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Understanding Environmental Security and Climate Change

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Introduction

> The danger from climate change is real, urgent, and severe. The change wrought by a warming planet will lead to new conflicts over refugees and resources; new suffering from drought and famine; catastrophic natural disasters; and the degradation of land across the globe.[1]

This paper analyzes the impacts of climate change on the security of the United States. As with all security analysis, context is crucially important in fully understanding the true nature of the problem. Climate change is a world scale issue, requiring broad changes in the way nations deal with many aspects of government and society, including but not limited to energy policy, environmental protection, economics, security, transportation, and other associated issues. It follows that dealing with climate change will require a whole-of-government response and that interagency cooperation will be essential. When the National Security Strategy speaks of the danger of climate change, that message should be an alert to the military, but must also be heard by agencies such as the Environmental Protection Agency, Department of Energy, Department of State, Department of Homeland Security, and the many agencies of the intelligence community. The National Security Strategy (NSS) of the U.S. represents the highest level of global strategic analysis and is where the U.S. identifies critical threats to peace and security for the Nation. This is a mission area that will challenge nearly every part of our government.

In the defense domain, however, the NSS now confirms what Norman Myers, a leading scholar in environmental security, accurately reflected in 1986 when he stated:

> Hence national security is not just about fighting forces and weaponry. It relates to watersheds, croplands, forests, genetic resources, climate, and other factors that rarely figure in the minds of military experts and political leaders, but increasingly deserve, in their collectivity, to rank alongside military approaches as crucial in a nation's security.[2]

Yet, the National Military Strategy (NMS) of 2011, which should follow the 2010 NSS

guidance, contains almost no mention of climate change or related environmental security issues.[3] The NMS does discuss the need to respond to many of the symptoms of climate change, such as natural disasters, disease outbreaks, and refugees. Why is there such a disparity between the NSS and the NMS on the issue of security threats posed by climate change? Is it a false belief that there are no military implications to climate change or other environmental security issues, and that this is a task for other elements of the government?

Environmental security issues, in general, and climate change, specifically, have direct impacts on many aspects of military contingency planning and are fundamental to understanding the true nature of many of the conflicts the U.S. is likely to face in the future. The complex and uncertain world that is described in the NSS and NMS is made more so by climate change and other key environmental issues.

As directed by the President in the NSS, the defense community must understand these threats in order to successfully prepare for and execute its military responsibilities in the course of securing peace and stability. The defense community fails to address these threats directly in the NMS because of a lack of understanding of the basic principles that define environmental security. This lack of understanding is not surprising as environmental security issues deal in strange languages and cultures foreign to military planners, such as thermodynamics, physics, ecology, geomorphology, and more. These subjects are not normally associated with strategic defense analysis. It may be that the admonishment of the British strategist B. H. Liddell Hart has relevance in understanding why strategic military thinking continues to ignore climate change: "The only thing harder than getting a new idea into the military mind is getting an old one out."[4]

The intent of this essay is to assist military, defense, and other national security professionals to better understand environmental security issues by explaining how environmental issues such as climate change become nation security issues. It will not be a lesson in how the laws of physics or thermodynamics apply to the atmosphere sciences of climate change; however, it is important to recognize that the laws and theorems of science do inform the discussions. This essay addresses both the science of key environmental issues[5] and the defense and security implications created by environmental issues such as climate change or freshwater water scarcity. This discussion will establish the link between climate change and other environmental security threats and strategic military planning.

Although this essay discusses a lack of strategic policies concerning environmental security within the Department of Defense (DoD), various defense organizations, particularly at the geographic combatant command level, have done good work in environmental security and in analyzing the issues of climate change. However, this work is dependent on the shifting priorities of consecutive commanders, which causes the efforts to be sporadic and uneven. This essay suggests a higher priority across commands consistent with the level of risk to overall national security posed by key environmental security issues. We recognize but will not address the many positive actions to mitigate climate change within non-DoD interagency programs.

The Science

The study of environmental issues that pose threats to security is not new, having been actively studied in academia for more than 50 years, typically under the term "environmental security." The hypothesis underpinning the environmental security concept is quite simple—peace is not the absence of conflict, but the ability to provide for basic human needs in a sustainable way.[6] The NSS

speaks directly to this in stating the need to "promote dignity by meeting basic human needs."[7] The absence of the life-giving conditions derived from the land, air, and water will destabilize communities, regions, and nations and can have world-scale impacts for such issues as global climate change.

Climate change and water scarcity (water wars) are examples of environmental security issues that are currently topical in the news media. This attention is helpful because it spotlights environmental security issues to the defense community by demonstrating the threats they pose to peace and stability around the world.[8] However, these two issues are not the full suite of environmental issues military, defense, and security professionals must consider. Other environmental security concerns include deforestation, desertification, loss of arable lands, and toxic contamination of the land, air, and water. The impact each of these environmental stressors has on security can change based on geographic setting and interactions among different stressors.

Most environmental parameters function interdependently. As a real world example, a drought in the Sahel Region of Africa has the direct impact of creating water scarcity for the population but can also lead to losses in arable lands, desertification, and increased infectious disease, depending on the duration of the drought and how the people of the region respond. Water scarcity may be a transient issue if the rains return; however, desertification and loss of arable lands take, in human measure, many generations to repair. As the world has too often experienced in this region, this

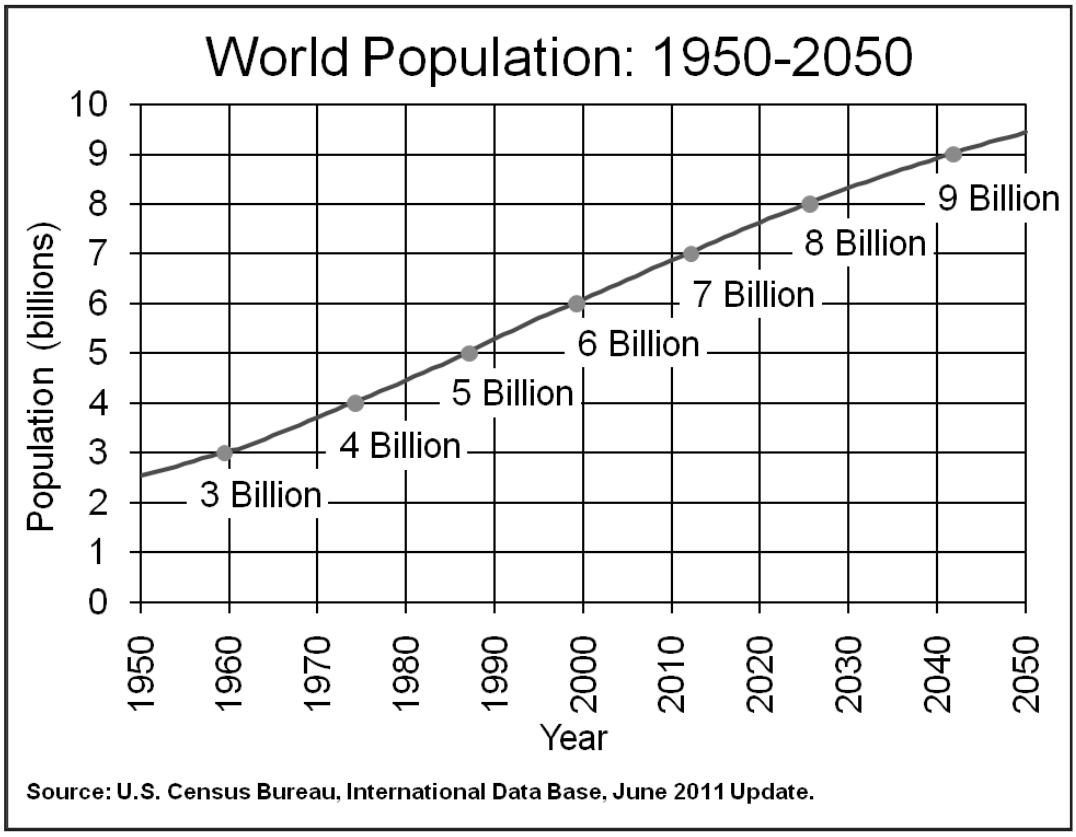


Figure 1. World Population

is a stark example of a regional environmental issue with worldwide ramifications. The visible signs are starvation, environmental refugees, and conflict. However, the root causes are overuse of fragile lands, water scarcity created by climate change, and exceeding the carrying capacity of a land by overpopulation.

The population growth rate is the independent and most critical variable in all environmental security analysis. Any farmer or rancher fully understands that over time a plot of land can only grow so many crops or support so many animals without losing productivity. That point where damage is caused is what defines the carrying capacity of an ecosystem. Earth is a very large and complex ecosystem, but it still follows the same basic scientific law. Consider the data shown in Figure 1.

The world population has increased by nearly three times since 1950. No credible science to date has been able to calculate the human carrying capacity of the Earth. Certainly technology can have an effect on that capacity, but in the end, the planet can only sustain a certain number of people.

This is an oversimplification of the complex issue of understanding how population growth rates, urbanization, health care, and many other factors interact to yield the carrying capacity of a region. It is sufficient to envision that a burgeoning population of more than 7 billion is contributing to the resource scarcities that are stressing many parts of the world today and raise even greater concern for the future.

Science of and Risk Posed by Climate Change

The best science in analyzing climate change is compiled in the work of the UN's Intergovernmental Panel on Climate Change (IPCC).[9] Comprised of scientists from around the world, this group has worked diligently to separate politics from the true science of climate change. Over the life of the IPCC, it has shaped a global consensus on what can be reasonably concluded from the existing scientific evidence describing the Earth's changing climate. The IPPC Working

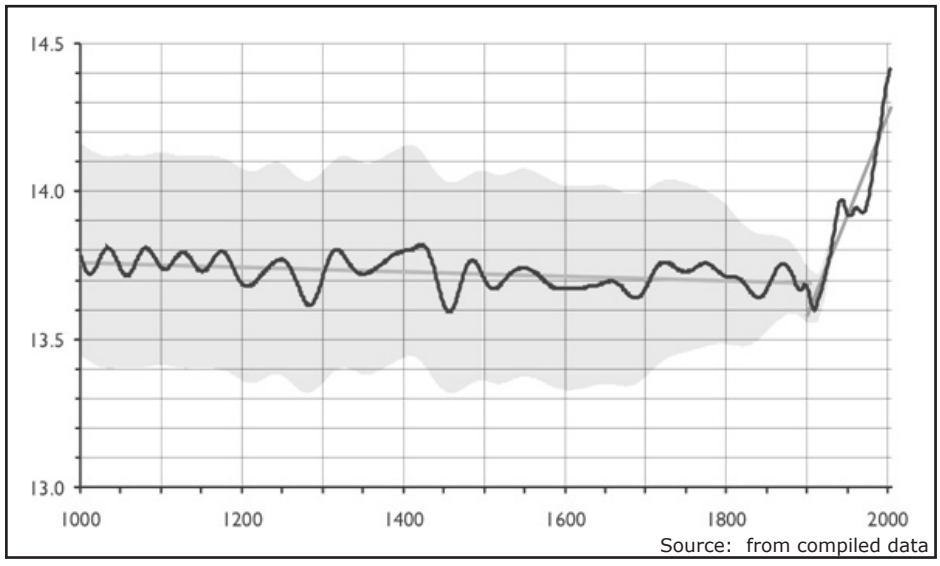
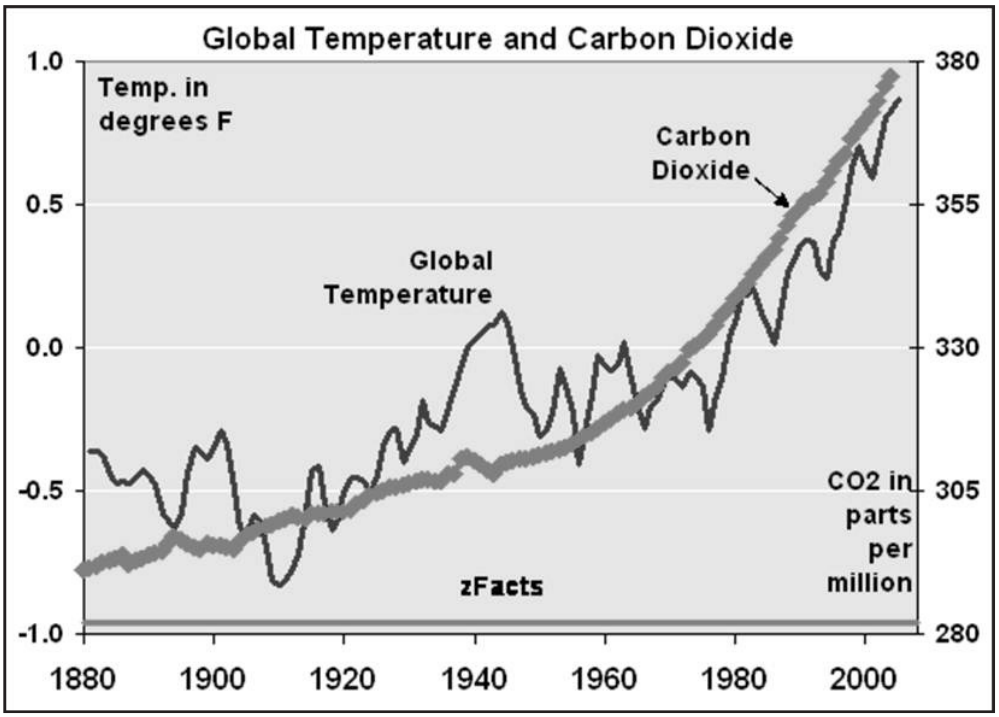


Figure 2. Global Temperature Data (Degrees C and Time AD)

Group 1 has just released its latest scientific analysis of climate change research in its Contribution to the IPCC Fifth Assessment Report.[10] This report further substantiates the certainty of the link between human production of greenhouse gases and climate change.

For defense and security risk analysis these data should be examined in two categories. First, there are the actual recorded data of temperature, winds, precipitation, pressure, and other climate measures. In IPCC work, these data are used to interpret how weather today (short term data) compares with climate (long term averages). Figures 2 and 3 are examples of these types of data showing world temperatures covering different time domains. For security analyses, these current data help assess the security risks posed by the existing changes in weather. In this example we would seek to assess the security impacts in the rapid rise in temperature that has occurred over the last 150 years.



Source: zFacts.com/p

Figure 3. Global Temperature and CO_2

The more challenging work of the IPCC and its most contentious products are the efforts to take weather data from today and develop predictions of the long-term changes in climate likely to occur from human-induced changes in the atmosphere. The crux of the scientific problem is rather simple, but the solution is quite complicated. Science has proven that only certain gases in the air absorb heat energy emitted from the earth in response to the sun's short wavelength energy striking the surface. This is often referred to as the "Greenhouse Effect" (not accurate but a close analogy). The "Greenhouse Effect" keeps the earth warm, compared to the temperatures in space. The greenhouse gases (GHG) include carbon dioxide (CO_2), methane (CH_4), water vapor, and several pollutants such as fluorocarbons. Today, seven billion people are dumping massive volumes of these gases into the atmosphere, thus dramatically increasing their concentrations in the atmosphere as shown in Figure 3.

The dominate culprit is CO_2, which is the primary by-product of combustion of any carbon-based fuel (wood, coal, natural gas, oil, or cow chips). Methane is a distant second in amount of GHG impact per year. It is primarily produced as a waste by-product from animal production—gaseous emissions and decomposition products of liquid and solid wastes. The relative impact on global warming of the three primary greenhouse pollutants has more than doubled just during the industrial age, again with increases in CO_2 being the major contributor.[11] The impact of these gases on climate is unprecedented in the last 10,000 years.[12] Much of IPCC work has been in developing computer models to predict how continuing increases in greenhouse gases will affect the earth's climate.

The fundamental thermodynamic process driving climate change is that increased atmospheric GHGs are causing increases in the total heat energy being stored in the atmosphere, and this energy is distributed unevenly across the globe. Weather, the natural process powered by thermodynamics, is constantly attempting to balance or equalize temperatures. Winds move air masses from higher pressures toward lower pressures in response to spatial differences in temperature. Ocean currents are the natural process to mix cold water at the poles with warm water at the equator. Certainly these systems are much more complex, but this basic sketch should provide a basic understanding of how the processes work. The greater the energy differences across the earth, the harder the weather and ocean current systems work to try to return the Earth's energy system to equilibrium.

In some cases, we do not understand all the science or the interrelationships among climate variables completely. It is this uncertainty that has caused some governments to resist acting. The work of the IPCC continues to reduce the uncertainty in its assessment of impacts and improve its predictive models.

The IPCC categorizes the predicted impacts of climate change into four outcomes: temperature change, precipitation change, sea level rise, and extreme weather. In addition, I believe the shrinking of the ice caps around the globe is of such significance that it should be analyzed as a separate additional impact. Each of these results of climate change has distinct security implications. The first step in a security threat analysis of climate change is to identify the major impacts expected. One needs to recognize that the impacts of these changes vary with location. There are winners and losers in impacts of global climate change, depending on geographic location. A summary threat analysis follows:

Sea level rise: The average sea level rise over the last 150 years is approximately 200 mm (8 inches). The prediction for sea level rise in the future is based on the predicted levels of GHGs added to the atmosphere. This value is directly tied to the rates of burning fossil fuels. Sea level rise is produced by the combined effects of seawater expanding as it warms and the melting of water previously stored as snow and ice on the land masses. The predicted ranges for sea level rise by 2099 vary from 0.2 meters to 0.6 meters,[13] which will result in inundation of lowland areas, salt water intrusion into coastal freshwater aquifers, more frequent coastal and inland flooding, and major changes in the estuarine ecology caused by altering the salt and freshwater balance. Estuaries are the primary food source for the fisheries of the world, and damage to them will directly impact billions who rely on the ocean for food. Some parts of the world are already experiencing adverse effects of sea level rise. Low-lying island nations in some parts of the world are in jeopardy of disappearing.

Temperature change: Global temperature patterns are shown in Figures 2 and 3. As with sea level rise, future temperature rise is directly proportional to continued build up of atmospheric GHGs. Some people point to the relationship shown in Figure 3 as evidence of the direct link; however, this piece of data alone is not convincing. The data in Figure 2 is more compelling in demonstrating the uniqueness of the recent change in temperature in the Earth's history. In examining Figure 2, the cloud area represents the range of temperatures based on the best available data to estimate global temperatures before actual records were kept. The IPCC has concluded that GHGs are the only feasible answer.[14] Current IPCC estimates of global warming range from 1-4 ^{o}C by 2100. The most significant impacts of global warming include geographic shifts in world ecosystems, loss of ice and snow caps, change in water balances caused be increased evaporation, increased infectious disease, melting of permafrost, and changes to global circulation systems.

Changes in precipitation: Drought and flooding have always been a part of global weather; however, additional energy generated by increased GHGs in the atmosphere is producing shifts in historical patterns of precipitation. The changes are occurring spatially (where the rain comes) and temporally (when the rain comes). There are regions that will benefit by the amount and timing of the rain making their land more productive. Likewise, there are regions where the land will become less productive because of the volume and/or timing of the rainfall. It is obvious, but worth stating, that water has to be in the right amounts; too much or too little both create negative consequences for human habitation and the ecosystem. The impacts of changes in precipitation include drought, floods, crops losses in areas, crop gains in areas, and more or less water to support domestic needs.

Extreme weather: The science introduced previously showed that additional GHGs in the atmosphere are increasing the amount of heat energy in the global climate system. This energy must be dissipated through mixing that is regulated by the major climate and ocean cycles. More energy in the atmosphere increases the number and intensity of storm systems, yielding higher-intensity weather and more tornados, hurricanes, and cyclones. It may also shift the geographic locations susceptible to these kinds of storms, generally increasing the areas in danger. The NMS addresses the need for the military to be ready to support other nations in the event of natural disasters and does recognize the effect that climate change may have on the nature or frequency of these events.[15]

Ice cap loss and snow melt: To understand the impact of the loss of significant amounts of ice and snow that cover the earth's surface, one must first look at what purposes those areas accomplish in the overall global ecology. The greatest value to the ecosystem from ice and snow stored on the landmass is that these sheets of ice and snow packs serve as huge freshwater reservoirs. They add to stored water in the cold periods and slowly release water in the warmer months. Changes in snow and ice cover will dramatically impact freshwater resources in many parts of the world.

In addition, the ice cover on the poles serve as a major climate modifiers by reflecting up to 90 percent of the sun's energy back into space as short wavelength radiation. This has a major impact on the energy balance and influences all of the global circulation systems. Loss of the ice cover further accelerates warming and ice melt. There is some critical value where a loss of too much ice at the poles will cause a rapid and destructive change to the global air and ocean circulation systems. Finally, the polar ice regions are unique ecosystems that support a fragile set of plants and animals. A loss of too much ice and snow will lead to rapid and dire changes in polar ecosystems.

The most immediate security threat from the loss of ice and snow cover relates to its impacts of

on water storage. A case study of the Asia Pacific region which follows will illustrate these concepts by examining the impacts of the loss/change in the ice on the Tibetan Plateau, a watershed which serves as the water source for billions of people.[16] Other security impacts from ice melt include opening of sea lanes on the northern pole, adding to sea level rise because less water is stored in ice, and the ecological changes on the Polar and Greenland ice caps.

Why Strategic Environmental Security Analysis?

In 2007, eleven highly respected retired senior officers endorsed the study, "National Security and the Threat of Climate Change."[17] Led by General Gordon Sullivan, former Chief of Staff of the United States Army, this elite group of war fighters from all services were clear in their analysis of the problem: "when climates change significantly or environmental conditions deteriorate to the point that necessary resources are not available, societies can become stressed, sometimes to the point of collapse."[18] General officers from many nations have formed a Global Military Advisory Council on Climate Change that advocates for the criticality of addressing climate change as a threat to global security and is working to address this urgent threat to global security.[19] Respected military leaders from around the world are making climate change an important security issue that must be considered in any nation's strategic analysis.

Many countries, at least at the policy level, recognize environmental security as a security issue. A large majority of the 85 countries with officers attending the U.S. Army Command and General Staff College identify environmental security and/or climate change as a significant threat to national security.[20]

To this point, this essay has focused on identifying the problems of environmental security and justifying the need to act. Before moving on to the "how" of environmental security analysis, let us revisit the NSS a last time for guidance on a way ahead:

> Wars over ideology have given way to wars over religious, ethnic, and tribal identity; nuclear dangers have proliferated; inequality and economic instability have intensified; damage to our environment, food insecurity, and dangers to public health are increasingly shared; and the same tools that empower individuals to build enable them to destroy.[21]

Conducting a detailed security risk analysis of all environmental security challenges across the globe is a project for books, not a single essay. However, since U.S. strategy now emphasizes a need to focus attention to the Asia-Pacific[22] and the NSS is focused on climate change, this essay will focus on producing an environmental security threat analysis for only climate change and only in the Asia-Pacific region.

Strategic Analysis of Climate Change in the Asia-Pacific Region

All good defense analysis begins with a map. Figure 4 shows the area of the Asia-Pacific region and highlights the Tibetan watershed area where more than half the world's population (3.8 of 7.1 billion people[23]) live with much of the population crowded into highly urbanized areas. Many countries of this region are already challenged to provide food, clean water, and other elements of a sustainable environment to many in their burgeoning populations, and a vast majority of the population lives close to the coast. Though the following analysis is limited to the effects of

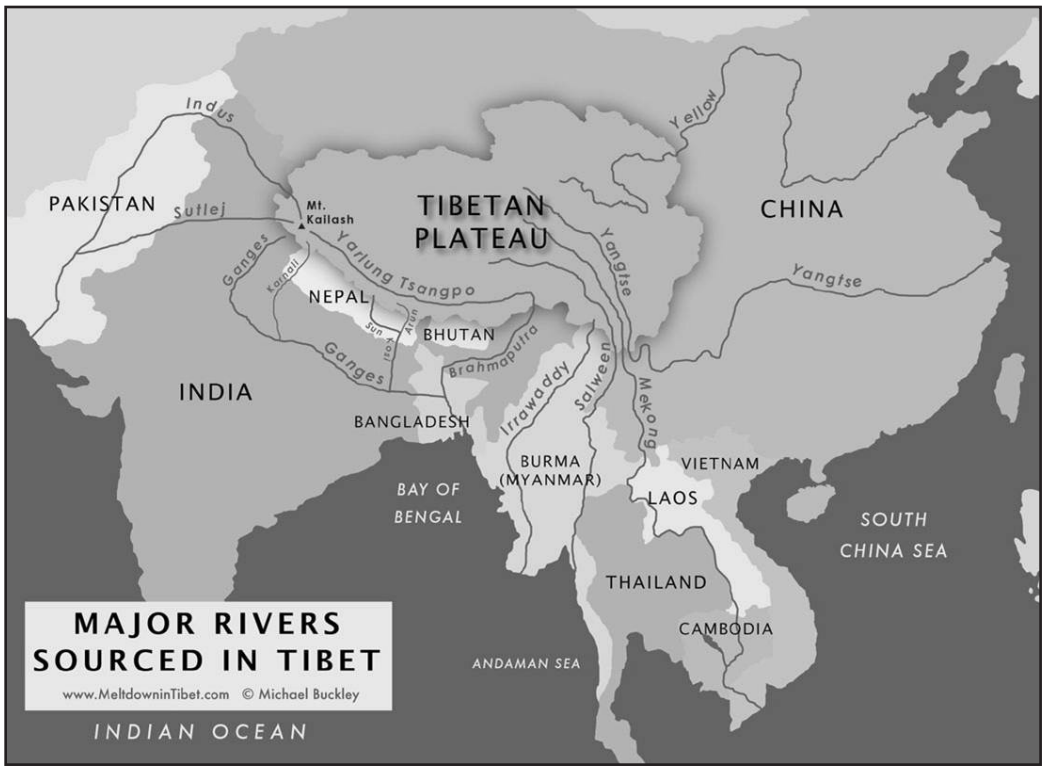


Figure 4. Tibetan Watershed

climate change, the region is at risk from many other environmental stressors driven by population growth, including fresh water scarcity, infectious disease, deforestation, loss of arable lands, and exposure to natural disasters. These existing environmental security issues are already stressing several countries of the region.

According to IPCC reports, climate change will contribute to the following environmental security issues:[24]

- By the 2050s, freshwater availability in Central, South, East, and South-East Asia is projected to decrease, particularly in large river basins.
- Coastal areas, especially heavily populated megadelta regions in South, East, and South-East Asia, will be at greatest risk due to increased flooding from the sea and in some megadeltas, flooding from the rivers.
- Rapid urbanization, industrialization, and economic development will compound pressures on natural resources and the environment.
- Endemic morbidity and mortality due to diarrheal disease primarily associated with floods and droughts are expected to rise in East, South, and South-East Asia due to projected changes in the hydrological cycle. (3.4 million people die each year from water-borne related disease and morbidity rates are at more than 1 billion per year)[25]

The IPCC predicts the island nations of the Pacific will experience the following:[26]

- Sea level rise is expected to exacerbate inundation, storm surge, erosion, and other coastal hazards, thus threatening vital infrastructure, settlements, and facilities that support the

livelihood of island communities.

- Deterioration in coastal conditions, for example through erosion of beaches and coral bleaching, is expected to affect local resources.
- By mid-century, climate change is expected to reduce water resources in many small islands, e.g. in the Caribbean and Pacific, to the point where they become insufficient to meet demand during low-rainfall periods.
- With higher temperatures, increased invasion by non-native species is expected to occur, particularly on mid- and high-latitude islands.

The IPCC work is built on a very conservative interpretation of the available data. Other scientists studying the region present a much more negative view of this region's response to climate change. A case in point concerns fresh water resources for the countries of South Asia. Eight major rivers supporting nations with more than 3 billion people (See Figure 4) emanate from the ice caps of the Tibetan Plateau.[27] These rivers are truly the life blood of this region of the world. Even without climate change, water is critically scarce for many people in the region. Many will not survive the conditions that result from climate change. As one of the leading security scholars of the region stated, "No region better illustrates the dangers of water wars than the world's largest continent."[28]

Water security issues in this region are not limited to the areas influenced by the Tibetan Plateau watershed. Many of the island nations already face water scarcity challenges, and the IPCC predicts climate change will exacerbate these issues. Islands typically possess little storage capacity for freshwater. They have small underground aquifers and surface streams with smaller storage capacities than those common to continental watersheds. Reductions in overall rainfall or even changes in the temporal rainfall patterns can have fatal consequences for many island nations.

Sea level rise is a formidable climate change driven risk for this region. This assertion is documented in the IPCC data referenced above, but the severe impacts may not be fully represented. Large populations live in and depend on the marginal lowlands/deltas for survival. Whether from the land they farm or the fish they harvest along the water coast, life for many is sustained at the estuarine interface of the land and the ocean. In the best of conditions, these lands routinely flood, both from the sea and the rivers. Rising sea levels increase the flooding potential. Salinization of the land and the drinking water make both unusable. Rising sea levels concurrent with extreme weather events make for massive natural disasters. In addition to the immediate loss of life, there is a latent effect where the damaged environment becomes an incubator for pandemic disease outbreaks. The impacts of predicted sea level rise in places like Bangladesh could create 35–40 million environmental refugees.[29] These risks represent regional human disasters with security implications for the world.

The U.S. has identified the Asia-Pacific region as an area of critical interest to the Nation.[30] It readily recognizes the geopolitical challenges that exist in the region. This essay emphasizes that threats to peace and stability in the region also include significant environmental threats that exist today and will be made worse by the impacts of climate change in the future. The seven countries of particular concern are those where the environmental stressors are present concurrent with high population growth rates (1.5 percent or greater)—India, Pakistan, Bangladesh, the Philippines, Burma, Nepal, and Malaysia. These countries of the Asia-Pacific region are all at high risk for the

environmental security threats just described. Because these countries are home to more than 25 percent of the world's population and occupy key terrain adjacent to the global commons, this is a world-scale issue. Peace and stability in this region have significant environmental security and climate change components that must be considered in security thinking.

Conclusions

This essay uses climate change, a key environmental security issue, to demonstrate the threats to peace and stability that the world now faces from human-induced changes to the environment. The changes are the result of exponential population growth, environmental degradation, and resource overuse. Using the Asia Pacific region as a model, this essay provides a process for analyzing environmental security. A similar analysis of Africa would produce the same overall result, but with different stressors and risks.[31] For example, water scarcity issues on the Nile River are different, but the resulting extreme risks to security in that region are just as dire as those seen in South Asia.[32] The environmental security analysis process demonstrated here is generally applicable worldwide.

Norman Myers was a visionary in predicting the world we face today where environmental issues, such as climate change, have reached a level of concern to where they must be considered as part of national security strategy. Unfortunately, his admonition about ideas that, "… rarely figure in the minds of military experts and political leaders…" remains valid. The U.S. government must recognize that solutions to environmental security issues, including but not limited to climate change, require whole-of-government and intergovernmental actions implemented over the long term. These are truly global-level concerns that no one country or even existing coalitions can resolve.

Military and non-defense security professionals have much to offer in the fight to preserve peace and security now threatened by global environmental pressures. Planning for contingencies and reacting to crises are fundamental strengths of military organizations that will prove essential in addressing emerging environmental security threats. Additionally, the capacity to respond to large-scale disasters is unique to military forces of the larger nations. They must prepare for today's concerns, while analyzing and assessing what the future might bring.

Contingency planning by DoD and other U.S. government agencies is required to address many regional level issues. These strategic plans must consider the natural sciences as well as the political sciences when examining the national security policies. Strategic planning is needed to assess the future implications of climate change and other predictable environmental security risks. It may be that the threats created by climate change and other environmental security issues, which are common to all nations, provide an opportunity to build partnerships and enhance understanding among nations, even where none existed before. In the end, facing the environmental security challenge can provide an opportunity to further peace and security.

We conclude where we started, by recognizing that climate change is a complex issue that will require a whole-of-government, interagency response. The security/defense community is a key component within the many players needed for this fight, but must integrate with and even be subordinate to the actions of the other instruments of power that will be necessary to address climate change as a threat to peace and security in the world. ***IAE***

ENDNOTES

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W. Chris King currently serves as the Dean of the U.S. Army's Command and General Staff College and Chief Academic Officer of the Combined Arms Center's Leader Development and Education Program. Dr. King earned his Ph.D. in environmental engineering at the University of Tennessee in 1988. Dr. King has authored two books, and 15 book chapters with his most recent manuscript being, "Understanding International Environmental Security: A Strategic Military Perspective." He has published more than 30 journal articles and scientific reports, and lectured at more than 50 professional conferences, including the technical sessions of the Copenhagen climate summit in 2009.

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