned above, a DoD policy of decreasing emissions which have positive environmental implications and promotes positive health effects associated with CO^2 reductions also has positive battlefield implications for the U.S. military. Thus the military has the unique potential to address an environmental problem in global warming whose myriad of effects are likely to act as a boomerang an increase in a variety of expenditures and become more bogged down in humanitarian operations.

The relationship between global warming and military operations could be summarized as follows. Global warming has a detrimental impact on military operations. However due to the magnitude of its total energy use the military can employ greater energy efficiency in military operations to help solve the global warming problem. In addition to its benefits for the environment, greater energy efficiency carries the additional benefit of improving the effectiveness of military operations.

Physical Implications of Global Warming for the U.S. Warfighter:

Global Warming could lead to increasing combat deaths. From a strategic perspective global warming can cause uncertainties in battlefield conditions. These uncertainties may include increased disease and vermin vectors or the possibility of unanticipated heat or

storm activity. These uncertainties in battlefield conditions complicate planning and execution of military operations.

The Department of Defense and Climate Change

Climate change has received little attention as a strategic issue. Reflecting some level of awareness about the potential consequences of global warming, however, the U.S. National Security Strategy 2002 (NSS) includes national reduction of greenhouse gas emissions as a strategic goal. The NSS states that:

> "economic growth should be accompanied by global efforts to stabilize green house gas concentrations associated with this growth, containing them at a level that prevents dangerous human interference with the global climate. Our overall objective is to reduce America's greenhouse gas emissions relative to the size of the economy, cutting such emissions per unit of economic activity by 18% percent over the next 10 years by the year 2012."[161]

In recognition of the link between global warming and national security, the Department of Defense implemented internal measurers to limit the Pentagon's contribution to the problem. The following Presidential Executive Orders in 2000-2001 on the agency-wide level.

- Executive Order 13123, Greening the Government through Efficient Energy Management.
- EO 13134, Developing and Promoting Biobased Products and Bioenergy.
- EO 13148, Greening the Government through Leadership in Environmental Management.

[161] George W. Bush, *The National Security Strategy of the United States of America*. (Available at http://www.whitehouse.gov/nsc/print/nssall.html.); accessed on March 3, 2008.
The National Security Strategy of the United States of America. .

- EO 13149, Greening the Government through Federal Fleet and Transportation Management.

The Department of Defense plays a significant role as an Environmental Steward. Global warming also has implications for U.S. national security because it has a direct impact on land used for military purposes. DOD bears fiduciary responsibility for resource conservation and environmental protection of 26 million acres of land and hundreds of thousands of square miles of airspace that is not necessarily being utilized for military purposes at any given time. DOD land, like all other, is subject to the effects of global warming. Chief among these effects are probably desertification and sea-level rise. The military's mission readiness, and even its fundamental ability to execute its mission, depends on continued access to and the condition of its bases and training ranges located on these lands.

Beside the negative physical effects of global warming on the training ranges themselves, DoD faces continued potential operational risks. These risks could actually be political in nature because perceptions can be as important as reality in global warming politics. They can be found as the in the form of community opposition of DoD operation due to the perception that it has failed to uphold its environmental responsibilities of stewardship of the land that it possesses. This type of opposition could be fomented by the perception that DoD has failed to protect the global environment by working to cut emissions commensurate to the actions now being taken within other industries and sectors of the economy from heavy manufacturing to the insurance industry. The

manufacturing and chemical sectors are examples of other sectors that have established various schemes to reduce carbon emissions.

Global warming may also impact on the ability of the Armed Forces to maintain focus on their primary mission of warfighting. It is a widely held belief among the American military leaders that operations other than war (OOTW) detract from "normal" military mission focus such as combat training and support for the current Global War on Terror. As noted in the case studies of the next chapter, U.S. troops will likely be diverted toward domestic and international non-combatant roles such as hurricane, tornado and flood relief. Disaster relief and civil unrest in Bangladesh for example is highly likely to require a U.S. role in peacekeeping operations there.[162]

Another potential national security liability is represented by the fact that on the domestic front, U.S. nuclear electric power is being ramped up partially in response to the desire to reduce greenhouse gas emissions caused by coal burning power plants. The addition of more nuclear reactors to the U.S. fleet will require increased critical infrastructure protection from the state and national governments including possible deployments of the National Guard to reactor sites. The National Guard is currently heavily overextended due to its ongoing deployment in Iraq. The aforementioned factors are only a few of the most notable impacts of global warming on the U.S. military as a whole impacts of specific services has been offered by other authors such as Sawin and Glenn.[163]

[162] National Intelligence Council 2000
[163] See Jerome C. Glenn, Theodore J. Gordon and Renat Perelat, *Defining Environmental Security: Implications for the U.S. Army*, Army Environmental Policy Institute, December 1998, AEPI-IFP-1298

Conclusions

The Millennium Ecosystem Assessment (MEA) offers a global perspective on global warming's impacts. The MEA is a four-year effort designed by a partnership of UN agencies, international scientific organizations, and development agencies, with guidance from the private sector and civil society groups. It is designed to meet the needs of decision-makers and the public for scientific information concerning the specific consequences of global ecosystem change for human well-being and present options for responding to those changes.

The MEA's work was conducted by 1,300 experts from 95 countries. It was overseen by a 45-member board of directors, co-chaired by Dr. Robert Watson, chief scientist of the World Bank, and Dr. A. H. Zakri, director of the United Nations University's Institute of Advanced Studies. The Assessment Panel, which oversees the technical work of the MA, includes 13 of the world's leading social and natural scientists.[164]

The study found that "Any progress achieved in addressing the goals of poverty and hunger eradication, improved health, and environmental protection is unlikely to be sustained if most of the "ecosystem services" such as clean water and fresh air on which humanity relies continue to be degraded." It specifically states that the ongoing degradation of ecosystem services is a road block to the Millennium Development Goals to alleviate poverty agreed to by the world leaders at the United Nations in 2000.

[164] About the Millennium Ecosystem Assessment : (available from http://www.millenniumassessment.org/en/About.aspx); accessed April 15, 2007.

In the MEA, experts warn that the ongoing degradation of 15 of the 24 "ecosystem services" examined in the report is increasing the likelihood of potentially abrupt global changes that will seriously affect human well-being. This includes the emergence of new diseases, sudden changes in water quality such as the creation of "dead zones" along the coasts, the collapse of fisheries, and shifts in regional climate.

The report also demonstrates perhaps not surprisingly that it is the world's poorest people who suffer most from ecosystem changes. This is at least partially due to an unlucky but not positive/significant correlation between poverty and areas that are heavily impacted by global warming. According to the assessment, the regions facing the most significant potential for ecosystem degradation are sub-Saharan Africa, Central Asia, some Latin American regions, and parts of South and Southeast Asia. An analysis of the report shows that these regions correspond almost exactly to the regions currently facing the greatest challenges in achieving the United Nations' Millennium Development Goals.

What is more interesting in the context of this dissertation, however, is that these areas also correspond roughly to the regions that greatest security concern to the U.S. intelligence related to the global war on terror.[165] When viewed in this context the dedication of significant resources to a National Intelligence Estimate on climate change would not divert resources for the global war on terror but may provide policymakers with a useful map marked with the potential locations of future outbreaks of violence.

[165] Sub-Saharan Africa is perhaps the sole exception to this observation. However, the number of poor people in this region is forecast to rise from 315 million in 1999 to 404 million by 2015 keeping it a priority for donor agencies.

Furthermore, the UN Environmental Program estimates that the extra economic costs of disasters attributable to climate change such as floods, storms, and hurricanes, runs at more than $300 billion annually. While this number is very conservative, my research indicates that the capacity of the U.S. economy to adapt to a limited climate change scenario such as that presented by the IPCC appears to be relatively high.

However, unlike the countries that I will examine in the next chapter America's low population, enviable geography and advanced health care opportunities give this country a relatively high capacity for adaptation to climate change. The potential mobility of the U.S. population within its borders alone gives it significant advantage over countries I will turn to in the next Chapter such as Egypt and Bangladesh.

Despite these and other significant advantages enjoyed by the U.S., I have briefly identified a number of discrete impacts of global warming through out this chapter that represent a significant economic burden. I have surveyed the destruction of land, homes, industries, species and military facilities. These impacts--when taken in the aggregate--demonstrate a substantial if not existential effect on various aspects of U.S. national security in the political, physical and strategic arenas of the heuristic national security typology I have presented. An illustrative summary chart of that typology is as follows:

Global Warming's Impact on U.S. National Security: Domestic Trends

CATEGORY	DESCRIPTION
Physical	Over the next 100 years, 4-10 inch sea level rise, 4-20 degree temperature rise and associated financial losses.
Physical	Threats to the health of the U.S. population such as increased disease vectors, summer deaths from heat waves.
Physical	Biodiversity: Species losses that effect aboriginal lifestyles in the Arctic, loss of forests, agricultural lands and water resources including coral reefs.
Political	Political instability caused by influx of environmental refugees
Political	Increased likelihood of internal conflicts over scarce resources (e.g. water in the Western states)
Strategic	Increasing tensions with Mexico over water usage spill over into other arenas such as trade.
Strategic	U.S. military becomes engaged at home in Operations Other Than War (OOTW) such as disaster relief operations from storms, floods and diseases, border patrolling., loss of military training ranges
Strategic	Territorial disputes with Russia and Canada over the jurisdiction over the Northern Sea route and access to seabed resources.

Chapter 3:

Scoping the Climate Change's Impact on U.S. National Security: Regional Case Studies

Introduction

Before delving into future scenarios of the impact of global warming as I shall do later in this chapter, I note that climate change has already resulted in significant changes to human lifestyle. Environmentally induced demographic shifts have clearly emerged as one of these trends. It has been estimated that 58 percent of the world's forty-three million refugees are displaced by environmental degradation.[166] Other weather related calamities provide ample precedent for the potential severity of global warming's impacts. Large weather related events have accounted for 90 percent of the global weather-related losses of $1.4 trillion and have accounted for 26 of the 36 most expensive insurance losses on record.[167] A 2003 heatwave in Europe was responsible for 38,000 deaths.[168] The literature on armed conflict demonstrates that more people have perished in recent years as a result of large scale natural disasters than from warfare.[169] But evidence also suggests that global warming can take a gradual toll on humanity that is less outwardly visible than natural disasters such as tsumanis. Nearly 60% of weather-related financial losses derive from simple temperature extremes or droughts.[170]

[166] Nate E. Hultman, "The Changing Face of Normal Disaster: Risk, Resilience and Natural Security in a Changing Climate," *Journal of International Affairs* 59: no. 2, 31.
[167] Ibid,
[168] Ibid
[169] Busby 28
[170] Hultman 27

Evidence regarding the significance of global warming and its impact on human lifestyle and ecosystems is growing and undeniable. However, I have found through my research for this chapter that the development of comprehensive threat assessments is challenging because climate change impacts must also be contextualized within a myriad of uncertain social and political situations.

A Note on Selection of the Case Studies:

I have chosen to measure the national security impacts on the United States of phenomenon brought about by climate change in Mexico, Bangladesh and Egypt. The following case studies were selected to focus on regions with different meteorological patterns and biomes. The selection of these countries will allow me to analyze a diverse a sampling of the potential variations in the regional effects of climate change. Focus on these countries allows me to control for a variety of climate change related impacts and to give as holistic an idea of the worldwide impact of the various manifestations of climate change as possible. For example, sea level rise is a greater root cause of potential societal instability in Bangladesh and Egypt than Mexico. Desertification is a more significant factor in Egypt and Mexico. I expected that increased storm activity is more of a factor in Mexico and Bangladesh than it is in Egypt. I have chosen to focus on these three not only for their differing climate but because they rely on different agricultural and industrial bases for their subsistence. There are also some similarities among the case studies. All of the countries in my case studies share the demographic trend of a high

population growth and they all contribute a small amount to overall world green house gas emissions.

Finally, choosing three countries that represent a geographical diverse sample allows me to analyze the impact on U.S. national security interests from a variety of regional and geopolitical perspectives.

I have noted several similarities in the following three countries chosen. The three aforementioned regions are similar in that they share the common challenge of a coping with resource constraints caused by a rapidly growing population in the context of a struggle to adapt to the effects of global warming. I have maintained a broad geographical scope while concentrating on the analysis of countries in regions that have proven themselves to be of traditional security concern to U.S. policymakers.

Overview:

In this chapter I have elected to examine global warming's effect on the national security status of three selected developing countries.[171] The hypothesis of the case studies is that global warming may be a cause or a causational factor in creating significant destabilization or societal disruption. The adverse effects of global warming can, particularly when combined with other factors such as population growth or scarcity of natural resources, contribute to increased potential conflict. These disruptions could in

[171] While I originally intended to include Afghanistan in this survey very little is known about the effects of climate change in this country due to the fact that the war there has prohibited research, such as the assessments related to the IPCC process, from being conducted.

turn spark significant violence possibly leading to phenomenon such as environmental refugee flight from regions that are sensitive to U.S. national security or in extreme cases, even state failure. So far, the Kyoto Treaty regime has not established mechanisms designed to moderate potential conflicts caused by global warming although such measurers have been discussed. Global-warming induced conflict may warrant direct U.S. military intervention or may cause conflicts that are likely to spread beyond the borders of the countries I have chosen to examine into more sensitive regions or in the case of Mexico, to the U.S. itself.

The following three case studies are an attempt to explain the ways in which environmental changes sparked by global warming may indicate a cascading series of events that are inimical to the national security of the Bangladeshi, Egyptian and Mexican States. More proactive climate and environmental policies could lessen global warming's impact and hence the potential for violence related to global warming. I have therefore held the variable of policy change constant in my analysis since changes in this area would be impossible to predict.

Bangladesh

Country Overview

"The price we pay for the crimes of the rich."[172]

Bangladesh is a relatively small country with a total area of only 147,570 sq km, approximately the size of the State of Connecticut. Three sides (West, North and East) are bounded by India and the south-east by Myanmar. The direct southern part of the country is bordered by the Bay of Bengal. Bangladesh is one of the world's largest deltas, formed by a dense network of 230 unstable rivers; most of the country is less than 10 meters above sea level.

Bangladesh has a warm, humid and tropical climate. Due to the influence of the monsoons, Bangladesh is wet throughout the year but the climate features three distinct seasons: hot summer with sufficient rainfall (March to June); hot and humid monsoons (June to October) featuring heavy rainfall; and a drier and cooler tropical winter (November to March).

Bangladesh is the most densely populated country in the world with 965 people per square mile.[173] The total population was approximately 150,000,000 as of July 2006.[174]

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[172] Mohammad Mozahidur Rahaman, *The Daily Star*, Vol. 5, No 213, December 29, 2004.
[173] Saleemul Huq and Khondkar Moinuddin, "Climate Change, Vulnerability and Adaptation in Bangladesh" in Climate Change Five Years after Kyoto, ed. Vlema I. Grover, (Enfield, New Hampshire , Science Publishers, Inc., 2004), 251.
[174] The Central Intelligence Agency, *World Factbook, 2006*. (available at https://www.cia.gov/cia/publications/factbook/geos/bg.html); accessed on February 1, 2006.

The Ganges, Brahmaputra, and Meghna (GBM) River systems flow through Bangladesh carrying at least 953 million acre feet of water. At least 90 percent of this water originates the upstream countries of the three major river systems. The water supplies an economy that is based primarily on self-sufficient non-plantation agricultural systems. Due to the lack of heavy industry, Bangladesh has one of the lowest per-capita energy consumption rates in the world. The aforementioned agricultural economy and a low rural electrification rate (only one fourth of Bangladesh's rural population has electricity), result in the country emitting less than 1 percent of the world's greenhouse gases.[175]

Survey of the Impacts of Global Warming on Bangladesh

Sea Level Rise:

Despite its minuscule contribution to global emissions, Bangladesh is the country where perhaps the greatest number of people will be affected by climate change-induced sea level rise. At least 17 million people live less than one meter above sea level.[176] According to several estimates, within the next 100 years, the oceans could rise by a meter or more leaving approximately ten percent of the country inundated. There are currently about 20 million people living in this area. The population of these areas is expected to grow by approximately half over the next 50 years. Therefore, the number of people that will probably have to be relocated and will certainly have to change their livelihoods to survive is in the tens of millions. One source has estimated that number at

[175] Bruce E Johansen, *Global Warming in the 21st Century: Melting Ice and Warming Seas*, (Westport Connecticut: Praeger , 2006)
[176] Arctic Council 5.

26 million[177] The following chart outlines two potential sea-level rise scenarios and their consequences for Bangladesh.

Sea-Level Rise	Potential Land Loss	Population Exposed
45 cm	15,668 km or 10.9%	5.5 million or 5%
100 cm	29,846 or 20.7%	14.8 million or 13.5%*[178]

The latest climate models indicate that flooding in Bangladesh will increase up to 40 percent this century as temperatures rise due to global warming. Each year, roughly a fifth of Bangladesh is flooded, and sea level rise is forecast to exacerbate the problem. As sea levels rise, monsoons become wetter exacerbating the problem. Evidence suggests that global warming may be causing more intense cyclones lead to higher tidal surges.[179] In the area of human health, sewer overflow caused by sea level-induced flooding will likely cause an acceleration of the outbreak of waterborne illness.[180]

In late December 2006, Lohachara island in the Sundarbans where the Ganges and the Brahmaputra rivers empty into the Bay of Bengal gained the dubious distinction of being the first inhabited island to be lost to global warming-induced sea level rise. Lohachara was once home to over 10,000 people. Two thirds of a populated island nearby has also

[177] Dr. Bryan Furnass, *Draft Discussion Paper for the Doctors for the Environment Australia* (Available at http://www.manningclark.org.au/newsletter/nl30_furnass.html); Accessed on March 3, 2007., Page 1.
[178] Intergovernmental Panel on Climate Change, IPCC. *Climate Change 2000: Synthesis Report* (Available at http://www.grida.no/climate/ipcc_tar/wg2/446.ht); accessed on June 7, 2006.
[179] Rahaman.
[180] Hultman, 31.

been inundated. There are reportedly one dozen islands with a combined population of 70,000 on the Indian side of the delta in danger of sharing the same fate.[181]

Consequences of a One Meter Sea-level Rise Scenario

The Bangladesh Center for Studies, the leading organization currently conducting research on climate change and Bangladesh, estimates that 17.5 percent of the country's land area would be inundated in the case of a one meter sea-level rise.[182] Similarly, the IPCC estimated that a 1 meter sea level rise would flood 17% of the country.[183] Approximately 6.5 million people live in this zone.[184] In the event of a 5 meter sea-level rise which is also within the scope of several estimates, water would rise 150 kilometers inland past the capital of Dhaka, which is the center of the country.[185] Tens of millions of people live between Dhaka and the sea right now would be displaced.

The floods resulting from sea level change would have a profound effect on Bangladesh's fragile ecosystem. The Sundarbans National Forest, the world's largest mangrove forest and home of the infamous man-eating Royal Bengal Tiger, is in the epicenter of the area that would be most affected by the one meter sea level rise scenario. The mangroves of the Sundarban serve as a buffer against the heavily populated Khulna region. Lack of

[181] Geoffrey Lean, "Human cost of global warming: Rising seas will soon make 70,000 people homeless" *The Independent UK*, December 26, 2006. (Available at http://news.independent.co.uk/environment/article2099971.ece); accessed January 17, 2007.
[182] James M. Broadus, "Sea Level Rise and the Bangladesh and Nile Deltas" in, *Global Environmental Risk*, eds. Jeanne X. Kasperson and Roger Kasperson (New York: The United Nations University, 2001) 357.
[183] Hans Gunter Brauch, *Climate Change, Environmental Stress and Conflict*, (Berlin: Federal Ministry of the Environment, Nature Conservation and Nuclear 2002) 77.
[184] Broadus, 371.
[185] Baruch, 80.

this buffer zone created by the mangroves could leave the population susceptible to storm surges. Bangladesh's agricultural productivity would be heavily affected by the floods as well. Agricultural production in this zone represents about 50 percent of Bangladesh's GDP and approximately 85 percent of its population depends on agriculture for its livelihood and sustenance.[186] A one meter rise in sea level could represent a one to two percent loss in agricultural productivity by 2050.

One fortunate aspect of the situation from the perspective of the Bangladeshi's is that due to the essentially agricultural nature of the land, very little durable infrastructure is found in the area that will be effected by a one meter sea level meter rise.[187] The small amount of industry Bangladesh does possess, however, could be motivated to relocate to more temperate nations as a reaction to rising temperatures.[188]

Global Warming's Effect on Monsoons

Warmer temperatures will increase the intensity of cyclones that develop over the Bay of Bengal making the prevailing weather patterns more unpredictable. In June 2004, meteorologists blamed global warming for Bangladesh's most overdue monsoon in 33 years. The monsoon occurred two weeks later than its normal arrival time. The monsoon, which brings much-needed rain following the dry season across the subcontinent, normally sets in across the entire country by June 5, bringing heavy downpours. The 2004 monsoon season was also unusual because it did not produce much rainfall. It

[186] Broadus, 359.
[187] Broadus, 367.
[188] Jurgen Schmandt and Judith Clarkson, *The Regions and Global Warming, Impacts and Response Strategies*, (New York: Oxford University Press, 1992) 86.

followed a year of unusual weather patterns. In 2005 experts said the winter was the shortest in 10 years with seasonal rainfall also 60 percent below average. Winter in tropical Bangladesh normally starts December 1 and lasts until February 28. But in 2005, meteorologists said winter was over by February 5.[189] Environmentalists claim the effects of global change on monsoons are not being adequately monitored since the last major studies were done in the 1990s.

Downstream Flooding Caused by Glacial Melting

Flooding, aggravated by deforestation in the Himalayan watershed and melting of the mountain glaciers, has exacerbated the already extant environmental refugee problem. Floods along the country's three major rivers are happening more frequently and this trend is expected to worsen. The cyclone that has killed the most people ever in recorded world history is an unnamed typhoon that struck Bangladesh in 1970 killing 300,000 mostly as a result of flooding.

There are 3,300 glaciers in the Nepalese Himalayas and 2,300 of them contain glacial lakes.[190] These lakes are growing because of flooding related to ice melting due to rising temperatures. More than 40 lakes in the Himalayas could burst at anytime according to a study by the International Center for Integrated Mountain Development; only two of the lakes currently have early warning systems. Mountain glacier melt is heavily accelerated by global warming and the lakes are growing deeper annually. Disasters are growing

[189] **"**Bangladesh Has Longest Wait for Monsoon in 33 Years" *Terra Daily***,** Dhaka, June 22, 2005.
[190] Navin Singh Khadka, "Himalayan Glaciers Melt Unnoticed" BBC News World Edition, Wednesday, November 10, 2004.

more frequent. Since 1935, 12 glacial lakes have burst in Tibet, an occurrence that used to happen every 500 years. Glacial melting has already led to disaster more than a dozen times in Nepal in the last 70 years. In 1985, Dig Tsho Lake burst destroying 14 bridges and killed at least 20 people. It also washed away a hydropower station and a trekking trail. A burst lake high in the Himalayas could have regional consequences for Bangladesh because it can cause flash floods which could sweep away people, houses, roads and bridges in Nepal, Bhutan, Bangladesh and India

As I have previously mentioned, no systematic on-the-ground research on the future prospects of such disasters has taken place since the mid-1990s. Despite this there is abundant anecdotal evidence of increased glacial melting in the region. Between 1970 and 1989, Japanese researchers discovered most of the glaciers in the Khumbu of Nepal had retreated 30-60 meters. In Nepal's Dhaulagiri region, field studies conducted before 1994 showed the same trend. Finally, Nepal's most studied glacier in Tsorong Himal underwent a ten meter retreat between 1978 and 1989.[191]

While swelling glacial lakes are increasing the risk of catastrophic flooding in Bangladesh the final impacts of global warming on the mountain systems could be even more devastating. In the long term, the glaciers could disappear altogether, causing several rivers to shrink and threatening the survival of those who depend on them for drinking and irrigation water.

Glacial melting as a result of global warming in the Himalayas has become so pronounced that a group of conservationists and climbers of Mount Everest have asked

[191] Ibid.

the UN World Heritage Committee to place Everest on a list of the world's most endangered places.

Increased Disease Vectors

Higher temperatures and greater amounts of standing water will increase the mosquito population. Mosquito-bourne diseases are therefore likely to increase. Malaria is the most dangerous of these diseases. Bangladesh currently experiences at least 5 million illnesses per year. The World Health Organization (WHO) says that the toll could double by 2030. A WHO official announced the worst outbreak of dengue fever in South Asian history; it affected 120,000 South Asians this year and killed 1,000.[192]

Selected Effects of Global Warming on Bangladesh

The following section summarizes the effects of global warming on Bangladesh.

Coastal Zone of Bangladesh

- Water left behind after a region is flooded caused by the high water flow and over sedimentation in the flood plain. (Drainage congestion)
- Encroachment of sea water causes increased salinity of freshwater bodies.
- Changing river flow dynamics causes erosion and degradation of the soil.
- Coastal storm-surges damage the land.

[192] Juliet Eilperin, "Climate Shift Tied to 150,000 Fatalities: Most Victims Are Poor, Study Says" *Washington Post*" Thursday, November 17, 2005.

Fresh Water Resources

- Fresh water availability is decreasing due to increasing demand, increased evaporation and lower river discharge.
- Decline in fresh water fisheries production.[193]

Agriculture

- Increased temperatures threaten agricultural production.

For each 1 degree of increase in night time temperature rice yield will decline by about 6-10%. The average change in wheat yields would average from +4- -34 percent.

- Loss of farm-level net revenue as high as 25 percent.
- Agricultural stocks are threatened by flood water.
- Saline water intrusion hampers agricultural production.
- Mass unemployment. 63% of the Bangladeshi labor force is engaged in agricultural production.
- Large parts of the Ganges Delta are subsiding because the water has been withdrawn for agriculture.
- Soil erosion and a falling water table will impede the Boro Rice yield which is essential to food security.[194]

Public Health

- Waterborne diseases are already responsible for 24% of all deaths in Bangladesh.
- Diarrhea, cholera and other waterborne diseases are increasing due to climate change.
- The rise in sea surface temperatures (SSTs) will better accommodate cholera.

[193] Huq, 269. :
[194] Hultman-33

- Reduction of drinking water availability
- Extreme events such as floods present risks to human lives.
- Loss in agricultural production poses an ultimate threat to the food chain.
- Hotter temperatures will cause more deaths.

Ecosystem and Biodiversity

- Increased salinity stunts tree growth in the Sunderban region.
- Lower River and ground water flow may cause desertification in the coastal zone in some sensitive area.
- Increase in temperature reduces the availability of fishes.

Adaptation Measures

Adaptation is defined as any adjustment of physical infrastructure, natural systems; social and economic activities or institutional arrangements that reduce the vulnerability to climate change or enhances the opportunities that these changes offer a society.[195]

The Bangladeshi government has a low "adaptive capacity." The structure of the government is such that it would impede effective adaptation response. Part of the reason for this is that the Government of Bangladesh (GOB's) lack adequate resource to address the problem and their government also expresses the sentiment that the international community bears some responsibility. Depending on the type and range of the problem, the GOB, NGOs or research organizations can play a role in the development of

[195] The World Bank. *Bangladesh Climate Change and Sustainable Development*, World Bank, July, 2001. (Available at http://wbln0018.worldbank.org/lo+web+sites/bangladesh+Web.nsf/All/6DE0A774ACF0365185256A7E006AE31A?OpenDocument); Accessed on October 17, 2008.

adaptation strategies. The United Nations Framework Convention on climate change (UNFCCC), adopted in 1992 also provides some mechanisms to fund adaptation.

The GOB has created a new division within the Department of Environment to address climate change. In 2005, with funding from the United Nations, it completed a National Adaptation Plan of Action, which proposed sweeping changes including reforesting the coast, finding new sources of drinking water, and spreading awareness about the effects of climate change among the Bangladeshi population.

In 2003, the GOB developed a Comprehensive Disaster Management Plan (CDMP) in conjunction with the United Nations Development Program (UNDP). In 2004 The GOB established a climate change office as a division of the Department of the Environment. The World Bank and Asian Development Bank (ADB) have also sponsored several adaptation projects in Bangladesh.

The GOB has constructed at least 1800 cyclone shelters and nearly 200 flood shelters.[196] However, Bangladesh faces many challenges as it tries top develop an adaptive infrastructure. Lack of funding is chief among these challenges.

With adequate funding and organization, the following adaptive measurers could be undertaken by Bangladesh.

- Increasing existing drainage capacity to avoid the drainage congestion in the coastal zone.

[196] World Bank, 21.

- Building new infrastructure and drainage to promote water management in the coastal area.
- Dredging of navigable channels (thalwegs) to increase the river flow in river and reduce the water congestion.
- Establishing warning systems that could be constructed to minimize the impact of storm surges and cyclones.
- Establishing water and sewage treatment facilities to maintain safety and provide quality drinking water.
- Constructing reservoirs behind dams upstream on the major rivers.

Due to the country's precarious financial status, it is unlikely that the government will be able to initiate sufficient adaptation measures before pressures such as the nation's rate of population growth overwhelms their reactive capacity as described below.

The major question is whether adaptation measurers undertaken in Bangladesh will be adequate even in the best of circumstances as most of climate change's effects in Bangladesh are irrevocable and gradual. Even a large budget dedicated to adaptation would thus fail to stem the rate of change.

Population Growth

The impact of global warming on Bangladeshi society's sustainability will only be exacerbated by rapid population growth and increased competition for scarce resources. The UN predicts that Bangladesh's estimated population of 142.9 million will nearly double to 235 million by the year 2025 if present growth rates are taken into consideration. According to the UN, the population of Bangladesh has been projected to

rise from 137.439 million in the year 2000 to 265.432 million by 2050.[197] For the sake of comparison, one need only consider that, the population of Bangladesh, which is roughly the size of the State of Wisconsin, is over 900 people per square kilometer. However, population density in the neighboring state of Assam in India is under 300 per square meter. This dichotomy creates incentive for refugees to flee across that border even in the best of times. Population migration from Bangladesh has expanded the population of neighboring areas of India by 12 to17 million of which only one to two million can be attributed to migration resulting from the 1971 war between India and East and West Pakistan.

The Indian state of Assam has received an additional seven million people many of whom are climate refugees. The Lalung tribe in Assam has resented the influx of Bengali Muslims who have been accused of stealing the best farm land. This situation could be exacerbated and violence could erupt in this region.[198] In the Indian State of Tripura, Christians have also been displaced by Muslims from Bangladesh. There is evidence that this migration resulted in a violent insurgency movement that lasted from approximately 1980 to 1988. The Indian government intervened and agreed to shift the land to the Tripuris.

Bangladeshi refugees could flee to the Indian States of West Bengal and Assam and to Myanmar. Bangladeshis have the potential to upset the delicate demographic balances in India but also to the Middle East where many Bangladeshis have traditionally sought

[197] Brauch, 78.
[198] Thomas A. Homer Dixon, Environmental Scarcities and Violent Conflict: Evidence from the Cases, *International Security*, 19:1, 21.

work. It is even conceivable that Europe and the United States could be affected. Larger intracommunal migration within Bangladesh itself is likely to cause increased competition for natural resources resulting in increased unrest and some level of violence.

While global warming undoubtedly plays a significant role it is worth noting that other factors beside climate change such as a sociological conception of the existence of a greater state of Bengal that have also accelerated emigration to India.

It is probable that economic hardship in Bangladesh could also lead to a refugee exodus to Myanmar (Burma) especially because India has been more effective at shutting down its shared frontier with Bangladesh. Burma is also a relatively attractive place to emigrate to because it has a much lower population density than India. Some analysts see a war between an increasing fundamentalist Islamic Bangladesh and a Buddhist Myanmar sparked by the flow of environmental refugees as being inevitable. The Burmese government has reportedly been talking with North Korea about the possibility of cooperation toward the development of a nuclear capability so that Burma can be ready for what they perceive is a Muslim invasion.[199]

Historical Overview of Communal Violence in Bangladesh

Bangladesh experienced several military coups after its founding in 1971. There is ample precedent in Bangladesh for communal violence related to land issues. In the Chittagong

[199] Laina Farhat-Holzman, "Rising Sea Waters Propel another Conflict: Bangladesh and Burma" *The Santa Cruz Sentinel*, April 16, 2006.

Hill Tract area of the country, population pressure led to the displacement of the population giving rise to the "Shanti Bahini" movement. The Shanti Bahini is an armed independence movement and political group that were finally banned in 1999. The group is composed largely of Chakmas, a Buddhist tribe of perhaps 500,000 who are distinct from the predominately Muslim population and view themselves as victims of land reform policies. The group was brought under government control in 1999.

The enormous influx of immigrants to Assam and Tripura over the last forty years has made pervasive social changes in the regions that have experienced the influx of immigration. Members of the Lalung Tribe in Indian Assam have long resented Bengali migrants. This resentment led to violence in 1983. In total, more than 4,000 people were killed in a series of violent incidents in the early 1980's. During a national election, Lalung Tribesmen massacred 1700 Bengalis in a five hour time span in an incident known as the Nellie Massacre.[200] Immigrants from Bangladesh have expanded the population of neighboring states of India by 12-17 million.[201] The situation has led some Assamese nationalists groups to push for succession from India. One such group is allegedly receiving assistance from Pakistani Intelligence and Al Qaeda.[202]

Geopolitical Conflict with India

It is likely that India will elect to increase its rate of water withdrawals from joint river systems due to drought conditions. This action will leave less water for downstream use

[200] Homer-Dixon, 183.
[201] Homer-Dixon, 95.
[202] "Ulfa: A Student Movement that Treads the Terror path": *The Times of India*, Monday, January 15, 2007.

in Bangladesh. This could increase the flow of refugees back to India. Bangladeshi immigrants to India's dissatisfaction with living conditions in the slums of Delhi and Bombay and native-migrant tensions has already led to many communal riots, and considerable loss of life. In 1992, the Indian government began a campaign to forcibly deport Bangladeshi immigrants. However, protests from the Bangladeshi government and Indian intelligentsia subsequently terminated this approach but the flow of refuges has deepened the rift between the two countries.[203]

Bangladesh felt an upswing in communal violence in August of 2005 when a series of over 300 bomb blasts shook the country simultaneously producing at least 100 casualties Most of Bangladesh's population is Muslim and the country has the world's fourth largest Muslim population. While the government of Bangladesh has always denied the existence of a significant Islamic militancy, these incidents demonstrate that all of the elements exist here to create such a phenomenon. An Islamic organization called the Jaamat-ul-Mujahideen that is fighting to establish Sharia law in Bangladesh claimed responsibility for the 2005 attacks. The group has also repeatedly threatened to attack judges, the law minister and court buildings if Sharia law is not instituted. The group is of national security concern to the U.S. because they have has also spoken out against American occupation of Muslim lands.

Bangladesh shares some of the same demographic and cultural trends that contributed to the rise of militant Islam in Afghanistan and Pakistan. Like Pakistan, Bangladesh has a network of madrassahs funded by foreign powers that have contributed to radicalization

[203] Robie I. Samantha Roy, *India Bangladesh Water Dispute*, ICE Case Study 78, American University, Washington D.C. (Available at http://www.american.edu/ted/ice/indobang.htm#r4); Accessed on May 4 2007.

of many poor youth. Furthermore, members of Jaamat-ul-Mujahideen reportedly received training from al Qaeda in Afghanistan and Pakistan and allegedly maintain links with that group.[204] It is also the case that many migrant laborers who have traveled from Bangladesh to Gulf countries such as the Saudi Arabia have become inculcated with a more radical version of Islam that in turn may make them more susceptible to recruitment by terrorists organizations and violent reactions toward the western nations that are primarily responsible for global warming.

The question is whether it is credible that the Jaamat-ul-Mujahideen or other radical groups would incorporate the United States' and other developed countries contribution to global warming, a phenomenon that threatens to eradicate Bangladesh, into the suite of reasons to contemplate and execute terrorist action against U.S. targets and interests. Elements of the potentially explosive mix of environmental degradation and nascent Islamic extremism described above are common to both Bangladesh and Egypt, a country I will turn to in a subsequent case study in this chapter. I believe that it is likely that the first significant documented cases of environmental terrorism will originate from this context.[205]

[204] Stratfor, Jamaat-ul-Mujahideen in Bangladesh: A Growing Threat, November 23, 2005 (available at http://www.stratfor.com/products/premium/read_article.php?id=258900): Accessed on July 13, 2007.
[205] While some events such as the destruction of a Ski Lodge at Vail by an organization known as Earth First in the 1990s could qualify as an environment-related terrorist act it does not qualify as a significant impact on national security.

Potential Effects of Global Warming Problems in Bangladesh on U.S. National Security:

There is mounting evidence that the ecological and socioeconomic damage caused by global warming will be disastrous for Bangladesh. The effects are expressed at least somewhat in terms of social unrest and violence within the country. Bangladesh almost certainly is likely to experience an exodus of economic refugees toward neighboring states, particularly India.

The resultant social dislocation is likely to spread their resulting in significant geopolitical ramifications. By 2100 taken at its most extreme, internal social and political instability caused by population migration and land eradication among other factors could threaten the very survival of the country.[206] For example, migration could lead to minor border clashes with India or Myanmar.

Bangladesh has resisted India's attempts to fence or wall off high-traffic sections of the porous boundary. A joint Bangladesh-India boundary inspection in 2005 revealed 92 pillars of the border fence are missing but Bangladesh has not taken action to address this problem.[207]

Although India has increasingly emerged as a potential U.S. strategic partner, particularly during the second Bush Administration, general regional instability short of all out Indo/Pakistan war will not have a great impact on U.S. national security given other

[206] Baruch, 83.
[207] CIA

urgent priorities. I have presented some evidence, however, that Bangladesh could prove to be an agreeable nesting ground for terrorists. However, events such as cyclones and extreme floods brought about by global warming in Bangladesh are also likely to cause an increase in U.S. military force requirements as the U.S. is asked to contribute both manpower and logistical support to new regional humanitarian missions. An example comes from the severe cyclone in 1991 when U.S. forces were deployed in significant numbers after a catastrophe that left 200,000 people drowned and an astounding 10 million were homeless.[208] It has been widely reported that in the wake of the 1991 storm U.S. action proved decisive. It was only this rapid mobilization of the U.S. military that prevented widespread starvation and disease. Another fierce cyclone hit the nation in 1997. The increased frequency of these incidents foreshadows a greater potential role for the need for U.S. military assistance in the region.

Another potential scenario for regional conflict relates to upstream attempts to regulate the flow of Bangladesh's river systems. Massive dams built upriver in India have contributed substantially to the problem of backflow or seawater seepage into the lower reaches of Bangladesh's deltaic river system. Global warming-induced sea level rise will only serve to worsen the situation. This situation raises the potential that the Government of Bangladesh could decide to approach the Indian government for compensation or impose sanctions. It is even possible that they would contemplate an armed attack against the Indian dams.

[208] James M. Broadus, "Sea Level Rise and the Bangladesh and Nile Deltas" in Jeanne X. Kasperson and Roger Kasperson eds., *Global Environmental Risk*, The United Nations University, 2001, 357.

Potential Bangladeshi aggression toward India or western nations is influenced by a victim mentality that may seem farfetched at first glance. There is a widespread feeling in Bangladesh that the international community—particularly the more advanced industrialized nations including India—are responsible for global warming and that they should therefore bear responsibility for funding adaptation measures. This perception is exacerbated by the fact that sources of emissions such as automobiles are luxuries that ordinary Bangladeshis can't imagine. When asked about the very sources of global change Bangladeshi's point out that the nation emits less than one percent of the world's greenhouse gases, yet may well host suffering on the largest scale of any nation in a warmer world.

Conclusion

After tracing global warming's impact on Bangladesh, I have found significant evidence that global warming's impacts in connection with several other factors–chief among them population growth—will likely contribute to regional instability. South Asian regional instability will in turn have negative consequences for U.S. interests. One primary reason why the South Asian region is important to U.S. national security is because it is already arguably the world's most dangerous potential nuclear flashpoint. As stated, regional instability is likely to occur because migration may provoke violent confrontation between Bangladeshi climate refugees and those populations with whom they interact including Americans. Environmental degradation may be a new motivation for terrorism. Likewise, evidence has shown that intensified competition for climate-change redistributed resources could change the balance of existing internal conflicts and play a

significant role in ethnic and sectarian strife. In any case, this strife is likely to be accelerated by other factors such as population growth and the rise of militant Islam in the region. The factors among others will retard the ability of the Government of Bangladesh to respond adequately to the challenges posed by global warming.

Mexico

In addition to a location that is of obvious strategic interest to the U.S., Mexico has the world's ninth largest economy and ranks second among U.S. trade partners.[209] The country shares a border with Guatemala and Belize to the South. Mexico has experienced rapid growth over the last decade. The population of Mexico at the 1990 census was approximately 81 million. By 2000, it had reached over 100.5 million.[210] The Mexican Government projects that 29 million people will be added to the country's population before it stabilizes at about 131 million after about 2040.[211] Aside from rapid net growth, urbanization has been a major feature of Mexican demographic movement. More than 60 percent of the population now lives in the major urban centers which have grown at the rate of five percent annually since the 1960's. *The UN World Urbanization Prospects Report* has predicted that urbanization in Mexico will increase from 74.4% in 2000 to 81.9% in 2030. While the overall population has grown steadily, Mexico has actually experienced a net decline in fertility rate over the last four decades. Demand for

[209] *USAID, Environment Mexico* May 2006 (available at http://www.usaid.gov/our_work/environment/climate/country_nar/mexico_profile.html); accessed April 25, 2007U.S.
[210] Pew Center on Global Climate Change, *Climate Change and Mitigation in Developing Countries* (Washington D.C., 2002) (available at http://www.pewclimate.org/docUploads/dev%5Fmitigation%2Epdf); Accessed on June 19, 2007., 28.
[211] Ibid

water is expected to grow substantially with the rise in population. Some of the most densely populated cities such as Mexico City, Jalisco and Nuevo Leon have the highest rates of water usage consuming approximately 350 liters per day.[212] Mexico lags far behind other industrialized countries in terms of several key development indicators. Nearly five million people are without electricity. 27 percent are below the poverty line.[213]

Due to its latitude and topography, Mexico has a diversity of climates. Unlike other countries in the case studies presented in this thesis, Mexico has a wide range of vegetation zones. It is one of twelve "mega-diverse" countries in the world.[214]

Mexico signed the United Nations Framework Convention on Climate Change (UNFCCC) in June 1992 and ratified the treaty in March 1993. Total CO_2 emissions doubled between 1975 and 1990. Despite this net increase, Mexico currently contributes less than 2 percent to global emissions. Despite its ascension to the treaty, Mexico has done relatively little to combat global warming or take care of its own environment. Economic progress is presently taking priority over environmental issues, such as global warming or saving its own tropical rainforests.

Developments in Mexico are of concern to the U.S. national security establishment primarily because of the influx of immigrants. According to a 2002 the Urban Institute survey as well as other government data, about 5.3 million undocumented immigrants

[212] Baruch, 276.
[213] CIA World Factbook.
[214] Baruch 73

from Mexico are living in the United States based on a 2002 survey as well as census and other government data. Over 50 percent of all Mexican immigrants are undocumented, compared with about one in every six for the remainder of the foreign born. Currently 57percent of the undocumented immigrants to the U.S. are Mexican.[215]

A baseline scenario that does not account for major economic or social disruption in Mexico or major changes in U.S. immigration policy or enforcement strategies predicts that immigration will continue at roughly current levels. Therefore, the United States can anticipate the entry of another 14 million immigrants between 2000 and 2010. It is not difficult to imagine that this number could double as a consequence of the dislocation brought about by global warming. This is especially likely when refugees from El Salvador who transit to the United States through Mexico are taken into consideration. Migration induced by environmental factors is widely believed to be more pronounced in this country.

Sea Level Rise

The best available case study of the effects on sea level in Mexico was presented as part of the "Country Study: Mexico" conducted during (1994-1996) as part of the U.S. Department of Energy-sponsored Country Studies Program. Using a scenario that predicts a 0.5 meter per decade sea level rise the study found that the states of Veracruz and Tabasco will be the most vulnerable. The delta of the Grijalva-Usumacinta River in

[215] Jeffrey Passel, *Mexican Immigration to the U.S.: Latest Estimates, March 2004* (Available at http://www.migrationinformation.org/feature/display.cfm?ID=208); Accessed on June 19, 2007.

Tabasco would one of the most targeted areas. The Sian Ka'an bioreserve in Quitana Roo would be especially hard hit by a sea level rise.

Under this scenario, the sea is estimated to penetrate approximately 40 to 50 km inland according to the predictions of the coastal zone study that make extrapolations based on trends observed in 50 years of aerial photography.[216]

Sea level rise could cause large economic dislocations in Mexico. In addition to displacing large numbers of population, sea level rise will have an effect on energy production, supply and distribution facilities. Much of the linking infrastructure for the Mexican petroleum industry is found near the coasts.[217] Oil extraction platforms in the Gulf of Mexico "Campeche Sound" will be impacted by sea level rise.

According to the Mexican government it is clear that sea level rise will further contaminate water that is already highly polluted in many areas leaving less usable land for agriculture.[218] In addition to sea level rise itself, the increase in sea temperatures brought about by global warming will cause damage to the Mezo-American coral reefs offshore in the Caribbean. The reef is home to a wide range of aquatic life including fish that are relied upon as a food source by much of the coastal population. Rough waves

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[216] Celinda Conde and Carlos Gay "Impacts of Climate Change and Climate Variability in Mexico" *Acclimations, Newsletter of the US National Assessment of the Potential Consequences of Climate Variability and Change,* (September-October 1999). (Available at *http://www.usgcrp.gov/usgcrp/Library/nationalassessment/newsletter/1999.10/Mexico.html*); Accessed on February 4, 2007

[217] Government of Mexico, First National Communication for the Framework Convention on Climate Change (1997)Available at (*http://unfccc.int/resource/docs/natc/mexnc1e.pdf*); accessed on August 27, 2006

[218] Ibid

and violent seas could be detrimental to the reefs health. Satellite data confirm that elevated sea surface temperatures have been associated with widespread bleaching of the reefs in the western Caribbean and in the Gulf of Mexico causing million of dollars worth of damage to the fishing and tourism industry.

Desertification

Growing water scarcity and rising temperatures induced by global warming have led to increased desertification in Mexico. Currently, the central problem with water resources in Mexico is not the lack of water but its distribution. Most of Mexico's water is found in the south of the country where the population density is the lowest.

Under current scenarios, Mexico's central zone would be hit the hardest by the consequences of desertification. This region encompasses the states of Michoacan, Jalisco, Colima, Nayarit, and Queretaro. This most populous region of Mexico is already the most fraught with water supply problems. The challenge is further compounded by the fact that the central zone contains most of the country's industrial base. An estimated 700,000 to 900,000 of the recent immigrants to the U.S. from Mexico have come from the driest parts of Mexico.

Mexico is also highly susceptible to desertification due to the chronic problem of soil erosion. A method called Global Assessment of Soil Degradation; (GLASOD) indicated

64 percent of Mexico's land is in the process of desertification.[219] The National Commission of Arid Zones shows that 97 percent of the country has shown some signs of land degradation with more than 60 percent showing severe or extreme degradation.[220] Eleven of the thirty-one Mexican states have more than 68 percent of their territory designated as highly vulnerable to desertification.[221]

The U.S./Mexico Colorado River Dispute

Water scarcity has already been a significant issue in U.S.-Mexican relations. Responding to growing demand for water from the river system, the two nations formed a Treaty for the Utilization of Water of the Colorado and Tijuana Rivers in 1944. The treaty allotted to Mexico a guaranteed annual supply of water. However the treaty did not provide for the level of water quality which became a problem with rapid development in the southern U.S. during the late 1950's. Also during this period, the water became more saline because the U.S. began to divert significant amounts of water from the Colorado River to irrigate new areas under cultivation.

In November 1961 Mexico made the case that the waters it was receiving from the U.S. were not suitable for agricultural uses, and that agricultural production in the Mexico's Mexicali Valley was being adversely affected. Mexico alleged that the United States was violating the 1944 Treaty and international law. Mexico then entered into negotiations

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[219] Oralia Oropeza Orozco *Evaluación de la vulnerabilidad a la desertificación* (Available at http://www.ine.gob.mx/ueajei/publicaciones/libros/437/oropeza.html); (Accessed on Sepetember 14, 2007), 311.
[220] Adrian Guillermo Aguilar, *La Urbanizacion y el Cambio Climatico Global, Los Asentamientos humanos y cambio climatico global, de Cambio Climatico: Una vision desde Mexico*, Secretaria de Medio Ambiente y Recursos Naturales Insituto Nacional de Ecologia, 270.
[221] Government of Mexico, 105.

to resolve the dispute. In 1974, an agreement was reached that interpreted the 1944 treaty as guaranteeing Mexico the same quality of water as that being used in the United States. The U.S. agreed to construct a desalination plant to remediate the water.[222]

While the U.S. may be meeting its requirements under the Treaty, the Colorado is not providing as much water to the Mexican region as it would have in the absence of the rapid development in the U.S. The regions of Mexico that are already scarce on water due to the lack of available Colorado flow will become even more even vulnerable due to the global warming induced drought. This situation could become a political liability and exacerbate relations between the two countries.

Deforestation

Desertification and deforestation are closely related phenomenon because the former can drive the latter. Mexico has the world's second highest rate of deforestation[223] Government statistics indicate that nearly 50 percent of the temperate forest covers is at risk due to global warming.[224] Drought and deforestation are closely related concepts. Prolonged drought alone in Mexico will produce millions of eco-refugees in 2030.[225] The Mexican government's own analysis indicates that the lumber textile, paper and food industries will be adversely affected by lack of water.[226] The states of Chiapas and

[222] *Colorado River Water Dispute Case*, American University: Washington D.C. , (Available at http://www.american.edu/ted/colorado.htm); Accessed on May 12, 2007.
[223] USAID
[224] Government of Mexico
[225] Thomas Karas, *Global Climate Change and International Security*, Sandia National Laboratories, Sandia, New Mexico, November 2003.
[226] Government of Mexico, 121.

Quintana Roo are expected to experience a greater incidence of drought.[227] Chiapas is a politically sensitive region as will be described in greater detail below.

Agriculture

Land use change interacts with climate change in complex ways but overall Mexican agricultural productivity will certainly decline with the advent of climate change. The northern and central regions are most vulnerable in the agricultural sector, according to application of crop simulation models and other studies conducted by the Mexican government. Decreasing quality of agricultural land will cause immigration from the rural areas to the cities. This population flow will ultimately lead more illegal refugees to the United States.

Effect of Global Warming on Maize Production

Global warming induced drought can cause soil erosion. Soil erosion is predicted to lead to a drop in maize crop yields which in turn leads to hunger in certain districts that fuels an increased migration to the United States. Mexico became a net food importer in 1992. It purchased cereals to meet the food needs of 28 million people. Salinization of irrigated lands brought about by drought-like conditions has also become a problem.

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[227] Philip Howard, *Environmental Scarcity and Violent Conflict*: The Case of Chiapas, Mexico (Toronto: University of Toronto) Project on Environment, Population and Security Washington, D.C.: American Association for the Advancement of Science and the University of Toronto January 1996 (available at http://www.library.utoronto.ca/pcs/eps/chiapas/chiapas1.htm); Accessed on March 16, 2007.

Studies in Mexico based on crop models project decreased yields for numerous crops including maize, wheat, barley, and grapes even when the direct effects of CO_2 fertilization and implementation of moderate adaptation measures at the farm level are considered.[228] According to estimates by the Mexican government, 59.6 percent to 75percent of the land will become unsuitable for maize production.[229] Mexico could lose between 20 and 25 percent of its maize production in the next 50 years.

Impacts on Human Health

The University of Pennsylvania has used five major global climate models projecting that a doubling of atmospheric carbon dioxide forecasted to occur by the year 2050 will raise temperature by five degrees (C) in Mexico City. Air pollution levels are also expected to rise as carbon dioxide levels rise. The air pollution will undoubtedly lead to an increase in Asthma rates. As a result of global warming, Dengue fever has now spread to higher elevations. It has spread beyond its former elevation limit of 3,300 feet to 5,600 feet.[230]

As has been the case with El Salvador, shanty towns on flood prone hillsides will be especially prone to climate change induced storms causing mudslides that could have devastating effects. Some mudslides in El Salvador have killed thousands of and forced as many to flee their homes often in Mexico where they will remain or possibly transit through to the United States.

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[228] Intergovernmental Panel on Climate Change: *Climate Change 2001: Working Group II: Impacts, Adaptation and Vulnerability, Technical Summary Latin America* (Available at http://www.grida.no/climate/ipcc_tar/wg2/045.htm); accessed August 1, 2007.
[229] Government of Mexico.
[230] This information is (available at www.climatehotmap.org); Accessed on April 3, 2008.

The Mexican government has determined that 60 percent of the cities in Mexico have problems with the supply of potable water. The CO_2 level rise is forecasted to decrease soil moisture in the basin of Mexico decreasing the potable water supply as well.[231]

Political Violence in Mexico and the Environment

1994 saw the emergence of the Zapatista National Liberation Army in the State of Chiapas. This movement was focused on bringing the plight of the Chiapas peasants to the attention of Mexicans. Chiapas, by far the most resource-rich state in the country, is important to agricultural, mineral and petroleum exporters. Mexican government plans call for it to become a leading light manufacturer as part of the Plan Puebla-Panama. Chiapas is part of a zone of land that has been designated the "Mezzoamerican Biological Corridor**"** due to its importance as a natural habitat for unique and endangered flora and fauna**.**

The Zapatistas take their name from the revolutionary Emiliano Zapata and they see themselves as his revolutionary heirs. The people are of Mayan decent. It is important to consider the fact that they understand the idea of a civilization being destroyed by environmental factors, most likely drought, in their institutional memory. The indigenous Zapatista struggle was framed as a reaction against obstacles to sustainable development such as a lack of access to land, water and other resources, and efforts of elite groups to wrest resources from the indigenous people. The Zapatistas have responded with a unique mix of political defiance, low level military insurgency and partnership's with

[231] J. Ross, "Dangers in Paradise: Economic Progress vs. Environmental Protection in Southern Mexico". *Sierra, 77*, 44.

outside NGO's to bring about change. They see their movement as a reaction against globalization as well as the IMF, World Bank and NAFTA which they see as an extension of the War on Terror.[232] The negotiations between the Zapatistas and the government lasted for three years culminating in an agreement in 1996 that granted special rights, including autonomy, to indigenous people. Chiapas remains the country's poorest state, and fully 80 percent of indigenous communities lack access to electricity, and most are also without potable water.

Various commentators have attributed a range of revolutionary objectives to the Zapatistas, often obscuring the insurgents' principal goal which was relief from escalating environmental scarcities that have impoverished their communities. The rebellion was connected to environmental issues such as deforestation, soil erosion, and biodiversity loss. Since all of these factors are exacerbated by global warming it is reasonable to assume that they will manifest themselves again, perhaps to similar effect, elsewhere in Mexico. The number of people killed as a direct result of military action in Chiapas has amounted to only a few dozen each year since 1998 but the death rate was much higher prior to this time period. Hundreds of refugees displaced by the war also die in and out of refugee camps from curable disease, lack of access to potable water and malnutrition. The conflict is still able to create considerable political instability in Mexico.

The war in Chiapas has produced environmental refugees. The Mexican army's eleven-year campaign of low intensity warfare has created an internal refugee population second

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[232] Andrew Willis, *Land, Biodiversity, and Exploitation in the Conflict Zone of Chiapas, Mexico* ICE Case Studies Number 157, (Washington D.C. American University) August 2005, available at http://www.american.edu/ted/ice/chiapas-biopiracy.htm (accessed March 12, 2008.)

only to Colombia's in the Western Hemisphere. Many of these refugees will eventually travel to the United States. The United States government has taken a keen strategic interest in the outcome of the war in Chiapas by boosting military aid and soliciting reports from intelligence agencies. Europeans have also been keenly interested by mobilizing citizens. For example, it has been estimated that that nearly a quarter of the Italian parliament has visited Chiapas. If climate change in the form of desertification were to reemerge as a problem in the peninsula, it would not be hard to imagine a reemergence of the Zapatista movement in a more virulent form.

Conclusions

The rate of population growth and urbanization and related demand for food and water are the main variables that will determine the extent to which global warming will impact on Mexico. The effects of climate change on Mexico are expected to become more severe due to the increasing need for water driven by population growth and increased demand on agricultural lands as well as erosion resulting from poor agricultural practices. It would not be hard to imagine a collapse of the Mexican government particularly the Northern regions due to desertification and the other consequences of global warming.

Due to the complex interaction and the methodological difficulty presented by an attempt to predict Mexico's adaptive measurers, it is difficult to draw conclusions about the net impact on national security. Whether environmental degradation driven by climate change becomes a spark for further class warfare and ethnic tension such as was

evidenced in the case of Chiapas in 1994 can not be fully predicted. The next greatest questionable variable in the complex equation is the performance of the Mexican economy. Taxation would increase the ability of the Mexican government to respond to climate change. Overall this case study offers more hope than the other countries examined in this dissertation that the government may be in a financial position to implement more significant policy measures to mitigate the effects of global warming.

I would not then be the first scholar to suggest that the promotion of Mexican sustainable development has become a U.S. national security priority. Given the environmental and economic forecast, some level of violence in Mexico is probably to be expected. The question is whether much of this violence will spill over into the United States. Environmental refugees are not the only threat. What is perhaps more significant is the fact that the U.S. border can not be made impermeable to the threat posed by the spread of communicable diseases. Rapid global warming is likely to change ecosystems, thereby affecting predator-prey relationships, allowing some populations of disease-bearing pests to proliferate. The pests could easily cross borders into the U.S. The hanta virus outbreak in the southwestern U.S. a few years ago was a manifestation of this risk. An outbreak of disease in urban slums such as Tijuana could spread across the border to the United States. Furthermore, illegal immigrants may have a higher incidence of some diseases such as tuberculosis, cholera and dengue fever that are rare today in the U.S. Illegal immigrants are acting as vectors for these diseases. Drought has been perhaps the key factor in encouraging immigration from El Salvador. Severe weather hits Central America then the refugees come through Mexico to the U.S. While this situation may

first manifest itself as a Mexican security issue it can soon spread to the U.S. as more migrants from Mexico already join those destined for the U.S. In any case the U.S. economy itself may worsen lowering the absorptive capacity for new low-skilled immigrants.

Finally in the case of coming droughts, the possibility for increased tension between the U.S. and Mexico exists in the border regions of Sonora and Baja California. The countries are already at odds over access and distribution of border waters such as the Colorado River system. The worst case scenario from the perspective of the military is that border control itself will be turned over to the U.S. armed forces sapping resources from the critical warfighting function.

Egypt

Introduction

The Egyptian population is one of the groups that is most vulnerable to the effects of climate change. My survey suggests that desertification, water scarcity and sea level rise are the climate change-related effects that will pose the greatest challenges for Egypt. The fertile area of the country, 1 million square kilometers, constitutes only 4 percent of the country's total area while the rest of Egypt's land mass is desert. The fertile area contains 99 percent of Egypt's population of approximately 69.8 million people.[233] The Egyptian government has undertaken a project to increase the inhabitable area of the

[233] *IUCC, Egypt and Climate Change*: *Fact Sheet 119* (available at http://www.cs.ntu.edu.au/homepages/jmitroy/sid/101/uncc/fs119.html); accessed on November 9, 2006.

country from about four to twenty five percent through irrigation.[234] The plan is likely to have negative environmental consequences that I will discuss later in the chapter.

Like other countries I have examined, Egypt is experiencing a high population growth rate. The annual population growth rate of 2.8 percent is clearly outpacing the growth rate in agricultural product that now stands at 2.6 percent implying that Egypt will be forced to rely increasingly on imported food. Cairo's population of 10.6 million alone is expected to grow to 13.8 million by 2015. The population is expected to double by 2050 if the present growth rate of 1.78 percent is maintained.[235] Although the government has expressed some appreciation for the magnitude of the challenges posed by global warming, the country is unlikely to have the resources necessary to undertake significant mitigation measures since it is relatively poor.

Egypt's vulnerability to climate change is exacerbated by the fact that the country consumes more than 100 percent of its renewable environmental resources including water. Egypt is 95 percent reliant on fresh water sources with the Nile River providing more than 95 percent of all water available to the country.[236] The rate of water withdrawal from the Nile system exceeds replenishment. Water scarcity is driven by lack of flow volume in the Nile River due to withdrawals from the upper riparian. These withdrawals are in turn driven by the diminishing amount of rainfall in the Ethiopia hills. In an arrangement that is geopolitically inconvenient, the Nile's source lies far to the

[234] Ibid
[235] Henry Huttinger and Eman Shaban Morsi, "The Heat is On: A New Report Says Millions Could be Displaced for the Northern Delta by Climate Change." *Cairo Magazine* November 2005.
[236] Egypt Climate Change, *Egypt Faces the Challenges*,.(Available at www.eeaa.gov.eg/ecc/climatemain.htm); Accessed on March 1, 2007

south of Egypt and includes 86 percent of its rainfall from Ethiopian sources and 14 percent from equatorial lakes that are themselves drying up due to drought.

Egypt is located in an arid to semi-arid climatic zone. The mean annual rainfall in Egypt varies from 180 mm per year in the north coast to a paltry two mm per year near Aswan.[237] As global warming increases over the next few decades the amount of rainfall is likely to substantially decrease. The temperatures in Cairo could increase by as much as four degrees centigrade by 2060.[238]

While Egypt is highly vulnerable to climate change impacts, it contributes just a fraction of one percent of mankind's total greenhouse gas emissions. Egypt's per capita CO^2 emissions were .36 tons compared to 5.44 in the U.S.[239] Many environmentalists have cited this disparity in the content of debates about equity. This logic could also be capitalized on by fundamentalists to incite hatred against the West. As noted I have found evidence that this is in fact occurring to a greater extent in the case in Bangladesh.

The Agricultural Sector

The agricultural sector consumes the greatest share of water in Egypt. Despite this, the agricultural yield for wheat is expected decline 18 percent by 2050 due to water scarcity. In the agricultural sector, increases in the average temperatures will also reduce the

[237]. Egypt Climate Change
[238] United Nations Environmental Program, *Environmental Outlook Egypt Country Profile* (available at http://countryprofiles.unep.org/profiles/EG); accessed on October 21, 2007.
[239] Egypt Climate Change

distribution and yield of crops causing substantial damage.[240] Most of Egypt's labor force is associated with the agricultural sector. This sector constitutes 20 percent of the GNP and consumes about 80 percent of the water budget. Egypt's problematic position is exemplified by the fact that food importation absorbs most of the nation's hard currency. Agricultural losses resulting from climate change will likely lead to a drastic increase in importation of cereals from abroad. Domestic livestock production is also projected to decrease correspondingly.

The IPCC third assessment report notes the high vulnerability of African countries to the six manifestations of climate change. These vulnerabilities include global warming's negative impact on:

- water resources
- food security
- natural resource productivity
- disease containment
- coastal zone ecosystems
- agriculture through desertification

All of these factors affecting the rest of Africa are indeed significant vulnerabilities in the Egyptian case and will be described in greater detail in the following sections.

[240] Baruch, 88.

The largest crop losses in Africa--up to 51precent in the case of wheat--are anticipated in Egypt. The potential for large reductions in Egyptian wheat and maize yields is supported by more recent extensive modeling work (El-Shear and others, 1997). Therefore, even allowing for some adaptation, yield losses may occur throughout the southern and eastern Mediterranean region.[241]

The Coastal Zone

The coastal zone of Egypt extends for more than 3,500 km and is the home to more than 40 percent of the population. Most of these people live in and around a small number of highly populated industrial and commercial centers such as Alexandria, Port Said, Damietta, Rosetta and Suez.[242] The coastal zone also includes areas on the Mediterranean and the Red Sea in addition to a number of lagoons situated along the Nile delta coast and to the east of the Suez Canal. Coastal lagoons and lakes are, in general, zones of high agricultural and biological productivity and are extremely sensitive to disturbances.

The Egyptian coastal zone suffers from a number of serious environmental problems including land subsidence, erosion, water logging, salt water intrusion, soil salinization, ecosystem pollution and degradation, and lack of appropriate institutional management

[241] Baruch, 89.
[242] N. Nasr, Antonio Marquina, M. Nasr, "Prospects for Desertification Impacts for Egypt and Libya" in *Environmental Challenges in the Mediterranean, NATO Science Series, IV., Proceedings of the NATO Advanced Research Workshop on the Environmental Challenges in The Mediterranean*, 2-5 October 2002. , Kluwer Academic Publishers, Dordrecht, Germany. .

coordination. Realizing the importance of this zone, the Egyptian government has taken some steps towards reducing the impact of these problems.[243]

Sea level rise is expected to have a heavy impact on fisheries within the coastal zone. Mangrove stands on the Red Sea stabilize shorelines and provide species habitat. The coastal lagoons and mangroves are also the centers of fish breeding because they serve as fish hatcheries. The coastal zones of Egypt as a whole are also particularly vulnerable to changes in precipitation, excessive frequency of storm surges and changes in the heat patterns related to the impacts of floods. The impacts of these phenomenons will be felt by the growing population of these areas.

The Impacts of Sea Level Rise

Large areas of the country including the governorates of Alexandria, Behaira, Kafr El-Shiekh, Port Said, Damietta and Suez, are particularly vulnerable to sea level rise. Other vulnerable areas include Lake Bardawil, the coast of Obeyedh near Matruh and the coasts of the Bitter lakes. Many other areas on the coast of the Red Sea are also now also vulnerable.

Sea level rise will displace a large number of Egyptians. One study now predicts a half meter sea level rise may displace two million persons and cost 214,000 jobs. The damage to beaches and installations as a result of a .5 meter sea level rise without

[243] Dr. Mohamed El-Raey et al. *Egypt: Inventory and Mitigation Options, and Vulnerability and Adaptation Assessment,* (available at http://www.gcrio.org/CSP/IR/IRegypt.html); Accessed on October 11, 2007.

adaptation is estimated at $2.5 billion in 1992 dollars.[244] Another study has estimated that a sea level rise of the same magnitude would permanently displace 16 percent of Egypt's population.[245] If a 30 centimeter sea level rise by 2025 inundates 200 square kilometers as predicted by estimate from the Egyptian Environmental Ministry, the result will be the displacement of 500,000 inhabitants and a loss of 700,000 jobs.

Economically, sea level rise will have a heavy impact on Egypt's vital tourist industry including the direct inundation of several key archeological sites particularly in the Alexandria area. In recent years tourists have also been increasingly attracted to the modern beach resorts that have been developed in other areas of the country including the shores of the Red Sea and the Sinai Peninsula. These resorts would be wiped out by the projected amount of sea level rise. Finally, sea level rise will also cause heavy damage to the fishing industry because a change in the coastal water circulation will potentially diminish the fish catch.

Agriculture will not be spared. In terms of the extent of sea level rise's damage to Egyptian agriculture, approximately 15 percent of the arable delta land will be lost as far as 20 km inland.[246] A decrease of the Nile flow rate would invite more salt water intrusion on to arable land resulting in diminished land productivity from a belt of water that is expected to flow at least two meters deep. Alexandria, Port Said and Rosetta are within this band that is would range from 30 to 60 km wide. Agriculture will also be

[244] Helmy Eid, *Case Study Overview Egypt- Review of the Sea Level Rise Impact Study, Soil, Water & Environment Research Institute* (SWERI), ARC, Egypt.)
[245] Ibid.
[246] Eid

negatively affected by increased storm activity. Sea level rise degrades mangroves that provide natural protection against cyclones. Large mangrove tracts have already been destroyed and others show imminent signs of degradation.

It is important to note the existence of dissenting views regarding the severity of the impacts of global warming in Egypt. Some analysts have argued that the Nile Delta will adapt to the new sea level by shifting upward into the Egyptian land mass essentially relocating itself and therefore not be substantially affected by sea level rise. It is worth noting that regardless of the situation surrounding the Nile Delta, sea level rise will cause significant losses to the tourism industry in the vicinity of the Red Sea.

Variation in the Regional Impacts Sea Level Rise

The shoreline of Egypt can be divided into four distinct sectors: the coasts of the western desert (west of the city of Alexandria); the Nile River delta and vicinity between the cities of Alexandria and Port Said including the coasts of the cities of Rosetta and Damietta; the coastal zone of the Sinai Peninsula; and the coastal zone of the Red Sea. These distinct coastal zones are important from an economic, industrial, social and cultural point of view. In addition to increased tourism activities, a tremendous move towards building new industrial complexes is in progress in virtually all of the coastal zones.

In Egypt agricultural production may cease altogether over an area extending 20 km inland. World prices for many key commodities such as wheat, maize, soybean meal and poultry consumed in Egypt could rise significantly as a result of climate change.

High vulnerability in the Nile delta and possible socioeconomic impacts have been well defined in previous study. These areas include Alexandria and Behaira governorate, Port Said and Damietta governorates, and Suez governorates as well as those near Matruh and north of Lake Bardaweel.

All major sectors of the Egyptian economy will be substantially impacted by sea-level rise. The agricultural sector is potentially the most severely impacted sector at (a potential loss of over 90 percent), followed by the industrial sector (loss of 65 percent) and the tourism sector (loss of 55 percent) due to a SLR of one half meter if no protection action is taken.[247] Estimation of the socioeconomic impact due to loss of land and jobs is possible using employment statistics relevant to each sector. Results of the impact on population and loss of employment are shown in a study by a group of Egyptian scientists.

[247] U.S. Global Change Research Information Office, Areas, Population and Percentages of Land Use Classes Above Various Elevations of Alexandria Governate (in percentages) chart available at (http://www.gcrio.org/CSP/IR/gifs/EgyptTab4.gif); accessed December 5, 2006.

Table 5. Population Expected To Be Displaced and Loss of Employment in Each Sector Due to SLR in Alexandria Governorate

Sector/Year	2000 (SLR<5cm)	2010 (SLR=18cm)	2050 (SLR=30cm)	2050 (SLR=50cm)
Area at risk (km2)	32	114	190	317
Population to be displaced (thousands)	57	252	545	1,512
Loss of Employment:				
a—agriculture	0,336	1,370	3,205	8,812
b—tourism	1,359	5,737	12,323	33,919
c—industry	5,754	25,400	54,936	151,200
Total loss of employment	7,449	32,509	70,465	195,443

References: El-Racy M., S. Nasr; O. Frihy; S. El-Desouki and Kh. Dewidar; 1995; Potential impacts of accelerated sea level rise over Alexandria, Egypt; J. Coast. Res. (In press).

Alexandria

Alexandria, one of the oldest cities on the Mediterranean coast, and is an important center of tourism, industrial and economic activity and cultural heritage. The city has a waterfront that extends for 60 kilometer and includes a number of beaches and harbors. Alexandria's beaches are the main summer resort of the country, and its harbors are the most important import and export link between Egypt and Europe. Overall nearly 40 percent of all Egyptian industry is located within the governorate of Alexandria.[248]

This case study and the vulnerability assessment of Alexandria governorate is based on assumed scenarios of sea level rise of one half meter by 2050?; and one meter by the end of the 21st century.[249] In this study, advanced remote-sensing and GIS techniques were used to assess vulnerabilities and to identify sectors likely to be most seriously impacted.

[248] Centro de Simulation y Modelos (Venezuela), *Impact of Climate Change on Egypt* , (Available at http://cesimo.ing.ula.ve/GAIA/); Accessed on April 13, 2006.
[249] Ibid

Several studies using less sophisticated methods have been carried out to assess the vulnerability of this region. It is estimated that a SLR of one half meter in the governorate of Alexandria alone would cause a displacement of almost 1.5 million people and a loss of about 200,000 jobs by the middle of the next century if no action were taken. In the city of Alexandria, a .one half meter to one meter sea level rise is the baseline assumption. If no mitigation action is taken then 30% of the city will disappear. At least 2 million people will have to abandon their homes and 195,000 jobs will be lost at a total economic cost of over $35 billion. The most severely impacted sectors are agriculture, industry, and tourism, respectively. Alexandria is one of the most significant areas because the impacts of global warming in Alexandria alone could cost Egypt over $30 billion a year in lost land, infrastructure and tourist revenue.

Alexandria is not the only major Egyptian city that stands to be heavily impacted by the effects of global warming. An Egyptian government sponsored study conducted in the historical city of Rosetta found that a one-half meter sea level rise would devastate the local economy to a point that the city's employment would be reduced by 30%. These loses would equate to a total loss of $2.9 billion to the Egyptian economy over the next century.[250]

In Port-Said City, the industrial and transportation sectors will be impacted most heavily. At least 6,000 jobs will be lost with a one half meter rise scenario.

[250] Centro de Simulation y Modelos

Mitigation measures such as beach reinforcement will probably be necessary in the near term.[251]

The Effect of Climate Change Induced Desertification on Egypt:

According to a report published by the United Nations Environmental Program (UNEP) Desertification is considered one of the most serious problems facing all Mediterranean countries -- including Egypt today. Climate change is likely to both significantly aggravate existing problems caused by desertification and critically undermine the effectiveness of efforts to combat the problem.

Somewhat surprisingly considering its dry climate, the phenomenon of desertification in Egypt has not been well studied. Analysis of the study of desertification effects in the Egyptian case is complicated by the fact that the fundamental definition of desertification is controversial and the phenomenon is sometimes viewed as a question of degree. An authoritative definition of desertification is "land degradation in arid, semi-arid and sub-humid areas resulting from various factors including climatic variations and human activities."[252]

Desertification is driven by certain factors such as elevated temperatures. One factor is that the Nile losses a disproportionately high amount of its volume due to evaporation. Population growth in Egypt's urban centers causes the population to rely increasingly on

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[251] Ibid

[252] *1992 UN Convention to Combat Desertification* available at (http://fletcher.tufts.edu/multi/texts/desertification.txt); accessed on November 16, 2006.

irrigation which in turn drives reliance on this method. Increased irrigation diminishes the waterflow of the Nile.

One possible desertification scenario is based on the output from four climate models. It suggests that temperatures could rise by over four degrees celsius by 2100 over many inland areas and by over half of this over the Mediterranean Sea. By 2100 annual precipitation is projected to decline by ten to forty percent over much of Africa and southeastern Spain.[253]

Egyptian food security already at risk from desertification on the one hand and sea level rise on the other is further undermined by the fact that the country's prime farmland is under pressure from the growing population. Despite this pressure, all indications are that the population will remain concentrated close to the coast and within the fertile areas adjacent to the Nile.

In Egypt, the rate of desertification will likely be increased due to increases in erosion, salinization and reductions in soil quality. As a result, the process of desertification is likely to become irreversible. Water pollution will become worse as pollutants become more concentrated with reductions in river flow. The combination of higher prices and crop losses would lead to deterioration in levels of food security. Despite the severity of this forecast and its implications for the future of Egyptian agriculture, the problem may be mitigated by advances in technology. Better rainwater harvesting techniques and bioengineering could sustain part of the crop yields. Another scenario is that the

[253]Greenpeace International, *Climate Change and the Mediterranean Region* (Available at http://archive.greenpeace.org/climate/science/reports/fulldesert.html); Accessed on March 3, 2007.

government might resort to privatizing water resources. This action would likely lead to violence.

Global Warming's Effects on Human Health in Egypt

The correlation between human health and climate change in Egypt is still a largely unexplored topic. However, evidence based on data obtained from a variety of other locations suggests that global warming will bring about increased prevalence of vector-borne illnesses, respiratory ailments, heat strokes and heat-related illnesses.

Climate change induced reductions in food supply would increase the risks of malnutrition and hunger which, in turn, makes the population more susceptible to disease. The combination of increased heat and the high level of pollution in Egypt will lead to an upsurge in respiratory illness among urban populations. Water shortages will also increase the risk of cholera and dysentery. Higher temperatures would increase the incidence and extent of infectious diseases, such as malaria, dengue fever, schistosomiasis and yellow fever.

The prevalence of snails that spread schistosomiasis has increased world-wide due to the spread of irrigation. Climate change will likely increase the incidence of schistosomiasis in Egypt. Snails that carry the disease lose their infections in the winter, but with higher temperatures they may now carry the infection throughout the year. Climate change will also increase the extent of potential malarial areas. Water shortages and increased concentrations of pollutants could, together with the higher temperatures, increase the

risk of cholera, salmonella and dysentery. This problem is likely to be compounded by damages to drainage and sewage infrastructure through sea level rise.

Finally, public health will be adversely affected by the likely impact of sea level rise and its damage to the actual public health infrastructure such as hospitals and sewage damage systems.

Water Scarcity

In development studies, the commonly used benchmark for water scarcity is whether people consume less than 1,000 cubic meters per year. Water availability either already falls below this level or is expected to fall below this mark everywhere in Egypt within the next two to three decades. Egypt draws the vast majority of its fresh water from the Nile River but in order to insure an adequate supply must rely on an annual water sharing agreement with the Sudan. Egypt is the last of downstream riparian country within the Nile system making cooperation with other nations necessary.[254] Egypt's water scarcity problem is well reflected by the statistic that in an extremely arid environment, only 55 percent of the households in rural Egypt have access to water pipes compared to 97 percent in urban Cairo. As noted previously Egypt is a net importer of grain. Two decades ago Egypt was self sufficient in agriculture and the problem of water scarcity has been perhaps the most decisive factor in reversing that trend. Given the water scarcity issue I believe that Egypt's most difficult challenge will be finding a way to manage the

[254] S.T. Abdel Gawadh, *Water Scarcity Prospects in Egypt 2000 – 2050*, (Dordrecht: Kluwer Academic Publishers 2004) Page 187.

prospects of the projected population growth. Egypt's population is expected to rise from 69 to 83 million by 2017.[255]

Global warming will likely continue to have an impact on this growing food crisis in Egypt. According to a recent analysis of the situation is Egypt, greater than half of the years from 2001 to 2050 carry a significantly high risk of food crisis related to climate change. However, only 10 percent of the years from 1901-1995, when the effects of global warming were not yet as pronounced, had a high potential for food crisis.[256] Although the population grow rate was another variable that increased during the period 1901-1905, growth in this variable alone can not explain the increase in risk.

Summary of Key Global Warming Impact on Egypt

The net effects of global warming in Egypt are summarized below.

- Loss of tourism revenue resulting from destruction of archeological sites in the Nile delta and associated losses of income.
- Loss of arable agricultural land.
- Loss of fisheries attributable to change in the pattern of coastal water circulation and damage to coral reef systems.
- Negative impact on agricultural water quality resulting from intrusion of salt water into the Nile.
- Increased desertification.
- Decrease in the structural integrity of coastal buildings due to salt water intrusion.
- Salt water contamination of the fresh water aquifer.

[255] Gawadh 193
[256] UNEP Global Environmental Outlook, 2000.

- Increased temperature stimulating soil erosion and increasing wind speed.
- Desertification causing heavier dust storms thus increasing the amount of Saharan dust carried across the Mediterranean to European countries causing health problems in both places.
- Sea level rise will impact on harbor designs and their ability to take on freight leading to economic losses.
- Displacement and economic adjustment caused by land inundation. Increased unemployment leading to potential civil unrest.
- Increased water logging leads to growth in mosquito populations that in turn increase human disease rates.

In sum, it is notable that the Egyptian national economy would be harmed not only by the direct physical impacts of global warming. The costs of implementing even fairly rudimentary adaptive measurers could be more than the developing economy will be able bear. As the lower riparian state in the Nile River system, Egypt will also have to face the consequences of reduced volume and quality of Nile water.

Above all other regions, the coastal zone of Egypt is most physically and socio-economically vulnerable to the effects of sea level rise and changes in weather patterns.

One challenge of this case study is that there is very little analysis of climate change's impacts done thus far. For example I have found that impacts resulting from changes in the precipitation pattern, shortages of fresh water resources, loss of already scarce vegetation cover, increased desertification and associated socio-economic impacts, have

yet to be studied in depth.[257] This problem is exacerbated by the fact the Egyptian environmental affairs agency has a small budget of U.S. 3.5 million in 1993.[258]

Global Warming's Impact on the Power Sector

It is reasonable to estimate that the supply of Egyptian hydroelectric power is likely to be significantly reduced as droughts become more frequent and an increase in water runoff or evaporation in the Nile River system occurs. According to the U.S. Department of Energy, Egypt was reliant on hydroelectric power for 15.9percent of its power needs in 2005.[259] With the loss of some of this hydro-electric capacity, Egypt will likely seek to increase the share of carbon dioxide-emitting fossil fuels in its energy production mix, further increasing it contribution to the problem of global warming. It is likely that Egypt will turn to nuclear power, an option that other countries in the region such as Iran have chosen. Global warming's effect on Egypt's power generation strategy would therefore have a secondary effect on U.S. national security interests. The lack of hydro power potential encourages the use of nuclear power in Egypt. A civilian nuclear power program dramatically increases the threat of Egypt developing a domestic nuclear weapon's program. This development could be viewed against the backdrop of internal forces that may cause an increasingly hostile national stance toward Israel and the west. Furthermore, the disposal of commercial nuclear waste or the possibility of accidents could also carry negative regional environmental consequences. Taken as a whole, the negative impacts of climate change could seriously undermine some fledgling efforts on

[257] Centro de Simulation y Modelos
[258] Centro de Simulation y Modelos
[259] U.S. Department of Energy, Energy Information Administration, *Egypt Country Analysis Brief*, Available at (http://www.eia.doe.gov/); accessed on May 7, 2006.

behalf of the Egyptian government efforts to reorient the country toward a model of more sustainable development.

Overview of History Potential for Political Violence in Egypt

Assessment of the impacts of climate change in Egypt is further complicated by the need to consider not only the nature of the physical and economic impacts of climate change, but also the sensitivity of the social systems to this change, and the degree to which adaptation is possible.

One potentially explosive social trend in Egypt is the emergence of a growing divide in Egyptian society between Western educated elites and the remainder of the indigenous population. This division has caused a reaction that has caused a growing number of citizens to embrace Islamic fundamentalism as a "shield" against the more prosperous western-educated elites. Although current Egyptian law prohibits the formation of political parties based on religion, Islamic groups such as the Ikwan al musilmani (Muslim Brotherhood) and the Jamaat al-Islamiyya (Egyptian Islamic Jihad) would be the most likely groups to gain control if Egyptian society were destabilized in any way. One way that Egyptian society could be destabilizes would be through socioeconomic dislocation inspired by environmental dislocation. The agenda of these Islamist groups, at their most extreme, calls for the restoration of an Islamic caliphate. The Muslim Brotherhood could fill the breach left by a paralyzed state by providing services to the people in the wake of a weather related event such as sea level rise or a dust

storm.[260] This development as well as the increased probability of a war against Israel under a more Islamic Egyptian regime is inimical to U.S. national security interests.

Strategic Implications for U.S. National Security

In addition to the bleak scenario offered above, the impacts of climate change on Egypt could exacerbate existing regional tensions by diminishing the already scarce supplies of water in the Nile and threatening the food security of millions of Egyptians. I refer to this catastrophic possibility as a *full collapse of the Nile Delta agricultural region.* This scenario would naturally lead to increased international competition for water from the Nile. Disruption and refugee flight caused by a water war between Sudan and Egypt, for example, would be inimical to U.S. interests in the Islamic world. If a migration of at least two million people from the Delta coastal areas due to inundation at the loss of fertile land is possible as the aforementioned study suggests, increased refugee flight to Europe could impact upon NATO allies making environmental refugees a U.S. security threat.

Furthermore it is possible that some of the Egyptian population growth will actually be caused by an influx of refugees from other countries such as Sudan caused by environmental factors.

Global warming is not itself the cause of conflict but it could provide a tipping point that could send a precarious political situation out of control. A collapse or

[260] Nils Gilman, Doug Randall, Peter Swartz, *A Systems Vulnerability Approach to Considering the Potential Impacts to 2050 of a Mid-Upper GHG Emissions Scenario*, Global Business Network, January 2007.

destabilization of the Egyptian government would most likely lead to some form of U.S. military intervention. The U.S. military would certainly be called upon to assist with large scale humanitarian operations. Egypt and Israel are already the recipients of 50 percent of all U.S. foreign military assistance. From a geo-strategic standpoint, Egypt has been considered a key link to other Arab regimes for many years and has been seen as playing a critical role between the Arab World and Israel.

Interestingly, the U.S. may be currently contemplating intervention in another African regional conflict that traces some of its origin to global warming. Washington may determine that is it unwilling to tolerate further suffering in Sudan due to continuing severity of the Darfur crisis. Global warming may have played a substantial role in setting the stage for this conflict. It was a drought that drove the nomadic Arabs to settle in the lands of the sedentary farmers in the South of that country driving them from their homes. This type of violence, while complex and multi-causal may foreshadow the growing role of environmental factors in emerging conflict.

Conclusion:

My analysis suggests that even in the absence of global warming, basic food security in developing countries such as those I have studied is likely to deteriorate due to a combination of population growth, land use changes and water problems. In two out of three of the countries I have surveyed, Bangladesh and Mexico, I have identified the link between global warming or environmental degradation and existing violence.

As a result of my findings, it seems likely that the potential impacts of climate change are understated in many studies. Assessing the impacts of climate change on food security alone is immensely complex undertaking. To do so, requires not just climate and crop modeling, but also economic modeling of the world's trading system since countries can turn to international trade to alleviate food shortages. Consulting economic models, of course, creates another level of uncertainty. Nevertheless, the initial work that has been performed in this region suggests serious implications for Egypt and its neighboring countries in the Mediterranean region. A collapse of the Nile agricultural region's productive capacity along with the displacement of Bangladesh's population due to sea level rise represents some of the gravest yet most unheralded threats to world security.

Chapter 4: Assessing Global Warming's Threat to U.S. National Security: The National Intelligence Approach

Introduction

Until as recently as last year, the national security implications of climate change have received little attention in the academic, government, and think-tank arenas. As evidenced by a recent surge of reports and seminars on the topic of global warming and national security, the U.S. intelligence and military communities are now more interested in this issue. Climate change has received a good amount of political and media attention in world Capitals, particularly in Europe, but it has been largely ignored by the national security establishment except in the United States.[261] A report sponsored the Pentagon's Office of Net Assessment in 2003 that assessed the national security implications of abrupt climate change was a notable exception. The U.S. intelligence community has now commissioned some analysis on the subject of national security and climate change. The results of this work are expected to be released this year. Sources such as Ross Feinstein, the spokesman for the Director of Central Intelligence suggest that the intelligence community has studied or may be now studying climate change in a limited way. Evidence collected from my interviews suggests that the National Intelligence Council has commissioned an NIE and that the results of this analysis are expected this summer.[262] The evidence that I have collected regarding the national security implications of global warming during the last two chapters of my dissertation suggests

[261] Peter Schwartz, *Inevitable Surprises*: *Talk of the National with Ira Flatow*, National Public Radio, May 4, 2007. -

[262] E-mail correspondence with Maj. Gen Richard Engel, Deputy National Intelligence Officer for Science and Technology, The National Intelligence Council, March 19, 2008.

that the seriousness of the issue does indeed warrant the performance of a National Intelligence Estimate.

While the weight of the evidence I have collected suggests that an NIE may now be warranted, my purpose in this chapter is to determine the best approach to analysis. Now that I have found and detailed regional data on impacts of climate change, in this chapter I will suggest the most appropriate mode of analysis. The "national intelligence" or estimative approach is one way to analyze the data I have collected. In the following pages I will describe this method and its history in detail, critique its usefulness as applied to global warming data and then analyze my findings using this paradigm.

The aim of this chapter is to answer to the following question: Using the estimative language and methods of the intelligence community, does the threat of global warming meet the realist definition of a security threat as described in my theory chapter? The final answer to this question will be presented in the conclusion. That definition at its strictest is characterized as premature death and global warming's impact on military operations. A National Intelligence approach is germane because I am characterizing the data I have found on the impacts of global warming using the vocabulary, and to some extent the methodology, used by the intelligence community during the formulation of the NIE.

The National Intelligence Estimate

Performed by the U.S. Intelligence Community, a federation composed of 16 U.S. agencies, a National Intelligence Estimate (NIE) is a comprehensive review and analysis of a potential security threat.[263] An NIE is part of the national estimating process. The process encompasses the total contribution to analysis made by senior intelligence officers across several agencies. NIEs are designed to determine and articulate the best known view of the true state of the world and the hazards that face the nation.[264] An NIE combines, correlates, and evaluates intelligence from all of the relevant U.S. intelligence agencies. The NIE's goal is to provide policymakers with the best unbiased and unvarnished information, regardless of whether analytic judgments conform to U.S. policy.[265]

During the production process, various intelligence agencies must pool data, share perspectives and work together to assemble an accurate and holistic picture of threats to U.S. security.[266] An NIE is the most authoritative analytical product concerning national security issues and is the coordinated judgments of the intelligence community regarding

[263] *Uncovering The Truth: The Intelligence Community*, available at http://www.intelligence.gov (accessed on 1/15/07.

[264] The intelligence community consists of the: Director of National Intelligence; Undersecretary of Defense for Intelligence; Air Force Intelligence; Army Intelligence; Central Intelligence Agency; Coast Guard Intelligence; Defense Intelligence Agency; Department of Energy; Department of Homeland Security; Department of State; Department of the Treasury; Drug Enforcement Administration; Federal Bureau of Investigation; Marine Corps Intelligence; National Geospatial Intelligence Agency; National Reconnaissance Office; National Security Agency; Navy Intelligence. Source http://www.intelligence.gov/1-members.shtml

[265] John Dwyer, "A Brief Overview of National Intelligence Estimates", The American Thinker, September 30, 2006, available at http://www.americanthinker.com/2006/09/national_intelligence_estimate.html (accessed 2/17/08)

[266] Senator Richard Durbin, Introduction to S. 1018 The Global Climate Change Security Oversight Act, March 28, 2007 Congressional Record (Senate) Pages S4059-S4061 http://www.fas.org/irp/congress/2007_cr/s1018.html

the likely course of future events. The estimate evaluates what trends seem likely in the future and how these trends might be affected in the event that certain other events occur.[267] Similar in principle to an NIE, the national intelligence produced by the CIA is intended to be a synthesis of the large amount of often highly technical knowledge possessed by the agencies that make up the US Intelligence Community, which would then be disseminated in a form easily accessible by the policymaker.[268] A small number of NIEs are produced each year. The actual number is classified.

Production of an NIE is a primary responsibility of the National Intelligence Council (NIC), an organization housed within the Office of the Director of National Intelligence (ODNI). The NIC is the Intelligence Community's center for mid-term and long-term strategic "over the horizon" thinking.[269] "The creation of the office of the ODNI by the Bush Administration in 2005 provided a focal point for coordination of the analytical capabilities of all agencies."[270] Thus it is consistent with that vision that the DNI would chair the NIC. Led by the Director of Central Intelligence, the NIE production process is a group endeavor involving give and take between the intelligence community and senior policy-making officials who commission the work.[271] Intelligence Estimates move beyond the established facts and into the unknown. However, estimates are not

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[267] David A Brinkley and Andrew W. Hull, *Estimative Intelligence: A Ttextbook on the History, Products, Uses and Writing of Intelligence Estimates*, Prepared for the Defense Intelligence School, 1979.
[268] Donald P. Steury, Introduction to the Collected Essays of Sherman Kent, Central Intelligence Agency, Available at https://www.cia.gov/library/center-for-the-study-of-intelligence/csi-publications/books-and-monographs/sherman-kent-and-the-board-of-national-estimates-collected-essays/intro.html#rft7 (Accessed 3/19/07)
[269] *About the National Intelligence Council* available at http://www.dni.gov/nic/NIC_about.html (Accessed 2/12/08)
[270] Richard A. Best Jr., *Intelligence Estimates: How Useful for Congress?* Congressional Research Service, Last updated February 2007, Page 12
[271] Best 12

judgments. Estimates and judgments are similar because in both cases, peoples' egos and intellectual biases mitigate against objectivity. NIEs are designed to convey the full range of possibilities, even though they might come down firmly in favor of one particular set of conclusions. The quandary involving estimates can be expressed in the following passage:

> To this day estimates remain controversial. In discussing large and complex topics, NIEs necessarily have to delve into a realm of speculation, a dense process of trying to separate out the probable from the possible from the impossible, and of trying to provide answers to difficult but important questions with an appropriate degree of uncertainty about incomplete information.[272]

Intelligence estimates are speculative. The amount of speculation contained in an Estimate can vary depending upon the subject matter, the amount of evidence available, and the amount of time the practitioners put into it. The subject of an environmental phenomenon that has a high level of scientific uncertainty would lead to a relatively high level of speculation in an NIE. Inevitably, however, this kind of analysis would contain some level of inaccuracy, either because of a mistaken judgment or because the available evidence is misleading, incomplete, or false.

Historically it would seem that the basis of credibility of any given estimate depends less on the quality of the analysis than upon the general credibility of the institutions that produced it. Unlike the case with most corporate products in the business world, intelligence agencies have no competition for their products. While they do have a monopoly, the Central Intelligence Agency and the NIC have limited credibility in many circles. This is especially true of the epistemic community that is responsible for

[272] Dwyer

implementing climate change policy, a group that contains a large number of political progressives.

The Epistemology of Estimative Intelligence

I will treat estimative intelligence as a subset of strategic intelligence. Strategic intelligence can be defined as knowledge that is vital for national survival or knowledge on which the foreign affairs of a nation must rest.[273] Therefore, strategic intelligence is knowledge meant to fit the requirements of Grand Strategy. Strategic intelligence tends to depend more on information that is publicly available or "open source". Variations of strategic intelligence include risk analysis and net assessment. Sherman Kent was primarily concerned with net assessment. According to Kent "If foreign policy is the shield of the Republic, then strategic intelligence is the thing that gets the shield to the right place at the right time."[274] Using this definition I would assert that most of the intelligence that could presumably be gathered related to global warming is actually not strategic intelligence because it is not strictly related to the action or potential action of other states as defined by Kent.[275] However, strategic intelligence -- or knowledge that results from the analysis of the intentions and capabilities of potential adversaries -- can be used to support compliance with environmental agreements such as the Kyoto Protocol. Otherwise strategic intelligence is only likely to relate to one dimension of an NIE on global warming; the dimension I have labeled "political" in my earlier chapters.

[273] Sherman Kent, *Strategic Intelligence for American World Policy*, Princeton, New Jersey, 1996 Preface vii
[274] Kent, Preface, vii
[275] Kent, Page 7.

Strategic intelligence may come into greater play, however during a regional intelligence analysis of the effects of global warming. Climate change induced environmental scarcity may cause local conditions to prevail that influence the intentions and reduce the capabilities of states to wield military power against their adversaries. Whether the United States is indeed one of those nations affected in this way is one of the guiding questions of this thesis.

To assess the role of estimative intelligence in the task of environmental analysis it is helpful to first establish an epistemological framework. Epistemology is the branch of philosophy that studies the nature, methods, limitations, and validity of knowledge and belief.[276] The analytic tradecraft that comprises estimative intelligence can then be fit into an epistemological framework. To begin with, some observers would no doubt posit that empiricism is the methodology for forming estimative intelligence assessments. In philosophy generally, empiricism is a theory of knowledge emphasizing the role of experience in the formation of ideas, while discounting the notion of innate ideas.[277] More narrowly, in the field of philosophy of science, empiricism is a theory of knowledge which emphasizes those aspects of scientific knowledge that are closely related to experience, especially as formed through deliberate experimental arrangements. The scientific method requires that all hypotheses and theories must be tested against observations of the natural world rather than resting solely on a priori reasoning, intuition,

[276] See, for example the Routledge Encyclopedia of Philosophy. (Find page)
[277] Ibid

or revelation. Science is methodologically empirical in nature. Insofar as scientists have knowledge of a subject, knowledge is a posteriori or dependent upon sense experience.[278]

One could now assert that a key question in establishing an epistemological map for estimative intelligence is where does the NIE process itself reside on the spectrum of an empirical versus a more theoretical or intuitive framework? Stated less obliquely, where is the estimative intelligence product found on the spectrum of empirical knowledge versus belief? (The answer is at least in part that an NIE is not fully methodologically empirical in nature because it rests on the invisible and intangible strand of the analyst's intuition. Due to time and resource constraints, the U.S. intelligence analyst does not have the ability to make scientific observations of the natural world as a researcher in the sciences might. The analyst's views are shaped by their preconceived notions and beliefs. The estimative intelligence products are then, more similar to beliefs. If the analyst were to utilize a more theoretical framework of analysis, the hypothesis would have to be more rigorously tested. Under this approach, the "scientific" methodology of analysis becomes more transparent.

Another factor to consider is that in estimative intelligence by definition, all conclusions can not be tested against the observations of the natural world because they are by nature predictions of future events. For example the reader can not say that every time X happens in a given country, dictator Y will do Z.

[278] Stanford Encyclopedia of Philosophy, *Rationalism Versus Empiricism*, Published on August 2004, available at http://plato.stanford.edu/entries/rationalism-empiricism/#1.2 (Accessed on 1/5/08.)

From his declassified scholarship it is clear that Sherman Kent, widely regarded as the father of estimative intelligence, would hold that intelligence estimates are closer to empiricism than pure theory. "Kent's methodological writings in the classified *Studies in Intelligence* reflect the essentially empirical framework that he applied to analysis.[279]

According to Kent, the two camps in the epistemological debate over intelligence production can be characterized as "poets" and "mathematicians." Kent also observed that the readers or consumers of the intelligence can fit into those same two camps. As an empiricist, Kent placed himself squarely in the mathematical camp of each debate. Kent explains that even the "gut estimate, as we [analysts] call it among ourselves" could be expressed in terms of probabilities and is therefore empirical in some way. "Let us talk of it in terms of odds or chances, and when we have made our best judgment let us assign it a word or phrase that is chosen from one of the five rough categories."[280]

I largely disagree with Kent's view. I find the process of estimative intelligence production to be more poetic than mathematical. Current intelligence literature suggests that the end of the Cold War and the "disorder" that this has imposed on the world has caused intelligence analysts to abandon some of the predictable models for analysis that applied to behavior behind the iron curtain in favor of a more journalistic approach. I would posit from my own experience working with intelligence products in the U.S. government that the modern policymaker/reader has become more of a poet as well. However contrary to new challenges such as leadership analysis of terrorist leaders,

[279] See Sherman Kent Estimates and Influence, *Studies in Intelligence*, Summer 1968. available at http://www.dni.gov/nic/tradecraft_essays_est_and_infl.html (accessed on 1/10/08)
[280] Kent

analysis of the national security implications of global warming might be a topic where a more empirical (mathematical) approach is required given the scientific nature or "quantifiability" of the data that the analysis must rest on.

This requirement for an empirical approach then plays into the argument against the performance of estimative intelligence analysis of the national security implications of climate change. The intelligence community does not have enough experts in the substantive area of environmental studies unlike what may have been the case in the now outdated discipline of Sovietology for example, to conduct meaningful empirical analysis on the subject. This argument notwithstanding, it does not mean that certain general political and strategic trends could not be observed and mapped in the context of an NIE on climate change.

The lack of documentation inherent to the NIE and other intelligence assessments also masks the existence of an empirical methodology. This problem is inherently noticeable to the policymakers who are the NIE consumers of these products. The higher the level of the intelligence product's proposed audience, the less complete its visible documentation will tend to be. In other words, the higher level it is and the closer the estimate gets to the influential official who will act upon it, the less substantiated it is. Busy policymakers may only tend to read an executive summary or have the key finding orally briefed to them in any case (Whether the policymakers choose to read the assessment at all is another problem altogether.) At the most exalted level of the NIE compared to "lesser" intelligence products, documentation even in the generalized form

of comments on sources has usually disappeared altogether. One is forced to rely on the shadings of meaning found within the document itself in order to glean the gravity of the findings. In the cases of unclassified or declassified assessments that I have reviewed in my research, no substantive footnotes exist. Generally footnotes are only inserted in cases where another agency dissents from the main views expressed in the NIE.[281] For example, when the Bureau of Intelligence and Research at the State Department dissented from the rest of the community's judgment in the case of the 2002 NIE concerning weapons of mass destruction in Iraq this objection was registered in the form of the footnote rather than a paragraph in the text of the document.

Although I will flesh this topic out in a subsequent part of my analysis I would note that one weakness of the NIE system as applied to the analysis of the national security impacts of global warming can be found in the approach used for review. During this process**,** reviewers within the intelligence community have generally not been systematically exposed to the raw data that underlie the assessment. (The exception to this rule in certain cases may be members of the Board of National Estimates.) In the case of an NIE on global warming, I suggest that a new review body would have to be established that having the scientific qualifications to review the data underlying climate estimates. Within the U.S. government, people with these qualifications could be most easily drawn from the National Laboratories or perhaps the Department of Commerce. My conclusion is supported by an interview with George Tenet, former DCI.[282] The short term operational question given the urgency of completing this assessment would

[281] See *An Intelligence Role for the Footnote* Available at https://www.cia.gov/library/center-for-the-study-of-intelligence/kent-csi/docs/v08i3a01p_0002.htm (Accessed 2/3/08)
[282] Interview with George Tenet, Former Director of Central Intelligence, conducted on October 4, 2007

be how to find people and issue security clearances to members of the board who have enough scientific qualifications to review the data. The exiting Foreign Intelligence Board would not be adequate to the task.

This reality ultimately boils down the following question. How much empiricism can be assigned to the estimation of climate change related phenomenons that are based on uncertain science? In this sort of undertaking, the analyst is not counting enemy tanks on a battlefield where the answer is a finite number. The problem is that the analyst can't, by definition compare observable changes in the natural world to future changes unless he or she is relying on historical data as a guide. As scientists are painfully aware the pure scientific approach is also fraught with difficulty. Nonlinearity inherent to climate science such as feed back loops would also tend to complicate projections of the climate's behavior. The earth's climate system is actually too complex for man to fully comprehend and model. Our sensory perception tells us that it is hot. In that way, global warming is empirical. But the earth operates according to cycles, so historical data perhaps found in Arctic ice sheet thickness must be employed.

Intuition is of little help in this situation. The intelligence professional enters dangerous waters if he or she is to rely on hunches or gut feelings about the natural sciences with limited knowledge of either science or history. This is the case partially because generally analysts are not trained in the natural sciences because they are for the most part social scientists. Most intelligence officers are trained as political scientists. This is one of the drawbacks of having political scientists trained in strategic studies, rather than a more interdisciplinary team working as the principal participants developing the NIE.

According to Sherman Kent, "Intelligence analysis is inherently an intellectual activity that requires knowledge, judgment and a degree of intuition."[283] Since CIA analysts are not subject experts, their degree of intuition about future climate dynamics is highly suspect.

Historical Overview of the National Intelligence Estimate

To better understand why the framers of the NIE are drawn from the social sciences it is useful to better understand the NIE's roots within the historical devselopment of the Intelligence Community.

Although there are fourteen members of the intelligence community, the CIA is the primary agency responsible for estimative intelligence. Formal estimative intelligence analysis probably traces its roots to a time when President Harry Truman created an organization called the Central Intelligence Group in the spring of 1946. The Group in turn established the Office of Reports and Estimates (ORE). The functions of ORE included the production of national current intelligence, scientific intelligence, as well as technical, and economic intelligence. The ORE was also responsible for the coordination of the newly-minted product called a national estimate.

It has been observed that as the CIA's existence evolved between 1947 and 1950, it never adequately fulfilled its estimative function but rather continued to expand its independent

[283]Best, 5.

intelligence production.[284] In 1950, Walter Bedell Smith became Director of Central Intelligence and, recognizing this problem, undertook a reorganization program. His most significant change at this time was the creation of the Office of National Estimates (ONE). The sole purpose of ONE was the production of National Intelligence Estimates.

There were two components of ONE. First, a staff which drafted the estimates and -- similar to today -- a senior body known as the Board of National Estimates, which reviewed the estimates, and coordinated the judgments with other agencies. Similarly, the ONE also negotiated over the estimates final form in a way that is similar to today's deliberations described in the introduction. The current form of an NIE that would be recognizable to analysts today was really first produced in 1950 by the ONE under the direction of Kent who became the Director of the office at that time. Dr. Sherman Kent began his career as a Yale professor. He later served as Deputy Chief and then Chief of the ONE unit until 1967.[285] His contribution to the field of estimative intelligence would be difficult to overstate. It was Kent who founded the CIA's classified journal called *Studies in Intelligence* in 1955. Above all, Kent was highly respected for the level of academic rigor his methods embodied. The first NIE produced by his unit treated the prospects of Communist Insurgency in the Philippines.[286] The document makes a compelling read even today and was prescient in many of its conclusions.

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[284] Federation of the American Scientists, *History of the Central Intelligence Agency* available at http://www.fas.org/irp/cia/ciahist.htm quoting from *Central Intelligence Agency*, Factbook on Intelligence, *December 1992, pages 4-5* .
[285] National Intelligence Council, *Brief NIC History* available at http://www.dni.gov/nic/NIC_history.html (accessed on 3/1/08)
[286] Kathy Gill, *National Intelligence Estimate*, U.S. politics.com, 9/26/06 available at http://uspolitics.about.com/od/usgovernment/a/NIE_2.htm (accessed 2/25/08)

By 1973 under the Administration of Richard Nixon, the responsibilities of ONE were assumed by a senior analysts know as National Intelligence Officers. The NIOs were, in turn, later subsumed into the National Intelligence Council (NIC) itself in 1979. That same year, the new DCI, William Colby, dissolved the ONE entirely and founded the system of NIOs that exists today. Evidence suggests that it was faulty intelligence estimates associated with the conflict in Vietnam as well as President Nixon's dislike of east coast intellectuals who composed a plurality -- if not a majority --of the CIA employees at the time that combined to motivate him to abolish the ONE. ONE was also seen as an example of an organization that had lost its way, by producing intelligence that was too "academic" in orientation. However, the concept of academic was not clearly articulated. [287]

By the 1990s, the end of the Cold War raised issues that impacted on intelligence analysis in a myriad of ways. The international system was now more dynamic. The state-centric system had given way to a system in which a variety of actors control multiple sources of power. This world system of subnational actors and transboundary phenomenon encourages new conceptions of intelligence analysis that more resemble journalism than to the rigorous scholarship conceived of by Sherman Kent. Nevertheless Kent's contributions to the methodology of intelligence remain substantial and his mark is evident in current intelligence products.

Today, the National Intelligence Council (NIC) who is primarily responsible for the production of the NIE, is composed of approximately twenty-five National Intelligence Officers (NIOs). The National Intelligence Officers' responsibilities are divided mostly

[287] Federation of American Scientists

on a regional basis, but some officers analyze topical or global issues such as terrorism or science and technology. In the production of an NIE, the NIC may utilize assets outside of the intelligence community itself. NIC members may draw upon the advice of substantive experts outside of the government. These experts may be accessed from the private sector through the National Intelligence Council Associates Program or other methods such as symposia designed to attract experts from academia.

The previous section has presented a brief historical overview of the institutional actors and focus associated with estimative intelligence. The next section will further analyze the methodology of the intelligence estimation process itself.

The NIE Methodology

The NIE production process is difficult to definitively ascertain from open sources. While I have been able to construct the following general outline, I understand based on informal conversations that the process may vary slightly on a case by case basis. First an NIE may be commissioned by, the President, an executive branch agency such as the Department of Defense or--less frequently--by Congress. However, under rare circumstances, the estimate may be generated within the intelligence community itself. Once the topic has been selected, the NIC will circulate Terms of Reference (TORs) that define the key questions to be answered and each agency's responsibilities for answering them. One or usually more analysts within these agencies are then asked to take the lead in the preparation of the draft NIE based on the relevance of their expertise. Once completed, the drafts are then reviewed by senior officials at the NIC. The NIC will then meet as a whole to review the draft. If approved, the NIEs are then received by the heads

of the relevant agencies and subject to a process of "line by line" review within the intelligence community where each agency has the opportunity to express their dissent with any part of the analysis. The National Clandestine Service, the secret wing of the Central Intelligence Agency responsible for intelligence collection and espionage, then reviews the NIE to insure that the information it was based on has not been derived from sources that have been recently discredited or are now seriously questioned.[288]

The next step in the process is a review by the National Intelligence Board, the body formerly known as the National Foreign Intelligence Board and chaired by the DCI. The board's membership varies but for this purpose is composed of the heads of the agencies most relevant to the assessment. After approval by the board, the completed NIEs are briefed to senior leadership such as cabinet secretaries, chairmen of Congressional Committees and the President's National Security Adviser.[289] The final product is then sent to, and depending on its salience, subsequently briefed to a combination of officials including the President, senior policy-makers and the two Congressional Committees with oversight responsibilities for intelligence matters.[290] The National Security Act of 2004 stipulates that NIEs are prepared for the government, not exclusively for executive branch officials as has typically been the case. The legislation has given the Congress greater access to the estimates. Within the Congress, the Senate Select Committee on Intelligence and the House Permanent Select Committee for Intelligence are the leading consumers of NIEs. The Foreign Affairs, Armed Services or International Relations

[288] The National Intelligence Council, *Prospects for Iraq's Stability: A Challenging Road Ahead*, January 2007 (Unclassified Summary)
[289] Ibid.
[290] Best, 5.

Committees may also be interested in NIEs that support decision-making in international or military affairs.[291] Greater Congressional access to the NIE has lead to politicization of intelligence. NIEs can be useful, if somewhat inappropriate, tools in parliamentary debate because they are understood to reflect the official position of the Director of National Intelligence (DNI) whether or not he has been actually involved in the preparation of the assessment.[292] This implication can lend more credibility to a certain proposed course of action or policy.

While any of the sixteen intelligence agencies may participate in the NIE depending on the relevance of the subject matter, the CIA has traditionally played the lead and dominant role in production due to the relative nature of its mission to gather strategic intelligence. This trend would be expected to continue in the case of a national intelligence estimate related to global warming.[293] Officers from the CIA, State and Defense Departments have traditionally formed the core of the NIC estimative group. While the views of these three agencies may then be disproportionately represented in the analysis, NIEs are required by legislation to reflect dissenting views from all sources within the broader intelligence community.[294] I as mentioned in a previous section, this dissent is reflected by footnotes in the document rather than the text itself.

Media and public awareness of the NIE process has increased in the last few years largely as a result of estimative analysis pertaining to the current conflict in Iraq. Specifically, the integrity of the process has come into question due to inaccuracies contained in 2002

[291] Best, 5
[292] Best, 2
[293] Interview with former DCI George Tenet conducted on October 4 2007.
[294] S. 1018 The Global Climate Change Security Oversight Act

estimate: *Iraq's Continuing Programs for Weapons of Mass Destruction.* This NIE that argued for the existence of weapons of mass destruction (WMD) in that country has thus far proven to be inaccurate.

As a result of the apparent inaccuracies contained in the NIE on WMD as well as those found in the reports of a separate WMD commission, Congress passed the 2004 Intelligence Reform and Prevention of Terrorism Act. Under the act, certain reforms have been undertaken to improve the integrity of the NIE process. For example, the Act requires all intelligence agencies to certify the credibility of the sources used to develop the estimate. This is now an earlier step in the process than the previously described intervention to verify the continued quality of sources by the National Clandestine Service. The intelligence community is now also required to articulate the reasons behind dissenting views cited in the NIE rather than merely listing them as a footnote as had been the earlier custom. The Congressional reforms have also emphasized the desirability of submitting the NIE's conclusions to review by outside experts when practical. This step would almost certainly be necessary in the case of an NIE on the national security implications of global warming due to the broad number of experts within the government and in some cases academia who could meaningfully contribute their perspectives to this complex analysis.

Before proceeding with a discussion of whether the NIE is the best framework to analyze the National Security Implications of global warming it is useful to review past U.S. intelligence activities related to analysis of the environment.

Historical Overview U.S. Intelligence Community Programs and Activities Regarding the Environment

Introduction

Some attempts have been made to analyze issues at the nexus of climate change and national security in the past. Some recognition of the connection between environmental issues and conflict caused the national security community to take several actions during the 1990s. The Department of State recognized the need to incorporate environmental issues into its strategic diplomatic plan. One of the first moves in this direction was in the 1990s when Pacific Northwest National Laboratory and the Department of Energy formed the Center for Environmental Security (CES) in order to provide a venue for the debate and evaluation of environmental issues that impact on national security. However, this organization is no longer active presumably because priorities have shifted elsewhere. At the Pentagon, the Office of the Deputy Undersecretary for Environmental Security was founded in 1993 but was dismantled in 2001. Until perhaps the summer of 2007, the national security policy-making community has failed to accompany these programmatic initiatives with an organized attempt to examine the connection between environment degradation and the erosion of national security through the lens of intelligence assessments.

The Environmental Intelligence and Applications Program

The Environmental Intelligence and Applications Program (EIAP) was organized within the CIA during the late 1990s as a successor to the Environmental Task Force established in 1992. The program has always been controversial among Congressional appropriators

as evidenced by language accompanying the 1996 appropriations authorization. This legislative passage explains EIAP duties illustrates how the program's funding was under siege at that time.

> Section 104 of the bill authorizes funding for the Environmental Intelligence and Applications Program (EIAP), formerly the Environmental Task Force, and the MEDEA scientists at $6 million, less than half the President's budget request. While we are heartened the funding for the program was not eliminated, as the original version of this legislation had proposed, we continue to be puzzled why this one program had been singled out [for elimination] among all the analytic efforts in the intelligence community. It is clearly responsive to the needs of national policymakers, brings unique information to our understanding of global environmental challenges, and has proven benefits for the intelligence community's own exploitation of national technical means.
>
> The EIAP evaluates data collected by national technical means for their utility for scientific study of the environment. Its recommendations were a factor in the declassification of imagery from the Corona, Argon, and Lanyard [satellite platform] systems. The MEDEA scientists who conducted that evaluation have continued to be a source of scientific talent for the intelligence community in addressing significant national questions involving environmental issues.
>
> The EIAP in fiscal year 1997 will continue to implement the "global fiducial" data bank project. Classified digital data on a set of environmentally sensitive points around the globe will be collected by the intelligence community and stored by the civil and military environmental agencies as a legacy for future generations of environmental scientists until such time as these data are declassified. This seems to be a low cost investment that could pay large scientific dividends in the future.[295]

A subsequent section of the Appropriations Committee Report noted that Navy Admiral J.M. Boorda, then Chief of Naval Operations, found the program particularly useful. Boorda spelled out the benefits and activities of the EIAP in a recent letter to the Appropriations Committee's Ranking Democratic Member.[296]

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[295] Committee Report

[296] The Intelligence Authorization Act for Fiscal Year 1007 (available at http://ftp.fas.org/irp/congress/1996_rpt/hpsci97f.htm); (Accessed April 2, 2007)

DCI Environmental Center

The CIA established a small office called the Center for Environmental Intelligence in December 1996 under DCI John Deutch that was later folded into another analysis unit in the intelligence community called the DCI Environmental Center. Among its other activities, the center directed satellites to actively track environmental change. This approach generated controversy among the traditionalists in national security affairs due to their belief that strategic resources were being misused. In describing the program one Republican politician said that "they took pictures of volcanoes and sea turtle nests and took air samples of air pollution, as opposed to checking for traces of biological or chemical weapons, and it was all done at the behest of Al Gore."[297] A project with similar objectives called MEDEA was developed at approximately the same time.

Measurements of Earth Data for Environmental Analysis (MEDEA)

Although it has never been a priority, there is some historical precedent for the intelligence community's collection and analysis of environmental-related intelligence. The most prominent example was the commissioning of a group of environmental scientists who worked under the aforementioned program called MEDEA or Measurements of Earth Data for Environmental Analysis. The MEDEA has also been referred to as the "global fiducials" program.[298] The initiative was launched at the urging of then Senator Al Gore in 1991 with the cooperation of the NIC and the Pentagon's

[297] Byron York, *Al Qaeda, Iran, North Korea and Global Warming*, National Review Online. May 10, 2007.
[298] John Deutch, Director of Central Intelligence, *The Environment on the Intelligence Agenda*, July 25 1996, World Affairs Council, Los Angeles, California.

National Reconnaissance Office (NRO). Under the MEDEA program, the CIA in coordination with other intelligence agencies organized a group of approximately 60 senior scientists to review data collect by the intelligence community that pertained to issues lying at the intersection of environmental science, national security and foreign policy. Under MEDEA, scientists were charged with examining classified data sets that may have contained information related to environmental trends and recommending whether the release of this data for study by the wider scientific community would be inimical to U.S. national security.[299]

MEDEA's objective was to then rely on these scientists' specialized knowledge to assess whether the data gleaned from classified sources could be used in mainstream scientific research. Finding useful data that was not coded for environmental purpose was likened to searching for a needle in a haystack. In 1992 Congress appropriated $200 million to finance the mining of classified data archives obtained from National Technical Means. The MEDEA program utilized data collected from antiquated CORONA, ARGON and LANYARD reconnaissance satellite systems rather than today's more advanced satellite systems.[300]

Nonetheless, images derived from the program proved useful. An example of how this program was valuable was that it declassified historical images showing how natural structures such as glaciers and rivers have moved over time thus demonstrating the

[299] U.S. Global Change Research Program, Our Changing Planet FY 1999 – Appendix B: Department of Defense, Available at http://www.gcrio.org/ocp99/dod.html; (accessed 12/15/07)
[300] Brown, Page 6

effects of global warming on these processes. The vanishing snows at the summit of Kilimanjaro were one of the areas that served as candidate site for the program. The rate of global warming could be inferred from this data. Changes in vegetative boundaries caused by deforestation are also clearly visible from satellites. New reconnaissance satellites reportedly have the technology to penetrate water well enough to be useful in assessing the size of fish stocks that have migrated or been depleted due to global warming. Instead of relying just on analysis of existing images, the MEDEA program also, to some extent, directed collection efforts at current environmental targets.

American diplomacy also benefited from the MEDEA Program. International organizations such as the Gore-Chernomyrdin Commission called for the use of environmental data gathered by intelligence agencies through the MEDEA program to be used to clean up polluted defense complexes of partner nations in the Former Soviet Union.[301] The diplomatic utility of the MEDEA program was manifest at a workshop held in the 1990s that addressed how remote sensing can support the Department of State in monitoring compliance of international environmental agreements such as the Kyoto Protocol.[302] The intelligence community also played an important role in the enforcement of the Montreal Protocol on Substances that Deplete the Stratospheric Ozone Layer.

In 1999, Vice President Gore directed the MEDEA program to declassify and release 59 satellite images of the Arctic to help scientists better understand the interaction between

[301] Michael Brown, *The Intelligence Community and the Environment*, January 6, 1997, Page 10, (available at http://fas.org/irp/eprint/snyder/environment.htm **;** *(accessed on 2/14/08)*
[302] Remarks by Dr. David Sandalow, Assistant Secretary for Ocean and International Environmental and Scientific Affairs, to the Conference on Remote Sensing and Environmental Treaties: Building More Effective Linkages 4-5 December 2000.

polar ice cap melting and global warming. Concurrently, the National Imagery and Mapping Agency (NIMA) released 7 previously classified images of the Dry Valleys Region of Antarctica. The declassified digital images provided detailed modified versions of spy satellite imagery from the 1970's and 1980's that provided a snapshot of about 7500 square miles of the polar environment. The release of the data increased the scientists' understanding of the ecological dynamics in this extreme environment and their response to climate change.[303]

MEDEA did have its limitations. One of the problems with the use of material obtained from the MEDEA program is that it has often been redacted. Scientists predictably bristle at the idea of using maps which do not explicitly specify time, date or location. Thus far in the case of MEDEA and presumably in other situations, this conflict has only been resolved in favor of the interests of the Intelligence Community because the idea of protecting national security interests has a higher priority than observing proper guidelines for scientific research.

Various sources within the intelligence community indicate that the MEDEA program was deactivated in the late 1990s to early 2000. The exact reasons for cancellation of the program are not clear. The author is not aware of any subsequent attempts by the intelligence community to share environmental data with civilian researchers especially within the context of an unclassified program although the U.S. Intelligence Community monitors commercial driftnet fishing for the Coast Guard.[304]

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[303] Fact Sheet *President Clinton Protecting the Antarctic and the Global Environment*, September 15 1999, available at http://clinton4.nara.gov/WH/New/APEC1999/fact5.html;(accessed 2/1/08)
[304] Barnett 99.

One partial exception to this outcome may be the methods employed by the CIA Disaster Response Team (DRT) that has been charged with the task of disseminating unclassified reconnaissance images to provide early warning against natural disasters.[305] The final report issued by MEDEA that presumably contains some details as to the reason why the program was cancelled remains classified.

The Director of Central Intelligence Environmental and Societal Issues Center (DESI)

Perhaps as a reflection of the new emphasis placed on environmental intelligence matters by the CIA under the Clinton Administration, DESI was established as an organization reporting directly to the DCI. During its time it was the only analysis unit to do so. (Please refer to the attached chart of the CIA's organization circa 2000.) The DESI was a high level group engaged in multidisciplinary analysis of environmental and human security issues. Examining the likelihood and consequences of famines was an example of one of the group's responsibilities.

Under the direction of Paul Frandano, a career CIA official, the center was divided into four units addressing environmental security, humanitarian security, instability assessments and water/territorial conflict. The humanitarian security unit dealt with issues such as environmental refugees and humanitarian hotspots. The environmental security unit had an office devoted to transboundary "topical issues." Two such issues

[305] William J. Broad, "U.S. Will Deploy its Spy Satellites on Nature Mission," *The New York Times*, November 27, 2007.

were climate change, and the international trafficking of hazardous materials. During its tenure, the DESI developed a prototype system of environmental indications for predicting conflict in Africa using food production, water supply and food demand as variables.[306] The system was notable in that, unlike MEDEA, it utilized completely open source data. To this author's knowledge, this system was never expanded to analyze areas of the world beyond Africa. If this system were made to be more robust, it is possible that data gathered from it could feed into an NIE on the national security implications of global warming and the community could rely on unclassified data gathered from sources within its control. This type of information would be valuable because it could supplement, but not necessarily supplant, the type of data found in the IPCC Fourth Assessment Report. It would certainly have a more predictive quality than the basic data on the impacts of climate change provided by the IPCC because it is designed to track conflict indicators and the data would be aggregated at a more local level.

Like its predecessors within the CIA the environmental security group, DESI also provided support to negotiations through functions such as the verification of other nations' compliance with international environmental agreements. The environmental center was dismantled and its functions distributed to other areas of the CIA (to the extent that they were retained) in approximately 2002 by the Bush Administration as analysis budgets were redistributed in support of the Global War on Terror.

[306] Capt. Steve Kiser, *Environmental Mission Recommendations for the U.S. Intelligence Community*, Woodrow Wilson Center for Scholars ECSP Report, Issue 7, Summer 2001.

The National Security Council

President Clinton established the position of Senior Director for Environmental Issues within the National Security Council. Analysis of the national security implications of climate change was now at least theoretically the responsibility of an official within the White House. Discussion with the incumbent of that position reveals that this issue received very little systematic attention at the time.[307] There are approximately 15 senior director positions in the NSC.[308] In February 2001, shortly after assuming office, President George HW Bush issued National Security Presidential Directive One which established eleven policy coordinating committees reporting to the National Security Council including one concerned with global environmental issues. However after almost seven years, this committee has left no identifiable trace on U.S. public policy.[309] An extensive search of the White House Archives offers scant evidence of its existence.[310]

While the Committee on Global Issues is defunct, it is interesting to note that the Bush Administration has systematically involved the National Security Council at the highest level of coordination and review of climate change policy. It is unclear whether the White House has taken this decision out of a belief that climate change is a strategic issue.

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[307] Interview with Ian Bowles, former National Security Council Senior Director for Environmental Issues, conducted September 18, 2002. .
[308] Ibid
[309] Steve Aftergood, *Bill Seeks Intelligence Estimate* available at (http://www.fas.org/blog/secrecy/2007/03/bill_seeks_intelligence_estima.htm); Accessed on March 12, 2007
[310] Search conducted on March 25-26, 2007.

The author suggests that it may have resulted more from the belief that implementation of measures to mitigate climate change such as U.S. ascension to the Kyoto Protocol could have such a deleterious effect on the economy that they may present a threat to national security. Estimates of the cost to the economy of ascension to the protocol could be high. Ratification would cost the economy 4.9 million jobs and $400 billion according to the Bush administration[311] This hypothesis is further supported by the fact that under the current system, Federal implementation of proposed climate change mitigation measures such as the "cap and trade" carbon emissions scheme require a security review and "sign-off" by the NSC. Thus the Bush administration's stance treats not global warming itself but the economic effect of potential response measures as a threat to national security.

Congressional Legislation

Reflecting growing public awareness, Congress has now taken up the issue of how to address the national security implications of global warming and the role of the intelligence community in that process.

In the spring of 2007, as awareness of the issue of the potential national security implications of global warming featured more prominently in the media, Congress took up the issue of a NIE on the subject. The U.S. Senate introduced a bill (S. 1018) the "Global Climate Change Security Oversight Act," mandating an assessment of the issue

[311] President Bush Speech, February 14, 2002, available at http://www.whitehouse.gov/news/releases/2002/02/20020214-5.html; (accessed on 3/12/07)

by all intelligence agencies and authorizing the Secretary of Defense to conduct further research on the military impacts of climate change.[312]

The bipartisan legislation was sponsored by Senators Richard Durbin (D) of Illinois and Chuck Hagel (R) of Nebraska. According to a statement introducing the legislation, global climate change "represents a clear and present danger to the security and economy of the United States," and it therefore warrants the focused attention of U.S. intelligence agencies. The legislations language sets an ambitious scope. It would require all U.S. intelligence agencies including the CIA, NSA, DIA and the FBI to conduct a comprehensive review of potential security threats to the U.S. related to climate change around the world."[313] The requirement that the FBI participate in this process makes this process more ambitious in scope than a typical NIE where only the most relevant agencies typically take part.

In framing the legislation Senator Durbin stated that, "For years, many of us have examined global warming as an environmental or economic issue" but he also emphasized that the situation has changed and, "we also need to consider it as a security concern." He continues by noting that, "our bill begins this process by requiring a National Intelligence Estimate to assess the strategic challenges presented by the world's changing climate." Durbin then refined the scope of the report in the following statement:

[312] Global Climate Change Security Oversight Act (S. 1018) Congressional Record: March 28, 2007. (Senate) , Pages S4059-S4061
[313] CBS News, "Intelligence Analysts Eye Climate Change", Washington, May 5 2007.

> "In this legislation, we ask for the intelligence community to provide a strategic estimate of the risks posed by global climate change for countries or regions that are of particular economic or military significance to the United States or that are at serious risk of humanitarian suffering [] This NIE will assess the political, social, agricultural, and economic challenges for countries and their likely impact."[314]

This appropriations bill will also fund additional research by the Department of Defense in order to examine the impact of climate change on military operations.

The language establishes the unclassified nature of the scientific basis for analysis in the following paragraph:

> The Director of National Intelligence shall prepare the National Intelligence Estimate using the mid-range projections of the fourth assessment report of the Intergovernmental Panel on Climate Change….

The language also introduces the key issue of the transparency of the findings.

> The National Intelligence Estimate required by this section shall be submitted in unclassified form, to the extent consistent with the protection of intelligence sources and methods, and include unclassified key judgments of the NIE. Such National Intelligence Estimate may include a classified annex.[315]

It is clear from multiple sources that whether or not this legislation becomes law the intelligence community is performing analysis similar to that being called for in the legislation. It has been difficult to find officials who will speak on the record about this ongoing work due to the intensity of the political controversy that has erupted on Capitol Hill. However, as of the fall of 2007, some experts believe that rather than using the base assumptions of the IPCC 4AR, the current NIE will start with the assumption that the

[314] Durbin statement
[315] According to the Bill Language found at http://www.fas.org/irp/congress/2007_cr/s1018.html

conclusions of the IPCC are based on outdated science and that the impacts of climate change will be greater and will occur sooner than the IPCC 4AR has predicted. This reaction is presumably driven by the prominence of a new body of largely non-peer review literature hypothesizing about the increased likelihood of abrupt climate change that is far more rapid than the IPCC estimates.

As of August 3, 2007 the legislation requiring the NIE on global warming was referred to the Select Committee on Intelligence. The measure requiring the NIE was ultimately defeated in the Senate on October 1, 2007 when the Intelligence Authorization Bill was offered on the floor for unanimous consent. Key Republican lawmakers agreed to vote for the authorization bill only if the language requiring the NIE was dropped.

The version of the language in the House of Representatives Intelligence Authorization Bill that was introduced in April 2007 has also been referred to committee in that body. Republican lawmakers attempted to strip the provision requiring the estimate from the 2008 Intelligence Authorization Bill but were defeated by a vote of 230-185. Democratic lawmakers then responded by tacking a similar provision onto a defense authorization bill.

On May 5, 2007 the House Intelligence Committee also approved a provision that would require the NIC to produce a NIE specifically on climate change. The provision calls on analysts to study the social, agricultural, and economic risks associated with climate change over the next thirty years. House Republican lawmakers have been vociferous in their objections to the maneuver as an unnecessary diversion of resources from more important national security priorities specifically collection and analysis related to the Global War on Terror. Intelligence officials have said that the NIE analysis would be

based on existing scientific foundations and would thus not divert collection assets in any case.

Two members of Congress, Representative Peter Hoestra (R- MI) and Darrel Issa (R-CA) offered an amendment to the Fiscal 2008 Intelligence Authorization Act to prohibit what they have characterized as "environmental spying" in the collection of data for the NIE. However, a committee aide said that the vast majority of the relevant information for use in the NIE would come from unclassified sources. A senior intelligence official responded that the NIE will not divert resources from the War on Terror because only unclassified sources would be used. The intelligence community has responded to these allegations by opponents of the NIE. "We are not tasking collection at all to do this assessment," said one senior intelligence official.[316] Analysts will also, "not be looking at the science or the actions to mitigate it."[317] The official also indicated that "CIA transnational analysts and the State Department's Bureau of Intelligence and Research will already be engaged in these estimates so no analysts will be transferred."

Upon receiving the news, another legislator, Representative Mike Rogers (R-MI) who opposes it called the approach of using only unclassified sources "watered down" and implied that an NIE resulting from this approach would be useless. Rogers also made the point that since a limited number of NIEs are performed each year this topic might not

[316] Walter Pincus, "Terrorism Work to be unaffected by Climate Review," *The Washington Post*, May 20, 2007.
[317] Ibid.

rise to the level that of concern that would warrant an NIE.[318] I believe that this view is held by the mainstream majority of Congressional opponents of an NIE.

Like the NIC, I have taken the approach of using data based on the IPCC projections in earlier chapters of this dissertation. I have found it equally desirable for the purposes of scholarly research to establish a solid baseline from which to evaluate the impacts without being trapped in the minutia of contention about the magnitude of the problem.

This case was strengthened when Director of Central Intelligence Mike McConnell wrote a letter to Representative Anna G. Eshoo who was a prime supporter of the NIE proposal, stating that climate change is an appropriate topic for a National Intelligence Estimate.

The letter notes a recent report from the Center for Naval Analyses entitled *National Security and the Threat of Climate Change*. McConnell noted that, "We have noted the report's recommendation that climate change be considered in future national intelligence estimates (NIEs) on global warming and will do so as appropriate."[319]

Director McConnell said that intelligence analysts would not do primary scientific research about climate change, but would instead rely on analyses by other government agencies such as the National Academies of Science and the National Oceanographic and Atmospheric Agencies for global warming projections. It is unclear whether the Director would consider bringing the IPCC into that circle.

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[318] Pincus,

[319] Letter from Director of Central Intelligence DCI McConnell to Rep. Anna Eshoo, Available at http://eshoo.house.gov/images/documents/eshoo-mcconnell%20letters.pdf; (Accessed on March 10, 2007)

Even as Congress was debating whether to mandate a national intelligence estimate, intelligence agencies had already planned to include a discussion of global warming in a report next year on the main security challenges facing the United States through 2025.[320]

However, the letter to Representative Eshoo did not arrive at the committee until after the vote to discharge the legislation. House Republicans failed to remove the provision from the Intelligence Authorization Act for Fiscal Year 2008 directing the NIC to produce an NIE on global climate change. The House voted to sustain the climate change NIE, 230 to 185, before passing the authorization bill, 225 to 197.[321]

In May 2007, Senator Hillary Clinton, a Democrat from New York, requested a similar provision to the Senate Defense Authorization Act for Fiscal Year 2008 to require the Department of Defense to consider the national security risks posed by global warming in the National Security Strategy, National Defense Strategy and Quadrennial Defense Review. The measure passed the committee by a vote of 19-6. Like the House legislation, the Clinton amendment called for the implementation of the recommendations found in the CNA report.[322] Also in May ,the House of Representatives passed a Defense Authorization Bill, "which includes a requirement for future defense planning to include consideration of the risks posed by global warming to

[320] Mark Mazzetti, "Spy Chief Backs Study on the Impact of Global Warming," *The New York Times*, May 12 2007.
[321] Office of Representative Anna Eshoo Press Release: Director of National Intelligence Supports Climate Change Intelligence Assessments, May 11 2007. Available at http://eshoo.house.gov/index.php?option=com_content&task=view&id=311&Itemid=159 ;(Accessed on June 15, 2007)
[322] Environmental and Energy Study Institute, May 25, 2007

current and future Department of Defense facilities, capabilities, and missions," according to a statement from Rep. Ed Markey (D-MA).[323]

CONCLUSION

A Congressionally mandated NIE on global warming would continue and amalgamate some existing but scattered efforts by the intelligence community to examine the national security impacts of climate change and other environmental issues. The debate over global warming and national security on Capitol Hill is likely to grow more intense as the NIC releases its NIE on global warming, perhaps in the summer of 2008.

As stated, intelligence analysts have already begun working on an analysis of the effect of climate change on national security that using existing scientific evidence such as the IPCC 4 AR report research as the basis for their analysis.[324]

Congressional legislation is not the only driver for an NIE on global warming. The measure has some support from within the Intelligence Community as indicated by the letter from DCI McConnell. In addition to the letter, the 2006 U.S. National Security Strategy provides a basis for intelligence analysis related to global warming. The 2006 National Security Strategy states that the United States faces new security challenges, including "environmental destruction, whether caused by human behavior or cataclysmic

[323] Congressman Markey Press Statement, *Global Warming Analysis by Defense Department Set to Pass House, May 16 2007*. Available at http://markey.house.gov/index.php?option=content&task=view&id=2839&Itemid=125 ;(Accessed 6/13/07.)
[324] Mazzetti, 2

mega-disasters such as floods, hurricanes, earthquakes, or tsunamis."[325] The document presents a scenario about the impact of environmental events, hypothesizing that the impact of these problems may be severe. Global warming would surely qualify as one of those events. The strategy reads that "Problems of this scope may overwhelm the capacity of local authorities to respond, and may even overtax national militaries, requiring a larger international response."[326] The Security Strategy could be interpreted as advocating preventative diplomacy or preventative defense and the analysis of global warming as a security issue by explaining that nontraditional security concerns can threaten national security if they are not addressed early.[327]

The National Intelligence Council

In addition to the ongoing NIE, the NIC has dedicated some previous attention to the topic of the national security implications of global warming. The Clinton Administration created the position of National Intelligence Officer for Global and Multilateral Issues at the National Intelligence Council and the Under Secretary for Global Affairs in the Department of State.[328] In 2004, the NIC sponsored a conference on national security and climate change in cooperation with the University of Maryland as a part of its "2020 project". The 2020 project was a report intended to provide US policymakers with a view of how the world developments in several categories could evolve over a fairly long time frame, identifying opportunities and potentially negative

[325] U.S. National Security Strategy of the United States of America http://www.whitehouse.gov/nsc/nss.html
[326] Ibid
[327] U.S. National Security Strategy, last four pages , (e)
[328] Barnett, Page 72

developments that might warrant policy action. The framers of the study hoped that the project would stimulate a broader discussion of these issues among educational and policy institutions at home and abroad. The report took a regional approach toward the examination of future trends. The entire project lasted approximately one year and involved about one thousand participants.[329]

The climate change session, held at the University of Maryland, focused on three areas:

- What was known about climate change
- Policy scenarios related to climate change
- Geopolitical, economic, and social implications of these policy scenarios

The findings from the University of Maryland conference were rather benign judging by the standards of subsequent studies. The conference report stated that:

> The rise in temperature under most forecasts over the next 15 years is unlikely to lead to significant physical disruptions -- such as a major rise in sea level or alteration of agricultural production -- therefore, physical changes to the world's climate are likely to have only a negligible impact on bilateral relations by the end of the next decade.[330]

In contrast their relatively moderate warnings on the physical impacts of climate change, participants concluded that its political impacts were far more significant. The conference summary found that U.S. policies designed to address climate change were likely to have a large impact on multilateral relations; and that the United States was more likely to face significant bilateral pressure to change its domestic environmental

[329] *The Climate Change Conference, June 28, 2005*, Available at http://www.dni.gov/nic/NIC_2020_2004_06_28_intro.html; (Accessed on 3/3/07)
[330] *Conference on Climate Change and Its Implications Through 2020* Summary of Proceedings of the Conference dated 06/28/2004, http://www.cissm.umd.edu/papers/display.php?id=66

policies and to be a leader in global environmental efforts.[331] Political risk is one of the levels of analysis of the NIE.

The group found that concerns about greenhouse gases will increase steadily through 2020, and that there are likely to be numerous weather-related events that—correctly or not—will be linked to global warming. The report then concluded that any one of these events could lead to widespread calls across the international community for the United States to take dramatic steps to reduce its consumption of fossil fuels. These experts did not make predictions about the form, scope or the intensity of these calls for actions by other states as I will attempt to do in the next chapter. .

Summary of Recent Reports on Climate Change and National Security

The aforementioned efforts of the NIC notwithstanding**,** little attention has been paid to the area of the national security implications of climate change until the last year when the issue has reached the headlines of the mainstream media. What follows is a brief summary of the most significant reports in the area.

Center for Strategic and International Studies

One notable exception to the dearth of literature on the topic is a report from the Center for Strategic and International Studies (CSIS) called *Climate Cataclysms: the Potential Foreign Policy and National Security Implications of Global Climate Change* released in

[331] Ibid

November 2007. The report was produced in collaboration with the newly established think tank called the Center for a New American Security. The project, which aims to combine the expertise of and stimulate a discussion between national security experts and experts on the science of climate change, claims to concentrate on the security, geopolitical and diplomatic aspects of the harm that can come from climate.

The authors take the methodological approach of scenario planning. The report moves on to trace three potential scenarios of climate impacts (expected, severe and catastrophic) over 30 years ranging from gradual to more abrupt change. The thirty year timeframe was chosen because it is the standard timeline utilized by the national security planner. Interestingly, 30 to 40 years is also the amount of time necessary to average weather events in one area before they can be referred to as climate. While the structure of the scenarios presented in the report generally correlate to those found in the IPCC Fourth Assessment Report they are unique to this study.[332]

In the first chapter John McNeill, University Professor of History at Georgetown University, provides a unique overview of the historical impacts of climate change on human security. He traces such developments as floods, epidemics, and the Irish Potato Famine that were brought about by climate disturbances and discusses the future prospects of similar developments.

[332] "Climate Cataclysms: The Potential Foreign Policy and National Security Implications of Global Climate Change", Page 36.

The study is probably most convincing in its presentation of the effects of climate change that fall into the diplomatic and geopolitical realms since it places the most emphasis in this area. It places less emphasis on the analysis of climate change's impact on U.S. military operations or the direct effects on US territory and while the report provides a wide survey of the potential national security consequences of climate change, it lacks prescriptive analysis and recommendations.

In general, the report concludes that the effects of global climate change will increase the risk of state failure thus creating fertile breeding grounds for terrorism. In the case of the "severe" scenario, one of the more interesting conclusions in that globalization itself may be threatened because the systems such as transportation that it is predicated on will be severely damaged.

The CSIS report was prepared by a self-described "eclectic" working group that included members of the Intelligence Community including the National Intelligence Council as well as academics and former Administration officials.[333] Therefore it is reasonable to assume that the upcoming NIE on the subject will draw from the analysis and "off the record" discussions surrounding the report.

Center for Naval Analyses

In May 2007 a study was released entitled *National Security and the Threat of Climate Change* by the Center for Naval Analyses (CNA). The Center for Naval Analyses is a

[333] The author was a member of the working group selected to contribute ideas to the study and review its conclusions.

federally-funded research and development organization that performs research to inform policy-makers. In consultation with business leaders, scientists and other experts, the report reflected the opinions of a Military Advisory Committee of eleven retired "flag" officers. The officers represented all four branches of the military and all of these officers served for over 30 years. The study presented the general findings of the panelists. Every member of the commission did not necessarily agree with every conclusion of the report.

The report found, first of all, that expected climate change poses a threat to U.S. National Security. Second that "Climate Change can act as a threat multiplier for instability in some of the most volatile regions in the world and presents significant national security challenges for the United States."[334]

The report raises the question of whether climate change should be viewed as a contributor to the scarcity that often fuels violence in current conflicts. For example, it suggests that desertification triggered by global warming led to the genocide in Darfur, Sudan because the drought encouraged nomadic herders to seize land belonging to pastoralists. This conflict resonates deeply with the American public although it is arguably not an immediate national security of the U.S. The report also pointed to the conflict in Somalia, identifying it as stemming partially from natural resource shortages related to climate.

In the recommendation section of the report, Retired Vice Admiral Paul G. Gaffney II calls on the Defense Department and the Intelligence Community to engage in more

[334] CNA, 1.

research surrounding climate science. Referring to past efforts such as MEDEA, he noted that the defense community has the capacity to engage in data collection as they have done in the past. He noted, for example, the existing capacity of the Navy to perform ocean modeling observing that, "Most of our ships are already outfitted to collect basic atmospheric and oceanographic data."[335]

The CNA report's impact was evidenced by the fact that the authors received invitations to testify before Congressional Committees in both the House and Senate. During the subsequent hearings, General Gordon Sullivan, a former Chief of Staff of the US Army, called for the application of more national security-related scholarship to the issue of global warming.[336] He further testified that the national security consequences of global climate change should be integrated into national defense strategies.[337]

The CNA study on climate change probably triggered but certainly factored heavily into the Congressional debate over mandating the Intelligence Community to perform an NIE on global warming. The testimony of senior military officials about the severity of the problem lent significant weight to the arguments of the proponents of further analysis in the area. Finally, the study concluded that "the intelligence community should incorporate climate consequences into its National Intelligence Estimate.[338]

The analysis in the report measurers the geostrategic, regional, and operational impacts of climate change in turn. The report defines the national security impact of climate change,

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[335] CNA, 23
[336] CBS News, Intelligence Analysts Eye Climate Change, Washington, May 5, 2007.
[337] Testimony of General Gordon Sullivan before the Senate Committee on Armed Services, April 18 2007 http://www.cna.org/documents/Gen.%20Sullivan%20Testimony,%204.18.pdf
[338] CNA, 23.

to refer to the influence of climate change on geo-strategic balances and world events that could likely involve US Forces or otherwise affect US strategic interests anywhere in the in the World. The definition that I have adopted in this thesis is narrower. My yardstick definition of an impact adheres more to impacts occur in areas of significant geostrategic interest to the U.S. that result in conflict with measurable death tolls.

By breaking down the threat analysis on a geographically regional basis, the framers of the NIE have taken a similar approach as that planned for the NIE. This is not surprising given that the team received briefings from the intelligence community.

The report is effective in exposing the link between U.S adversaries ability to exploit weaknesses in countries whose capacity to govern is truncated by the impacts of global warming and the resultant erosion of U.S. geopolitical interests. The report suggests that under the umbrella of the new AFRICOM, the U.S should constructively engage to enhance the capacity of weak African countries to resist offers of the Chinese and Islamic extremists who could otherwise provide some of the services and facilities that the government is incapable of providing.[339]

The methodology of this report does not tie the findings to any particular scenario presented by the IPCC but offers a more general assessment based loosely on the state of the current science.

The CNA study is prescriptive and therefore more useful to the policymakers than the forthcoming CSIS study that presents both a historical and forward looking analysis but does not advocate a certain policy path. The CNA study is not fully rigorous or

[339] CNA 47

substantiated in the academic sense. It relies heavily on anecdotal assertions from former flag officers who may or may not have been astute in their analysis as a basis for the impacts of climate change. The impacts outlined in the report warrant deeper analysis by experts.

However, the high seniority and credibility of the interview participants raises the issue of the national security implications to a higher profile. The fact that this particular group is not known for being at the politically liberal end of the spectrum that are seen as alarmist on this issue also adds to their credibility on this issue. I suspect that the Congress was the intended audience for the report. It has in fact become a key factor in triggering the waves of testimony and discuss on this topic. What the reports that I have surveyed have in common is that they are valuable because they pave the way toward future analysis. The future analysis is perhaps most appropriately performed under the rubric of the NIE grated that certain conditions are met. I will examine these conditions in the next sections of this chapter.

Determining the Methodology of Threat Assessment within the U.S. Intelligence Community

Methodology of the NIE for Global Warming

The intelligence authorization legislation calls for a regional-based approach of pinpointing the areas at highest risk of humanitarian suffering caused by global warming and assessing the likelihood that wars fought over diminishing water and resources will

erupt in those areas.[340] Analysts would concentrate on areas where nations and ethnic groups are most likely to fight over resources and/or where large migrations of victims could occur. The effect of global warming on factors such as food supplies and the spread of diseases in these specific regions would also be examined.[341] This is the method that I have chosen to follow in chapters three and four of this dissertation. Anecdotal evidence based on discussions with members of intelligence community suggests that the NIC will follow the same approach toward the NIE. Secret intelligence data obtained from satellites would presumably not be used for this estimate but that option would always be possible as long as sources and methods remain classified.

Note that the Intelligence Community must develop an approach toward measuring political harm. It is much easier to measure physical phenomenon such as sea level rise and desertification than effects such as foreign nations' capacity and will to initiate actions against the U.S. based on their stances in climate change negotiation processes. The latter factor still stands to limit the policy options available to U.S. leaders.

Some members of Congress have stressed their preference that NIEs should be limited only to information acquired through intelligence agencies.[342] This would not be the best approach for an NIE on the topic of global warming because other agencies have the technical capacity to collect valuable data.

[340] Bryan Bender, "Bill Ties climate to national security: CIA, Pentagon urged to assess warming's effect on security", *The Boston Globe*, April 9. 2007.
[341] Ibid
[342] Best, 4

Evaluation of the Applicability of the NIE to the Global Warming Case

I will attempt to answer the question of whether the NIE process as currently designed and previously described in this chapter is the best vehicle to inform U.S. policy makers about the national security impacts of global warming in the coming decades. I will then suggest certain changes to the estimative process that may increase the utility and accessibility of an NIE on the impacts of global warming.

In contrast to the requirements for the performance of the NIE found in the authorizing language, it strikes me that one must examine the question of the effects of global warming on military operations within the preliminary NIE. The Congressional language instructs the Secretary of Defense to submit a report on this topic nearly one year later. Under my approach, I choose to analyze the impacts of global warming on military operations along with other sectors because it gives a more holistic concept of global warming's impact on national security. In any case it is difficult to separate global warming's impact on military operations from other dimensions of national security. I have also chosen to take a regional case study approach similar to that suggested for the NIE by members of the community I have interviewed. It may be helpful to disaggregate the examination of the deleterious impacts of global warming by researching the sources of conflict on a regional basis and then factoring in the variable of climate change. Conversations held at a recent conference indicate that the intelligence community is also working to disaggregate the analysis of climate change impacts down to the regional level. However, decentralizing the findings can make the worldwide impacts of global

warming seem less precise or accurate since many of the scientific data, such as sea level rise estimates are only accurate on an aggregate basis."[343]

The answer to the question of the applicability of the NIE process to the global warming issue depends first on a determination of which fields or situations are "legitimate" for analysis by intelligence agencies. This question has be framed as should NIEs be conducted on "soft" security issues as opposed to more imminent threats such as the proliferation of weapons of mass destruction? This question is increasingly salient in an atmosphere of scarce strategic resources. It is probable that the relevant agencies will have to be more creative to explain how issues based on some degree of scientific uncertainty, such as environmental change, are ripe for analysis within the framework of the NIE. However, a small number of NIEs have been performed that treat similar nontraditional transboundary security issues. Two declassified examples are NIE's on infectious diseases (2000) and on the geopolitics of energy (2004). These estimates provide precedent for NIE analysis of issues that fall into this category

The NIE entitled, "*The Global Infectious Disease Threat and Its Implications for the United States*" was released in the unclassified version in January 2000. It represents an initiative on the part of the U.S. government, more specifically the Clinton Administration, to consider the national security dimensions of a non-traditional threat. According to the document, it "examines the most deadly diseases, locally and by region; develops alternative scenarios about their future course; examines national and

[343] Remarks by Sherri Goodman, *National Security and the Threat of Climate Change*, seminar held at the Woodrow Wilson Center for Scholars, May 14, 2007.

international capacities to deal with them; and assesses their national and global social, political and security impact."[344]

Unlike the proposed NIE on global warming, the infectious diseases estimate does factor in nonlinearities and the potential response mechanisms such as existing institutional strengths in the health infrastructure as well as potential policy responses to the problem. Unlike other NIEs, the conclusions found in the NIE on infectious diseases approach the point of making policy recommendations in the sections that discussing the development of a global surveillance and response system.[345] Likewise, an NIE on global warming might take into account U.S. institutional capability to diagnose the problem as well as existing proposed national mitigation actions to respond to global warming's impacts.

The NIE on global infectious diseases indicates such diseases kill approximately 170,000 Americans annually.[346] It is likely that annual deaths from global warming in the U.S. will exceed that amount every year over the thirty year timeframe proposed for the global warming NIE. Therefore, if the only criterion for whether the NIE is appropriate is the scope of the associated premature death, the NIE for global warming would appear to be justified on these grounds alone. Premature deaths of citizens form the crux of the "realist" definition of national security articulated in an earlier chapter. This level of premature death would be inimical to national security.

[344] The National Intelligence Council, *Global Infectious Disease Threat and Its Implications for the United States*, NIE-17D, January 2000., Preface
[345] Ibid
[346] Ibid 31

Criticisms of the NIE as an Estimate Tool

While the performance of an NIE approach does seem to be appropriate and valuable there are some inherent drawbacks of applying this type of analysis to the case of global warming. First, NIEs are primarily estimative. Consistent with this objective NIEs tend to be conducted at the highest level of analysis and are less detail oriented than more in--depth studies. For example, my purpose in writing this dissertation is to make an argument based on a cataloging of the damage that global warming has done within certain regions. This amount of data would be difficult to present in such a low detail oriented, forward looking, assessment such as an NIE. Therefore, the NIE is decidedly not the best tool to accomplish this goal of providing historical background in any depth. The NIE could be viewed as an attempt to formulate a forecast based on the type of case specific information about global warming's regional impact that I have collected and presented in the previous chapters. Due to their structural limitations, intelligence agencies would not be the best location to gather the "baseline" scientific data. As noted, this hurdle could be overcome by using existing estimates such as the IPCC 4 AR. In any case the possibility exists that the intelligence agencies are currently not structured to perform environmental analysis.

An additional potential weakness of the NIE as a tool is that it will likely not lead to the type of prescriptive results than the academic or think tank community, for example, might deliver. Even if it is made public, an NIE is unlikely to hold up well to academic rigor. In a classified estimate, there is no opportunity for peer-review beyond a small number of analysts in the intelligence field. Academic writing is characterized by peer

review to a much greater extent especially when a topic has a high amount of scientific content. On the other hand, an NIE is the flagship product of the intelligence community and it will almost certainly carry more weight among the Washington policy elite than articles in even the most prominent scientific journals. In this case, the opinions of the academics will not be very important.

The other weakness of the NIE approach is its level of generality. The NIE analysis does not present a sufficient level of detail to make any but the most general conclusions about global warming's implications for military readiness. It will be impossible to glean facility-specific data such as the extent of sea level rise from the general conclusions of the estimate. If Congressional legislation allows, a separate report such as that by the Secretary of Defense referenced in the previous passage will be used for that purpose. This more detailed report would, in turn, drive the defense acquisition process due to its proposed focus on regional impacts.

Another argument against the NIE is that reliance on this tool could yield a situation that intelligence scholars refer to as a failure of imagination. Not thinking of passenger planes as a tool of war is a failure of imagination[347] The tool used to avoid failure of imagination is called alternative analysis. Transnational issues present a different set of analytical challenges than do more traditional intelligence topics targeted toward issues such as conflict among nation states. The NIE may hedge in favor of the type of evidence that confirms rather than challenges the current hypothesis about international

[347] Central Intelligence Agency, The Sherman Kent Center for the Study of Intelligence, *Occasional Paper: Making Sense of Transnational Threats*, Volume 3, No. 1, October 2004, Page 11. Available at https://www.cia.gov/library/kent-center-occasional-papers/pdf/OPV3No1.pdf (Accessed on 12/10/07)See

affairs. Stated another way, the intelligence community has developed a type of groupthink that could make its conclusions more suitable for analyzing problems through a traditional cold war lens. Thomas Friedman, foreign affairs columnist for the New York Times has characterized this type of groupthink as a failure of imagination.[348] It is possible that academics using government data and methods may not display this bias since their minds are more open toward flexible approaches.

While NIEs do carry great weight in the policy community they do not usually take into account economic, political or legislative initiatives that are planned by the U.S. government in their analyses.[349] If the rhetoric of the White House is to be believed, then the Bush administration is prepared to take drastic policy measurers to limit emissions and has a willingness to implement mitigation measurers. These actions would skew the NIE intelligence analysis by introducing previously unseen variables into the equation. Intelligence analysts can provide tentative assessments of the potential effect of various U.S. policy initiatives but this becomes unwieldy as I have outlined in the preceding pages as the full range of options should be developed and analyzed elsewhere in the government.[350] Intelligence analysts' ability is further constrained by the fact that they are not aware of the budgetary and political factors that policymakers will weigh when making decisions so their ability to predict outcomes is constrained. It is important to remember that NIEs are only one element of the national security decision-making process. The National Security Strategy and the QDR implementation, for example, play

[348] Central Intelligence Agency, 14.
[349] Best,10
[350] Best, 10

a role. Reports on the effect of global warming on military operations will also play a role if they are done separately from the NIE.

Likewise, intelligence agencies are not in a position to assess the potential likelihood that diplomatic initiatives will be carried out and what their effects on future policies are likely to be. In order for the intelligence community to adequately treat the variable of policy change, the Department of State or the White House would have to provide them with the range of policy options that they believe may respond to a given contingency treated by the analysis. This level of cooperation is unlikely to occur in any case due to the history of the bureaucracy and the nature of the relationship between political appointees and the intelligence agencies.

Furthermore, the type of analysis found in the NIE is geared toward events that take place outside of US territory. Following this logic, the CIA would then have a higher quality of information for say desertification in Egypt than it would have data for changes in the Alaskan tundra's surface that may impact on arctic military basing.

The potential inability to measure policy change presents a very real analytical challenge for any NIE. It would be very important to take the concept of policy change factors into account to achieve a holistic analysis of the impact of global warming on U.S. national security. In the case of global warming, the magnitude of the problem itself could be captured by various scenarios that depend on the relative scale or intensity of human economic activity. This raises the question of whether a more policy dependent or a more targeted analysis that examines the impact of global warming on a particular

industry or sector would yield more applicable results than a more diffuse approach toward the NIE.

Unlike other types of studies by scientific agencies within national governments, or by groups such as the Government Accountability Office (GAO), NIEs are not subject to review through the process of open Congressional hearings due to the sensitivity of their content. Perhaps this policy should be reexamined in the case of the NIE on global warming. This type of review may be suitable however for an NIE on global warming. The global warming NIE addresses a complex problem that warrants a complicated, multidisciplinary approach that could potentially involve multiple members of the national and international scientific community. In addition to the concern about confidentiality, Congressional hearings are not entirely suitable to an NIE because they may serve to politicize the assessment and put the drafters themselves under political pressure to justify their analysis.

One of the reasons that the completion of an NIE on the national security implications of climate change has been so contentious is the argument, forwarded by some members of Congress, that valuable intelligence resources such as National Technical Means (NTM) will be misused to collect information for the effort. The type of information that they are referring to presumably pertains to the state of climate science for the estimate. As the argument goes, this action would tie up resources that could be better used directly to pursue and destroy terrorists. The NIE as envisioned by the May 2007 proposal before

Congress or that actually planned by the intelligence community, does not call for the use of secret data collected from satellites.

However, as described in previous sections, intelligence assets could reasonably be deployed on a limited basis in another manner related to climate change issues such as the verification of agreements in the area of international negotiations. Satellites could be used to obtain intercepts that monitor foreign governments' reactions to U.S. climate change policies. Such assets have been used to monitor treaty compliance in the areas of arms control and environmental agreements. Some of this information could in turn be well used in the formulation of the political dimensions of a threat assessment. It is probable that this could be managed in a way that would not place a significant amount of stress on the availability of these resources and assets for other purposes.

The Language Barrier

Historically, the imprecision of the language used in an NIE has historically made it a relatively blunt instrument. NIEs are highly anecdotal but a clarification of terms used improves their precision as much as possible. Perhaps because they are consumers of NIEs themselves Congress moved to rectify this problem in the Intelligence Reform Act of 2004. The legislation requires the inclusion of a language in NIEs to explain the precise meaning of relatively imprecise terms such as "we judge" and "we assess." The language must also include the difference between high, moderate and low confidence in various judgments.[351] While avoiding the creation of terms that could be referred to as

[351] Best, 11.

illusory precision, this explanation should prove valuable to policymakers who rely on the NIE.[352] The reader of my dissertation will also benefit from an additional clarification of these terms as I move forward since I intend to use this language as well to express my findings. The best available example of the Intelligence Communities clarification of estimative terminology comes from the 2007 NIE: *Prospects for Iraq's Stability: the Challenging Road Ahead*. The NIE outlines the list of changes related to the Intelligence Reform Act of 2004 and provides the following description of estimative language.

An Explanation of Estimative Language

Some analytical judgments are based on information on collected information; others rest on previous judgments, which serve as building blocks. In either type of judgment we do not have "evidence" that shows something to be a fact or that definitely links two issues.

Intelligence judgments pertaining to likelihood are intended to reflect the community's sense of the probability of a development or an event. Assigning precise numerical ratings to such judgments would imply more rigor than we intend. Chart below provides an idea of the relationship of terms to each other.

Remote	*Unlikely*	*Even Chance*	*Probably Likely*	*Almost Certainly*

We do not intend the term "unlikely" to mean that an event will not happen. We use "probably" and "likely" to indicate there is a greater than even chance. We use words such as "we cannot dismiss", "we cannot rule out" and "we can not discount" to reflect an unlikely -- or even remote – event whose consequences are such that it warrants mentioning. Words such as "may be" and "suggest" are often used to reflect situations in which we are unable to assess the likelihood generally because relevant information is non-existent, sketchy or fragmented.

[352] Credit for use of this term can be assigned to Professor John Holdren of Harvard University who either coined or borrowed this phrase.

In addition to using words within a judgment to convey degrees of likelihood, we also ascribe "high," moderate or low confidence levels on the scope and quality of the information supporting our judgments.

- *"High confidence" generally indicates our judgments are based on high-quality information and/or the nature of the issue makes it possible to render a solid judgment.*
- *"Moderate confidence" generally means the information is interpreted in various ways, we have alternative views, or the information is credible and plausible but not corroborated sufficiently to warrant a higher level of confidence.*
- *"Low confidence" generally means that the information is scant questionable, or very fragmented and it is difficult to make solid analytic inferences, or we have significant concerns or problems with the sources.*[353]

I intend to use the language outlined above to analyze my findings from chapters 3 and 4. During the last year NIEs have become more prominent or perhaps notorious both within the government and in the public debate following the impact of the assessment of Iraqi instability mentioned above as well as reports on WMD in Iraq (2004) and the resurgence of Al Qaeda (2007). Both of the estimates were found to be significantly flawed. It is worth considering the proposition that a more prominent role for NIEs in the public debate has actually played a significant role in masking their inherent limitations as a limited analytical tool. Despite widespread questions about their accuracy the NIE is now seen by a wider audience as the flagship product of the Intelligence Community. This was reinforced by the December 2007 NIE (title) on the Iranian Nuclear Program finding that Iran had discontinued the program in 2003 despite assertions by the Bush Administration to the contrary. Partially as a result of both the reforms of 2007 and the relative inaccuracies NIEs now note dissent toward the findings through either textual or parenthetical notation.

[353] Text box found in Declassified Executive Summary of National Intelligence Council, *National Intelligence Estimate, Prospects for Iraq's Stability: A Challenging Road Ahead*, January 2007

One observable aspect of this phenomenon is that each side of a debate is likely to "cherry-pick" the findings from the scenario in the NIE that most closely resembles their predetermined argument. The integrity of the product is then lost. This frequently has the effect of making the NIE less of a sharp policy tool than may be necessary to point the way toward resolution of the issue. The "on the one hand, on the other hand" approach of the estimate provides uniquely suitable fuel for partisan Congressional debate. The public debate over the NIE on the resurgence of Al Qaeda 2007 illustrates this dichotomy. The NIE is a kind of political Rorschach test: everyone tries to see in it what they want to see. Nevertheless, a fundamental issue with the use of an NIE on global warming is the inherent limitations involved in casting environmental phenomenon, such as climate change, as national security issues. It is likely to tempt policymakers to use the wrong lens to analyze the problem.

Analyzing the global warming issue from the perspective of an NIE could exacerbate this problem identified by environmental security scholars such as Richard Matthews. He has been prominent among those making the argument that the national security approach can encourage the thought that environmental security questions have military solutions like the other problems that are typically the focus of NIEs. Applying an NIE to the problem of the impacts of global warming that warrants a coordinated response from several sectors including public policy, civil society, business and the military may heighten the perception on the part of the other actors that they do not have a relevant role.

This effect of "over casting" global warming as a national security issue will be magnified if the findings are not shared with the civilian agencies such as the Departments of Energy, and Commerce, the Environmental Protection Agency and FEMA that possess a large share of the capability to approach the problem. These civilian agencies are less likely to see an NIE as being relevant to their core missions -- if their personnel have access to it at all -- than the more traditional national security agencies. This problem can be ameliorated to a certain extent if the NIE is made more accessible through declassification or the use of an unclassified annex as called for in the 2007 intelligence authorization language. The potential 2007 NIE on global warming proposed by Congress requires the inclusion of an unclassified annex summarizing the findings. This is especially important because a large number of the personnel in the civilian agencies do not have the necessary security clearances to read the NIEs.

The use of a classified NIE could create a paradigm whereby except for civilians at the highest levels of the non-defense agencies, only the Defense Department and the military have access to the report. This contingency may then support a type of groupthink that would favor the implementation of military solutions to the problem. An example from my case studies of such a military response might be if the U.S. were to decide to invade Mexico in order to stem the flow of environmental refugees.

The question of how to respond to the challenges imposed by global warming suggests a multidisciplinary response where input from various agencies would be equally valuable. Implementing humanitarian assistance and preventative measures such as legislative,

diplomatic and engineering remedies does not fall under the Defense Department's purview nor does it play to the Department's strengths. Furthermore, the NIE, if applied in a manner similar to past estimates, does not encourage the U.S. government to undertake domestic mitigation measures. It would likely frame the question in terms of threats that originate from abroad. Again, this paradigm would make the policy response to the security threat an issue for the foreign affairs or defense establishment rather than other civilian agencies such as the Department of Energy or the Environmental Protection Agency.

Another aspect of the dilemma posed by the concept of an NIE for global warming is that the medium of an NIE itself has been discredited in the eyes of many. The credibility of NIE's as well as the very competence of U.S. intelligence agencies has been questioned in light of the failure to find WMD in Iraq despite the 2003 NIE findings that weapons were present. Public confidence was also shaken when, a 2006 NIE claimed that Al Qaeda's strength had diminished and that their leadership capability had been significantly eroded. However, an NIE just one year later indicated that the movement was again gaining momentum. Major NIEs with grand public conclusions have thus displayed a growing pattern of unreliability. The fact that NIEs are not peer-reviewed by people outside of the intelligence community, a group that has been discredited lately, may contribute to the growing perception of the unreliability of the estimates perhaps even among analysts themselves based on my inquiries.

Incorporating Military Challenges into the National Intelligence Estimate:

The earlier comments about the drawbacks of DoD assuming the role as the primary actor in responding to global warming does not imply that DoD will not be a valuable consumer of intelligence obtained from the NIE. Many of the NIEs findings could point to global warming's impacts on the military operations as I described in some detail in Chapter 3.

Africa Command (AFRICOM), the newest of America's regional military combatant commands is currently operational on a limited basis. This organization could become a key consumer of climate change-related strategic and tactical intelligence for two reasons. One of the core functions of the command is to insure U.S access to a regional petroleum energy supply. A quasi-governmental group called the African Oil Policy Initiative Group played a significant role in starting discussions over the creation of an Africa Command. They produced a white paper that emphasized the Intelligence Community's analysis that that the U.S. will purchase 25% of its oil supply from Africa by 2015.[354] The geopolitical dynamics of energy exploration are likely to change as the U.S. government becomes more aware of the impacts of fossil fuel use on the one hand and diversifies its exploration to non-Middle Eastern sources of petroleum on the other. Africa will become more strategic to U.S. interests than ever before. The second reason is that AFRICOM will also seek to build relationships and cooperate with local populations to address local environmental security challenges.[355] These environmental challenges such as desertification may have been caused by or exacerbated by global

[354] "With Mideast Uncertainty, US turns to Africa for oil" *Christian Science Monitor*, 5/23/02.
[355] Interview with Major Shannon Beebe, Africa Desk Officer, Office of the Army Chief of Staff, conducted November 20 2007.

warming. Intelligence analysis of the effects of climate change on Africa will be especially valuable for AFRICOM as they seek to identify new areas of cooperation or to head off environmental catastrophes, such as crop failure, or floods before the occur. Of equal interest to Africa Command are areas such as Somalia or Darfur that are likely to experience outbreaks of violence sparked by environmental conditions such as drought which are actually predictable under the right conditions.

While the NIE is not required to specifically address the issue of the operational impacts of global warming, the 2007 Senate bill required the Secretary of Defense to submit to Congress a report on the projected impact of global climate change on military installations and the "capabilities of the United States."[356] The language dictates the exploration of climate change's foreign policy ramifications by requiring the Secretary of State to submit a report to select committees that addresses inter alia:

> the potential for large migration flows in countries of strategic interest or humanitarian concern as a response to changes in climate and the implications for United States security interests; and the potential for diplomatic opportunities and challenges facing United States policy makers as a result of social, economic, or political responses of groups or nations to global changing climate.

Furthermore, the language authorizes the Secretary of Defense to carry out research on the impacts of global climate change on military issues such as operations, doctrine, organization, training, material, logistics, personnel, and facilities and the actions needed to address those impacts.

[356] U.S. Senate, The Global Climate Change Security Oversight Act (S. 1018) available at http://www.fas.org/irp/congress/2007_cr/s1018.html ; (Accessed on December 4, 2007)

The analysis will be comprehensive. Quoting from the authorizing legislation, the research carried out by DoD through the use of war gaming and other analytical exercises may include analysis of:

- the implications for United States defense capabilities of large-scale Arctic sea-ice melt and broader changes in Arctic climate;
- the implications for United States defense capabilities of abrupt climate change;
- the implications of the findings derived from the NIE for United States defense capabilities;
- the strategic implications for United States defense capabilities of direct physical threats to the United States posed by extreme weather events such as hurricanes; and
- the existing policies of the Department of Defense to assess the adequacy of the Department's protections against climate risks to United States capabilities and military interests in foreign countries.[357]

Finally, the language requires the Secretary of Defense to submit a report within two years after the NIE is submitted to Congress on the results of the aforementioned research related war games, and other activities.

Whether or not this type of analysis is ultimately required by legislation, I would argue that it is consistent with national security objectives. It is very difficult to obtain a holistic picture of the national security implications of global warming without a solid understanding of the impact on military operations. This is the most effective way of measuring the national security impacts from the perspective of the realist definition of national security I have framed in the first chapter of this dissertation. In fact, the

[357] S. 1018

blunting of national military capabilities could be a significant aspect of global warming. Without this piece, a true test of the phenomenon against a realist definition of national security is not possible. This is the reasoning behind my inclusion of global warming on military operations in the analysis in this dissertation.

As of November 2007, the language mandating the performance of an NIE was not included in the Intelligence Authorization Bill. However, the legislation is in some ways irrelevant because according to several sources interviewed, an NIE or similar study is already at some stage of preparation within the Intelligence Community. Unfortunately the presumed lack of adherence to the parameters specified by Congress makes the actual methodology less transparent. According to George Tenet, former Director of Central Intelligence, the NIC estimation team would strongly benefit from consultations with experts outside the intelligence community such as those from academia and NGOs in any case.[358] I presume that The NIC will roll the most recent reports especially CSIS *Age of Consequences* into their estimate.

Conclusion

In the end a successful NIE must provide a sober indication of the limitations of the evidence that is available.[359] In the case of an NIE concerning global warming, the variability of the scientific evidence about the rate at which environmental change will set in must be emphasized. The use of a solid scientific baseline such as the IPCC 4 AR without qualification may lead to results described in the NIE that are taken literally by

[358] Interview with George Tenet, conducted October 10, 2007.
[359] Best, 12.

the readers leading to the impression that this type of forecasting is an exact science from which precise policy responses can be crafted. National Intelligence Estimates are but one of the decision making tools -- albeit very important ones -- that should be utilized by high level decision-makers and taken in account by the public in crafting a response to the security challenges presented by global warming or probably any other issue.

Another more refined decision-making tool is a well developed policy options, or "white" paper. The NIE, if unclassified, could help form the basis of a Presidential Administration transition white paper in anticipation of the 2008 elections and the coming Presidential administration. All indications are that the new government will take a different approach to this issue. A white paper is by definition more prescriptive than the NIE itself. This approach would compensate for the NIE's deficiencies as a fully prescriptive vehicle towards addressing the national security implications of global warming.

As stated, one of the weaknesses of strategic intelligence analysis methodology is that it concentrates heavily and reports on phenomenon representing national security problems that are essentially military in nature. Threats posed by WMD are a common target. My research indicates that the damage caused by global environmental change is similar in scope to that caused by WMD so the approach to analysis could be methodologically similar. I have presented substantial grounds upon which the use of the national intelligence approach toward the analysis of global warming can be critiqued. However, some of the effects of global warming are strategic in the sense that they relate directly to

these national security challenges that are military in nature due to the operational challenges they are likely to present for the armed forces.

Not withstanding the general validity of this critique there is the significant possibility that global warming will indirectly cause wars by contributing to environmental scarcity. However, a framework based on analysis of strategic threats from a military perspective is not necessarily the best approach to analysis of post Cold War transboundary challenges to national security. Some of these challenges affect aspects of human security as established by Jessica Tuchman Mathews such as health, damage to private property or to the comfort of a population.

Taking these factors into account, I have used evidence gleaned from the previous two chapters of the dissertation to identify the ways in which global warming affects national security through an approach that approximates national threat estimation to the best of my ability to understand it. Secondly, I have made recommendations toward a better analytical model that could be more appropriate to the task of analyzing global warming as a national security threat than the historical and presumably current approach the National Intelligence Council is taking toward the NIE on the National Security Implications of Global Warming. The NIE process is still largely dominated by strategic analysts from the CIA using an analytical framework derived from the Cold War.

Recommendations

In coming years global warming will pose an increasing challenge for national security analysts and practitioners alike. They will both be charged with measuring and reacting to the U.S. decline in global standing coincident with policy inaction on global warming. The NIE is important because it will do something that Congress does not do often enough do in politics. That is to look beyond the next election or the next few years and require the intelligence community to think about these issues in the context of the next 30 years

New Early Warning Systems

The intelligence community should develop a better early warning system to forecast environmental threats similar to the past attempt by the CIA's DESI that utilized unclassified input. The system could incorporate geospatial intelligence as well as the use of historical and meteorological data. Under this system, the intelligence community should cooperate with scientific agencies and invest the time to create better vulnerability metrics to aid in activities such as famine forecasts. These metrics can be used to assess the countries that are most susceptible to climate change and most likely to experience conditions such as drought or flooding that could lead to dislocation and potential violence. Future intelligence work including NIEs could be based on data obtained from this system. This approach could augment the existing amount of information obtained by the IPCC that must rely on unclassified data for its predictions.

The use of NTM and other intelligence collection capability may address what has been identified as a problem with the level of geographic fidelity of the presentation of the data in the IPCC 4 AR. The 4 AR it is based on general conclusions from aggregate data.

Intelligence assets such as satellites or possibly human collectors could assist in better aggregating the broad data down to a more local level. This observation is particularly true of data collected by the U.S. Navy related to ice core thickness, etc. This will be essential for the subsequent report for the Secretary of Defense called for in the legislation.

Incorporation of the NIE into Other National Security Planning Documents

Perhaps most importantly, the NIE should not stand alone. It could form the basis for other strategic planning documents such as the semi-annual National Security Strategy. A report from the Strategic Studies Institute of the Army War College recommends that new legislation should be enacted in the form of a new national security act of 2010 calling for intergovernmental cooperation to support climate change mitigation.[360] The findings of an NIE would provide impetus for such an effort.

Ultimately, an intelligence estimate on global warming is valuable because it establishes a baseline that policy planners can use to compare the amount of available resources against. The NIE would be a useful tool in producing the Quadrennial Defense Review (QDR). The QDR is the congressionally mandated, medium range planning guide that the armed services use to justify their budget requests each year. The document assesses the mission of the Armed Forces and the resources that are necessary to accomplish the mission. The National Security Strategy and the National Defense Strategy are other

[360] Kent Hughes Butts, *Environmental Security: A DoD Partnership for Peace*, April 1994, Available at http://www.strategicstudiesinstitute.army.mil/pubs/display.cfm?pubID=339; (Accessed on June 12, 2007)

studies that would benefit from the conclusions of an NIE on the National Security Implications of Global Warming.

An International Intelligence Consortium

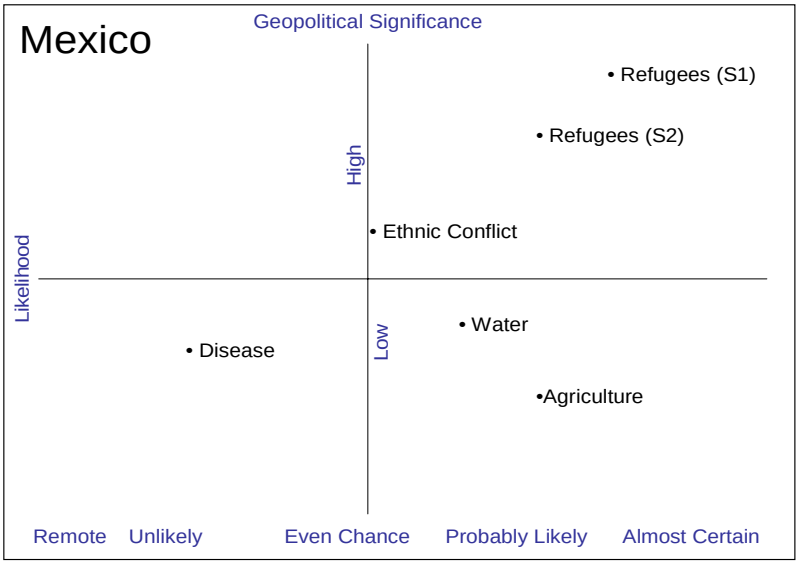
As stated, the NIE on global warming should either be itself unclassified or should include an unclassified version. The product could then be part of a two-way system that I am labeling a consortium. This system would be in some ways similar to the MEDEA program of the 1990s mentioned earlier in this chapter. First, the best available science including the IPCC 4 AR and data from international universities and research centers would factor into the production of the estimate at the "front end" of its production. It is possible that some business entities such as consulting firms may also have information to contribute to the system. The intelligence community would then build upon this data as the NIE process went forward to develop their own models of the impacts of global warming. Physical profiles of countries vital to national interest could then be assembled into a central database. Sea level rise estimates for Egypt are an example of the kind of data that could be assembled. The advantage the Intelligence Community has over other scientific bodies is that it could then use classified assets to verify or augment existing data. U.S. Government resources such as the supercomputers of the U.S. national laboratories would be available for the purpose of developing and maintaining climate models. It is therefore conceivable that the NIE would contain the best available science on the impacts of global warming. These models, once established would probably be relatively easy to maintain. They would form a nexus for international cooperation.

Through an intelligence consortium, the U.S. would then share the NIE results and model as a quid pro quo for the information it had received to produce the NIE. Ideally, the sharing of information could then become an organic process where data concerning observable changes would be shared by citizens of other nations in the field and compared to the new evolving climate model created by the intelligence community. Ironically, one of the probable significant finding of an NIE would be the existence of a threats based on "political" unhappiness of other nations toward the U.S. for either playing a disproportionate role in the creation of global warming or not participating in the Kyoto Protocol, the most apparent remedy. The intelligence consortium based on the NIE would assuage the very threat it is designed to measure by providing data that gives other nations a better scientific basis to take real steps to mitigate the problem. The NIE itself would be then become an engine of U.S. security.

Chapter 5: Summary of the Case Study Findings

In the section I am using estimate language to summarize my findings from previous chapters keeping in mind the question that I have identified in the previous chapter. The process is: using the estimative language and methods of the intelligence community, does the advent of global warming meet the realist definition of a security threat as described in the theory chapter of this dissertation? That definition includes threats against the lives of inhabitants in a state and the limitation of the options available to policymakers**.** I have summarized my significant findings from Chapters two and three in a matrix that measures geopolitical significance against the likelihood of occurrence and concluded that the potential threat that global warming poses to the U.S. does indeed warrant the performance on a National Intelligence Estimate or similar study. Please find the summary of my findings below.

Mexico



- **Environmental Refugees (S1):** A rise in immigration to the U.S. from Mexico and Central America will result from scarcity driven by global warming (likely) Geopolitical significance (high). Migrants will be absorbed into areas of the U.S. suffering from similar problems.

- **Environmental Refugees (S2)**: Refugees flee to Mexico from Central American Countries that have been more deeply affected by scarcity causing higher internal instability. (likely). Geopolitical significance (high).

- **Agriculture:** Decline in Mexican agricultural productivity (maize production) (likely) Geopolitical impact (low)

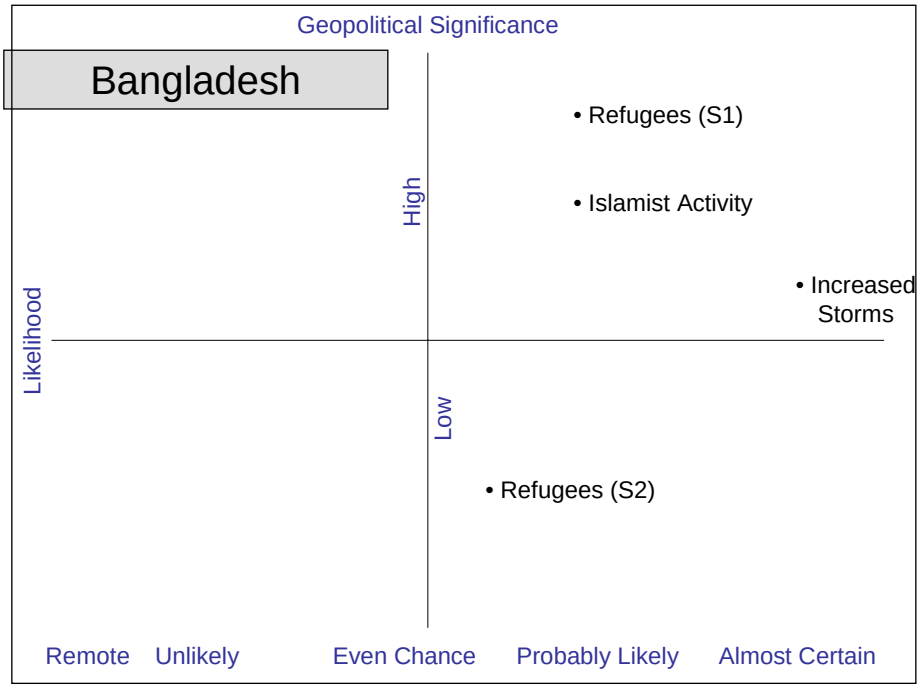
- **Ethnic or regional conflict:** Environmental Scarcity triggers a regional instability such as a resurgence of the Zapatista rebellion. (even chance) moderate geopolitical significance.

- **Water disputes:** Desertification leads to decline in supply of potable water causing Mexico to push for renegotiation of the Colorado River Water Sharing Agreement and other pacts. (likely) Geopolitical significance (moderate)

- **Increased Disease Vectors**: Major outbreak spreads to the United States (see section for impact on the U.S.)

- **Political Instability:** Zapatistas reignite their revolution in response to a drought in the Yucatan. Again the perception that the drought was caused by Climate Change is more important than the reality.

Bangladesh



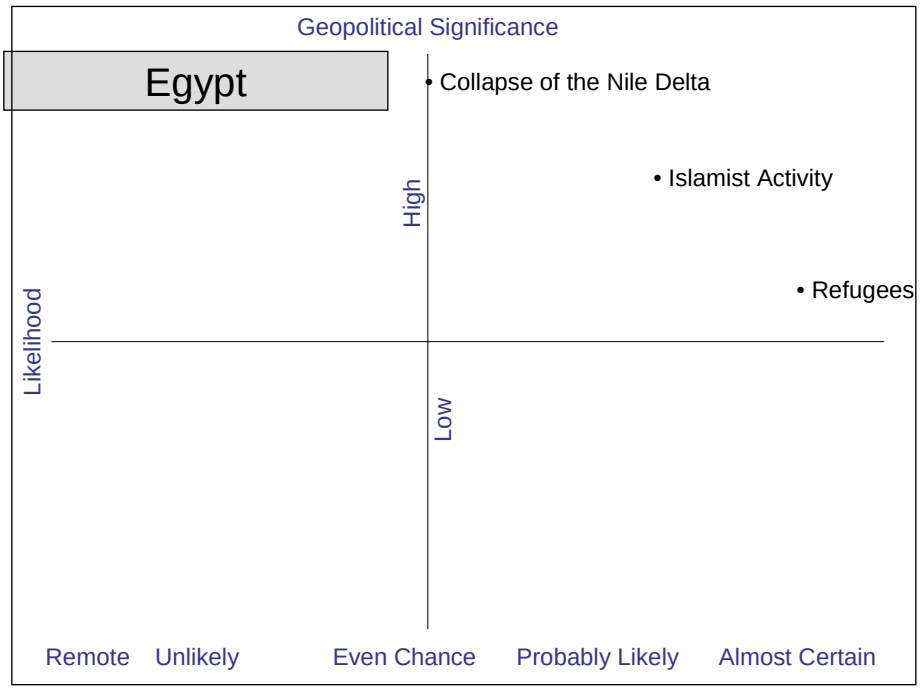
- **Environmental Refugees:** (S1) Migration from Bangladesh to India causes sectarian strife in Assam exacerbating existing tensions between Hindus and Muslims. (high likelihood) moderate strategic significance to the U.S.

- **Environmental Refugees**: (S2) Migration from Bangladesh to Western Europe and the U.S. (likely) Geopolitical significance (low)

- **Islamist Activity:** Adherence to Islamist and jihadist groups in Bangladesh increases as a result of scarcity (likely). Moderate military significance to the U.S. Ill will, possibly manifesting itself as terrorist activity, is directed against the U.S. based on our high status as an emitter of greenhouse gases.

- **Increased Storms:** Storm activity that has become more severe as a result of climate change causes widespread dislocation warranting a response by the international community including the U.S. Armed Forces (almost certain). Moderate military and geopolitical significance.

Egypt



- **Agriculture:** Collapse of the Nile Delta agricultural zone (even chance). Geopolitical significance (high) Triggers U.S. humanitarian intervention through and the need for Military Operations other than War (OOTW). Widespread famine could results.

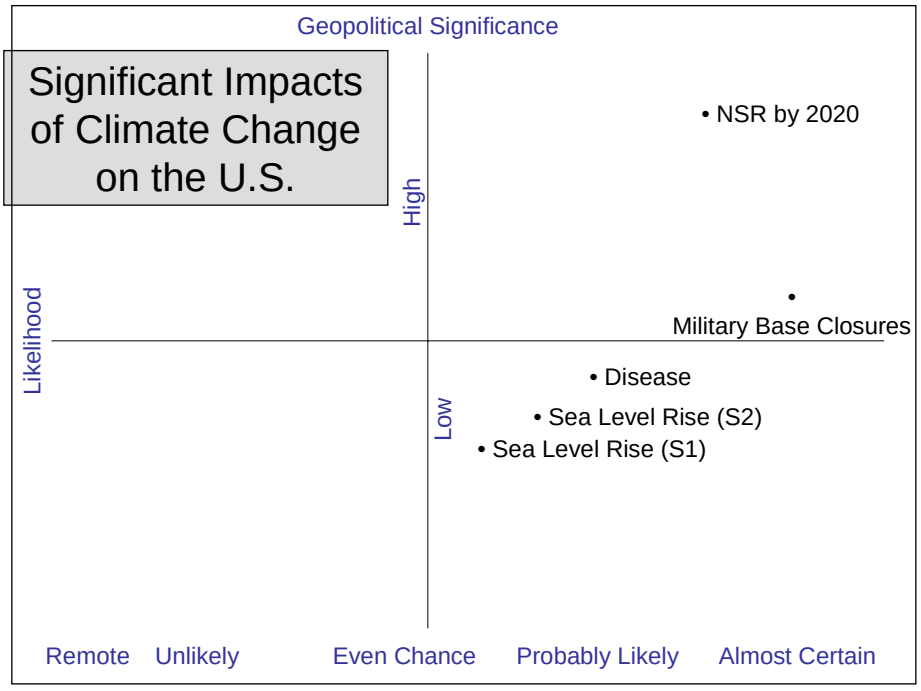
- **Islamist Activity:** Existing scarcity and potential agricultural collapse increase popular adherence to Islamist and jihadist groups as citizens turn toward extralegal organizations for legitimacy and as a source of basic goods and services. (likely) Geopolitical significance (moderate to high)

- **Environmental Refugees**: Internal displacement of (at least 10 million people) resulting from sea level rise. (almost certain) Geopolitical significance (moderate) Cairo will become more crowded and possibly restive.

United States

While global warming may contribute to the rise of political ill will and even possibly terrorism directed against the U.S., these consequences will arrive in tandem with the actual physical impacts that the phenomenon will have on the United States. These impacts are summarized on the following pages using the following charts.

Physical Impacts



- **Military Base Loss of Capacity and Closures**: Military facilities, particularly in Alaska, such as air bases and training ranges are rendered less useful due to soil conditions at a time when the region is becoming more strategically significant.

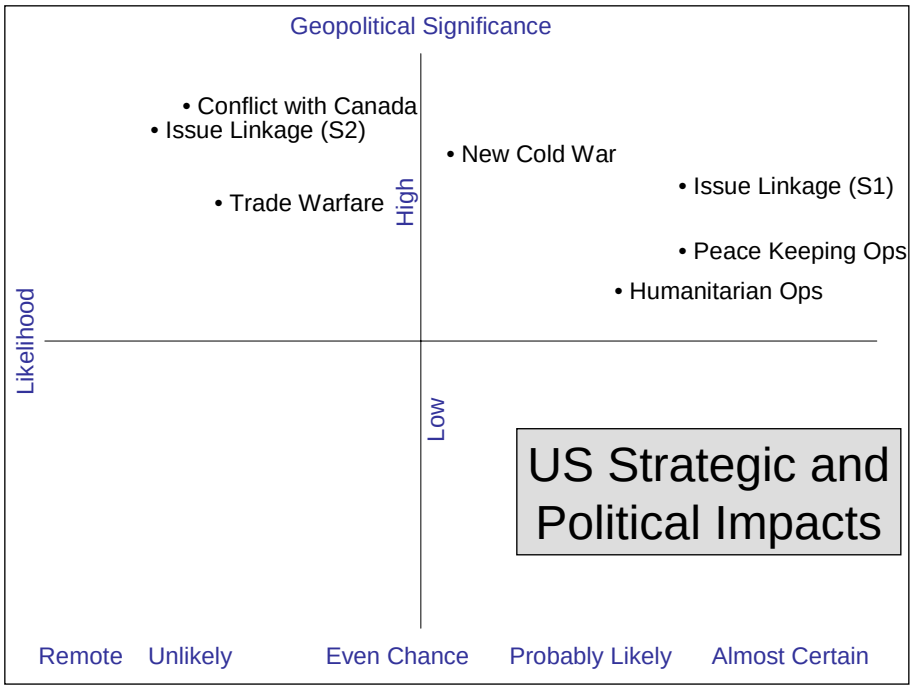
- **Northern Sea Route:** Potential for military conflict associated with ongoing dispute with Canada and Russia over sovereignty (freedom of navigation, fishing and mineral rights) of the passage which may open as soon as 2020. Associated costs of regulating commercial navigation, oil spills, etc.

- **Sea Level Rise (S1)** of 7 to 23 inches by 2100 with at least $138 billion worth of "primary" damage to U.S. Port facilities

- **Sea Level Rise (S2):** Sinking of low level islands that delimitate maritime boundaries causing a loss or reconfiguration of the Northeast Fishing Banks Exclusive Economic Zone (EEZ) leading to economic losses or potential conflict with other fishing nations.

- **Increased Threat of Disease:** Tropical diseases such as Malaria and Dengue fever are likely to spread to the U.S.

Strategic Consequences



- **Increased Commitment to Humanitarian Operations**: Operations Other Than War and humanitarian operations such as flood relief in Bangladesh detract from the traditional military warfighting mission and missions such as the Global War on Terror. The military will be called upon to assist in this mission on U.S. soil.

- **UN Peacekeeping Operations:** The U.S. will likely have to contribute to peacekeeping operations that respond to conflict sparked by environmental factors.

- **Trade Warfare**: A country such as Brazil successfully brings a WTO case against the U.S. for dumping cheap non carbon-constrained goods on the world market causing harm to the U.S. economy.

- **Negative Environmental Issue Linkage (S1):** U.S. allies, particularly in Europe, view direct support for U.S. military actions in the Global War on Terror as a "quid pro quo" for participation in a global climate treaty.

- **Negative Environmental Issue Linkage (S2**): Potential adversaries such as Islamist militants in the global south direct acts of environmental terrorism

against the U.S. mainland or interests based on non-participation in a global climate regime.

- **New Cold War:** Opening of the NSR to commercial traffic and extractive exploitation leads to a "New Cold War" with Russia**.**

- **Conflict with Canada**: Opening of the NSR leads a territorial dispute and a downturn in relations with Canada**.**

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