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WORKING PAPER

Natural Security

By Sharon Burke

Center for a New American Security

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Cover Image

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About the Author

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"Not even the most casual reader of the public prints of recent months and years could be unaware of the growing chorus of warnings from qualified scientists as to what industrial man is now doing – by overpopulation, by plundering of the earth's resources, and by a precipitate mechanization of many of life's processes – to the intactness of the natural environment on which his survival depends."

–George F. Kennan, "To Prevent a World Wasteland," Foreign Affairs (April 1970)

"We also know that over the next 20 years and more certain pressures – population, resource, energy, climate, economic, and environmental – could combine with rapid cultural, social, and technological change to produce new sources of deprivation, rage, and instability."

— Robert M. Gates, Remarks to the U.S. Global Leadership Campaign (July 15, 2008)

INTRODUCTION

This paper is intended to be the starting point for a new program of exploration at the Center for a New American Security (CNAS). As such, it is a concept paper rather than a research paper, though there is certainly a wealth of fascinating scholarship on the range of natural resources challenges the United States will face in the coming years. We hope to build on this research – and take it in a different direction.

Over the last two years, CNAS has developed a body of work on the national security and foreign policy implications of energy and climate change. As we conducted this work, we came to understand that these challenges are linked to other natural resource challenges, most notably non-fuel mineral supplies, water, land use/food supply, and biodiversity. Consider that as the United States attempts to address the inherent geostrategic weakness of its reliance on oil (and the role the U.S. military, as a significant consumer of hydrocarbons, plays in that vulnerability), some of the proposed solutions will simply swap in other dependencies, also with security consequences. A shift to coal, for example, which the United States has in abundance, would greatly exacerbate global climate change. Corn-based ethanol has implications for global food prices, which provoked unrest in some 40 countries in the last three years. Hybrid electric vehicles depend on minerals such as lithium, concentrated in a few countries worldwide (Bolivia has more than 50 percent of global reserves of lithium). Solar photovoltaic panels require a range of materials and minerals, such as gallium, for which the United States is 99 percent reliant on imports, and for which there is no information about the global reserves-to-production ratio. And though we do not know how much gallium exists in the world, we do know that China supplies almost 40 percent of U.S. consumption.[1]

At the same time, there are ways in which conservation, water rights negotiations, and other environmental strategies can complement and enhance national security strategies, and ways in which national security strategies are unlikely to succeed without addressing such concerns. For example, President Obama has stated repeatedly that peace in Afghanistan will be contingent on economic, civic, and political development as much as military successes. A 2003 UNEP report found, however, that most of Afghanistan's natural resources are severely degraded and that any

"In the 21st century, the security of nations will increasingly depend on the security of natural resources, or 'natural security.'"

recovery would depend on restoration of these resources.[2] Achieving U.S. goals in the region may well depend on our ability to tie natural resources into national security. For that matter, negotiations about climate change will be central to the relationship between the United States and China going forward.

The CNAS experience working on energy and climate change taught us that natural security is a critically important yet underappreciated and underdeveloped facet of U.S. national security strategy. Going forward, CNAS will look at the key facets of natural security: consumption of resources (particularly energy, minerals, water, and land) and the consequences of that consumption (climate change and biodiversity). More to the point, as we develop the program, we intend to look not just at the security implications of each of these areas, but how they relate to each other – and how other actors, such as those in the private sector, come into play. The challenge for the U.S. government will be not only to address natural security challenges, but how to do so in a mutually reinforcing way that builds security. CNAS will seek to come up with the practical ideas and strategies to help practitioners in the foreign policy and national security communities shape and respond to this changing global strategic environment.

WHAT IS NATURAL SECURITY?

In the 21st century, the security of nations will increasingly depend on the security of natural resources, or "natural security." The modern global economy depends on access to energy, minerals, potable water, and arable land to meet the rising expectations of a growing world population, and that access is by no means assured. At the same time, increasing consumption of these resources has consequences, such as climate change and biodiversity loss, which will challenge the security of the United States and nations all over the world. Natural security ultimately means sufficient, reliable, affordable, and sustainable supplies of natural resources for the modern global economy. This will require the United States to both shape and respond to emerging natural resources challenges in a changing strategic environment.

These concerns are not necessarily new, even in the context of war – access to resources has always been a concern. In World War II, for example, American civilians contributed their pots, pans and car tires to help the war effort, while both Allied and Axis forces struggled with oil shortages. At one point in the war, General George Patton wrote to his wife: "if I could only steal some gas, I could win this war."[3] Even today, U.S. military forces are defending fuel supply lines from attacks every day, albeit from a foe that targets convoys with improvised explosive devices instead of air raids and suicide bombers instead of uniformed soldiers.

From George Kennan in 1970 to Secretary of Defense Robert Gates just last year, scholars, theorists, and practitioners in the national security field have long realized that there are security implications of natural resources. The end of the Cold War, however, sparked a more serious debate about whether environmental issues are the single most important element of security. Policy makers such as former Vice President Al Gore and former

Secretary of State James Baker and scholars such as Jessica T. Mathews, Geoffrey Dabelko, Peter Gleick, Thomas Homer-Dixon, Hal Harvey, and Robert Kaplan shaped this debate and expanded it into a serious sub-field of security study and practice.

Today, however, strategic concerns surrounding natural resources are set in a different context, because the global strategic environment is increasingly different. Russia, China, and other emerging (or re-emerging) states are part of an extraordinary rebalancing of global wealth and power, which will characterize the 21st century, according to the National Intelligence Council (NIC). These shifts are already evident: more people in more places in the world are seeing improved living standards, with access to modern technologies. According to the NIC, these shifts mean that by 2025 "unprecedented economic growth, coupled with 1.5 billion more people, will put pressure on resources—particularly energy, food, and water—raising the specter of scarcities emerging as demand outstrips supply."[4]

In this new strategic environment, how nations actually define and achieve security is changing. Indeed, there has been some concern, in both the environmental and defense communities, about the appropriateness of "securitizing" natural resources challenges such as climate change (i.e., overusing the security framework to understand challenges that are not at their heart about security), but that concern is misguided. The concern, more appropriately, should be about "militarizing" such challenges. Climate change, for example, may not be a threat that soldiers can attack and defeat, but it is likely to affect the safety and prosperity of every American, both through its effects on global stability and on our local environments.

It follows, then, that if security threats are not always military in nature that military means are not the only way to achieve security, a point Secretary of Defense Robert Gates has made repeatedly (including explicitly about natural resources). "The challenges confronting our nation cannot be dealt with by military means alone," Gates noted in May of 2009. "They require instead whole-of-government approaches."[5] In both Afghanistan and Iraq, for example, the U.S. government has invested billions of dollars in Provincial Reconstruction Teams (PRTs) that rebuild civilian infrastructure, including institutions and systems of governance.[6] Neither the staff nor the goals of these efforts are primarily military – or they should not be, though the United States is short on expeditionary civilian resources to staff the PRTs – but they are an important part of the military campaign to defeat insurgents and stabilize the region. At the same time, Admiral Dennis Blair (USN, retired), U.S. Director for National Intelligence, declared in recent testimony that the greatest threat to the United States today is the global financial crisis – again, a *security* threat, but not a *military* threat.[7] As his testimony affirms, the traditional definition of "national security" is too narrow to reflect the breadth of the actual challenges facing the country. Indeed, in many cases, whole-of-government may not even be enough; the private sector will play an important role in recovering from the global financial crisis, for example, and it will also play an important role in natural security.

"Today...strategic concerns surrounding natural resources are set in a different context, because the global strategic environment is increasingly different."

Natural security may require a military response at times (e.g., disaster relief), but it is not a military threat, per se. Still, there are a variety of ways in which natural resources can and will shape the strategic environment and affect U.S. foreign policy, economic, and military goals.[8]

First, nations that consume imports of natural resources may be vulnerable to disruptions of supplies, with broad economic and security consequences. The United States, for example, depends on imports of many strategic commodities, particularly oil and non-fuel minerals, for a range of economic and defense uses. This import dependence is not in and of itself necessarily a threat or even a challenge, and ideally is a force for great global prosperity and stability for nations on either end of the transaction.

Import dependence can become a strategic liability, however, when the sources are highly concentrated, demand is rising, or substitutes for the commodities are limited. In such circumstances, such as the Arab oil embargo of 1973, the political and geostrategic motives or stability of the suppliers can become a significant problem. In other cases, countries with ample supplies can affect market dynamics and drive out other producers; the United States, for example, has not mined tungsten since 1995, even though the United States has 5 percent of global tungsten reserves and imported about 10,000 metric tons in 2007. Tungsten is used in a range of applications, including important defense applications (steel hardening and toughening). One reason for U.S. import dependence is that the United States simply cannot compete on pricing with China, which possesses two-thirds of the world's tungsten reserves.[9] In other cases, resource rich nations may choose to use their wealth as a tool of economic and political power; Russia, for example, has used natural gas exports to influence Ukraine, but also Turkmenistan, Iran, Turkey, and all of western and eastern Europe. The presidents of both Venezuela and Iran have explicitly linked energy wealth to their ability to counter U.S. foreign policy goals.

A complicating factor for import dependence is the lack of information about global supply chains. Lack of reliable data on reserves-to-production ratios for oil or natural gas can directly affect the market. For example, markets played an amplifying role in the oil price shock of 2007-2008; at the time, it was unclear why prices were escalating so much, so fast. In retrospect, oil production had stagnated in the face of sharply growing Chinese demand, but it is still unclear why production stagnated.[10] Sharply rising oil prices certainly played a part, and perhaps a dominant part, in the ongoing global economic crisis, with pervasive security and stability implications.[11] In the case of minerals, there is uncertainty about global supply chains. The United States, and this includes for militarily significant systems, does not actually know if we are vulnerable to supply disruptions of some strategically important minerals.[12] Planning for and managing such uncertainty can be a security challenge. Note also that supply chains are physically vulnerable: the entire energy supply and distribution infrastructure – from pipelines to shipping chokepoints to the vast domestic electric grid – is highly vulnerable to sabotage, natural disasters, and disrepair.

Concentration of supply can also be a problem for the supplier nations, leading to instability in a variety of ways, including conflict over land use between pastoralists and farmers in Darfur or tensions over water rights in the Levant. But there is a more fundamental way in which resources can be destabilizing, variously described as the "resource curse," the "paradox of plenty," and other terms. While commodities, such as oil and critical minerals, can bring in significant funds, in many parts of the world these proceeds come through state-owned companies and go directly into state coffers. This has a tendency to promote corruption, undermine accountability, increase vulnerability

to market forces outside the country's control, spur tension, and, in some cases, depress long-term growth. It can even facilitate armed rebellion: as one economist has noted, "where natural resources abound in rural areas they are uniquely vulnerable because they are difficult to defend, lucrative, and immobile,"[13] thus attracting rogue groups and vigilantes. Even when commodity prices are low, the "resource curse" can be tremendously destabilizing, as seen with the prospects of civil unrest in Zambia in early 2009, stemming from sharply falling copper prices.[14]

In addition to these vulnerabilities of supply, high consumption rates are creating other weaknesses. More countries are competing for the same strategic resources, at a time when access to those resources increasingly will be compromised by climate change and loss of biodiversity. This has the potential to directly promote tension, mass migration, and even interstate conflict, as well as more natural and humanitarian disasters, such as last year's devastating cyclone in Burma and the collapse of food supplies in Haiti, which led to the fall of the government. As disaster rates rise, the U.S. military and civilian assistance agencies are likely to be called upon increasingly to conduct and support humanitarian and disaster relief operations, similar to Operation UNIFIED ASSISTANCE, which responded to the Indian Ocean Tsunami. These disasters will vary in scale and location and the United States and other developed nations will be unable to bring relief in all cases. Social unrest and state instability may result, which will likely increase and contribute to supply disruptions and influence U.S. strategic priorities.

These issues – from natural disasters to geostrategic tensions – demonstrate the importance of natural security to the future of the nation.

NATURAL SECURITY FOCUS AREAS

There are two broad categories of consideration for natural security: consumption and consequences. Consumption of natural resources, especially energy, non-fuel minerals, water, and land, can affect geopolitics and the stability of nations. At the same time, the consequences of high consumption rates of these resources, such as climate change and biodiversity loss, can also create geostrategic pressure, instability, and disasters.

Each of these natural security concerns has somewhat different challenges. Energy, as currently used for example, is finite in the sense that once oil or coal is burned, it is expended. Many non-fuel minerals, however, can be recycled but often are not or are recycled in ways that may not alleviate security concerns. Water and land tend to be "renewable" resources, in the sense that they generally can be replenished, though they can be used in ways that render them unfit or unavailable for human consumption. Energy, food, timber and fiber, and minerals can be produced in one place and transported around the globe; water is largely a locally or regionally consumed resource, with large-scale global transport being economically infeasible. Climate change has broad implications for every aspect of life, as does biodiversity loss, but in less obvious ways; the effects of catastrophic storms on human societies are clear, but the loss of just one of the 20 plant species that make up 80 percent of the human diet may be no less consequential for human wellbeing and societal stability.

CONSUMPTION

Energy

Energy is essential for all aspects of human life, with the world more than 80 percent dependent on oil, coal and natural gas to fuel vehicles, light and heat homes and businesses, and drive industry and agriculture. Global dependence on these fuels and the concentration of supplies in a limited number of countries mean that energy resources are associated with geostrategic pressure, instability, and vulnerability, including for the U.S. military.

This overwhelming global dependence on hydrocarbons clearly presents security challenges for the United States and other nations; a shift toward nuclear energy presents different security challenges. Oil, in particular, has a stranglehold on transportation (the United States is 96 percent dependent on oil for transportation). Two-thirds of all oil reserves are in the Middle East, where instability and hostility to the United States run rife and can threaten economic and national security, and at least three-fourths of proven oil reserves are controlled by often-inefficient national oil companies. At the same time, the two largest holders of global natural gas reserves are Russia and Iran, which consistently challenge global agreements and norms and American interests. High oil and natural gas prices translate into a massive transfer of money and power to these nations, giving them geostrategic leverage. Low oil and natural gas prices can be greatly destabilizing, as well. The United States and other nations do possess large reserves of coal, but coal is a major contributor to the emissions of gases that are trapping heat in the atmosphere and changing the global climate. Nuclear energy also depends on a mineral resource, uranium, and while it is relatively plentiful, it is also concentrated in certain regions. From a security perspective, nuclear energy has other downside risks that have to be managed: proliferation of nuclear weapons, materials, and know-how and the attractiveness of nuclear plants and waste as targets for sabotage.

Even with projected efforts to curb dependence on fossil fuels, the International Energy Agency forecasts that the world will still be 80 percent dependent on oil, natural gas, and coal by 2030. This means that the global actors that control those resources will continue to shape the geopolitical landscape. Indeed, as primary suppliers to American markets today – American and Mexican producers – continue to decline, supplies will be further concentrated in the Middle East and a few other places. Even new supplies are likely to bolster existing "petro-superpowers." The U.S. Geological Survey estimates, for example, that there are 90 billion barrels of oil and 1.7 trillion cubic feet of natural gas in the Arctic (roughly 20-25 percent of global reserves of natural gas). Russia's access to natural gas in its undisputed and thawing Arctic territory will double Russia's reserves, making it an even more powerful player in global energy supplies.

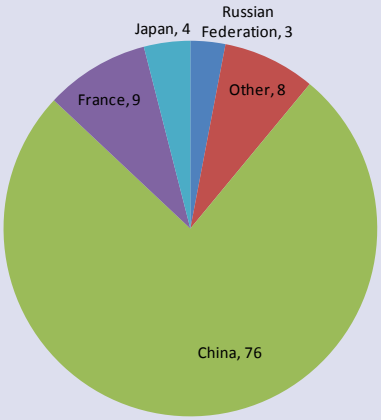
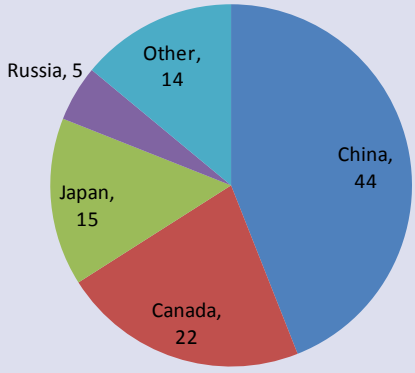
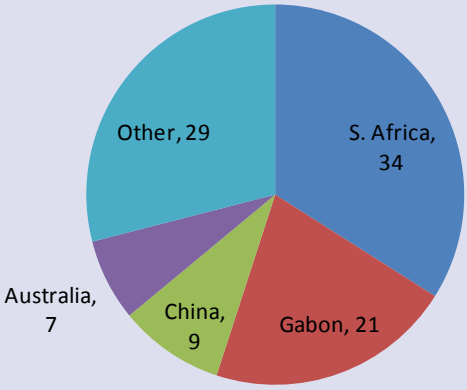
Minerals

Today's global economy depends on the availability of a wide range of non-fuel minerals that are essential for the manufacture of everything from aircraft to computer screens. Consider that a modern automobile can contain up to 39 different minerals.[15] Historically, the United States has been the single largest consumer and producer of such minerals, but today China is the largest producer and consumer – and an increasingly important importer – of minerals.[16] In general, knowledge about the reserves-to-production ratios (i.e., how much ore is recoverable at economically feasible rates) is either not well understood or proprietary.[17]

The National Academies of Science estimated that in 2006, non-fuel minerals added more than $2 trillion in value to the U.S. Gross Domestic Product. Many minerals or materials would be familiar to most Americans – copper has been in use for thousands of years and today may be found everywhere from the water pipes in a home to the wiring in a car. Other minerals would be unfamiliar, but also ubiquitous in American consumer products. There are now almost as many cell phones in America as there are people, and these phones use a range of minerals, including tantalum, indium, Rare Earth Elements, and titanium oxide. Copper is relatively plentiful, with diversified sourcing. Eighty percent of global tantalum reserves, however, are in the Democratic Republic of the Congo, which is considered at extreme risk of state failure in the Failed States Index.[18] The National Academies of Science and U.S. Geological Survey have identified 11 minerals as particularly critical, meaning that they are essential to the functioning of the U.S. economy and are at risk for a supply disruption. Of the 11, five are considered highly critical (indium, manganese, niobium, Platinum Group Minerals, and Rare Earth Elements), and the United States is nearly completely import dependent for these minerals. Moreover, most of these have growing uses for emerging technologies (e.g., alternative energies and batteries, telecommunications). It is hard to know exactly how shortages of these minerals would affect the U.S. economy, certainly in the near term, but it is possible to imagine a scenario similar to that of oil markets. The United States is limited in how much leverage it is willing to exert over a nation such as Saudi Arabia, which is crucial to global oil supplies and the U.S. economy; there may be similar constraints in dealing with major suppliers of some minerals in the future.

Defense systems heavily rely on minerals, as well, and sometimes minerals that are equally essential for civilian uses. A recent report about the Department of Defense's National Defense Stockpile (NDS) identified 13 such critical or strategic minerals for defense purposes, as well as 39 other minerals in need of further study. The United States is 100 percent import dependent on five of the top 13 minerals, and more than 58 percent dependent for all of them. China is a top producer of five of the minerals, South Africa of four, and Kazakhstan of three. The report also noted that the Department does not have good information about the availability of minerals needed for defense systems or about vulnerabilities in the global supply chain, adding that DoD components have reported that minerals shortages have already caused weapons systems production delays.

U.S. Import Dependence for Select Critical and Strategic Minerals

Mineral	Degree of U.S. Import Dependence	Common Uses	Country of Origin for U.S. Imports
Rare Earths	100%	Catalytic converters, metallurgical additives and alloys, glass polishing and ceramics, phosphors for televisions, monitors, radar, and lighting	
Indium	100%	Coatings, electrical components, semiconductors, solders, and alloys	
Manganese	100%	Steel and cast iron, other alloys, dry cell batteries	

Source: For Rare Earths and Indium, National Research Council, Minerals, Critical Minerals, and the U.S. Economy, Committee on Critical Mineral Impacts of the U.S. Economy *(Washington, D.C.: The National Academies Press, 2008).; for Manganese, import breakdown is for all Manganese from all Manganese imports, as tabulated by the U.S. Geological Survey at http://minerals.er.usgs.gov/minerals/pubs/commodity/manganese/mcs-2009-manga.pdf*

As more of the world's population has gained access to technologies such as cell phones and computers, demand for critical minerals has grown sharply. Technological improvements have expanded supply, and some supplies are left untouched, particularly in the United States, because of environmental and social concerns. Nonetheless, rising global demand will put pressure on global supplies, particularly for minerals that are not abundant, and may well increase near-term supply unreliability. As the report by the National Defense Stockpile noted, there is "an emerging global competition for access to raw materials and [there are] concerns regarding the long-term implications for the competitiveness of U.S. manufacturers."[19] The United States currently has no strategy for dealing with either near-term supply security of minerals or long-term scarcity challenges. In fact, since 1993, the United States has sold 99 percent of its National Defense Stockpile of minerals, worth $6.6 billion, though many of the minerals in the stockpile did not reflect 21st century needs, in any case.[20]

China, on the other hand, does appear to have a strategy, and that involves capturing its competitive advantage in critical minerals. For Rare Earth Elements, in particular, China controls almost all of the current global supply. In addition, China is actively developing long-term relationships with other suppliers all over the world. For example, the Chinese own a majority stake in the Democratic Republic of the Congo's Gencamines national mining company. According to the Jamestown Foundation, "In 1995, overall Chinese imports from Africa were worth $1.4 billion; 11 years later, their value soared to $28.7 billion, a 2,000 percent increase."[21] In many cases, trade agreements or concessions are accompanied by political non-interference and development aid.

Water

While water is abundant on the planet, it is unevenly distributed and most (about 97 percent) is saltwater in the oceans, unsuitable for human consumption and agriculture without expensive and energy-intensive desalination. According to the United Nations, these supply and other constraints mean that 1.1 billion people in the world are now without access to safe drinking water and 2.6 billion are without access to basic sanitation.[22] Moreover, according to the UN World of Water report, this problem is getting worse under the strain of growing populations and a changing climate; almost half of the world's population will live in areas of high water stress by 2030.[23]

Water is a fundamental resource; without access to drinking water, humans can rarely survive longer than a few days.[24] Rivers, littoral areas, and oceans also support ecosystems that supply human societies with food and livelihoods, and some 40 percent of crops worldwide depend on irrigation.[25] Basic industrial and manufacturing processes and most electrical generation require massive inputs of water on a daily basis.

While there may be little evidence that nations will actually declare war over water,[26] there is certainly an ample record of conflict within societies, tension between states, and other water-related national security challenges, including the use of water resources as a tool of political influence.[27]

Syria and Iraq, for example, both protested vehemently over Turkey's construction of the Ataturk Dam on the Euphrates River, which flows through Turkey into both countries.[28] In Pakistan, droughts and general water scarcity have threatened the economy, provoked civil unrest – including riots and bombings – and further complicated relations with India. In Central Asia, Kyrgyzstan's and Tajikistan's desires to build hydroelectric dams on tributaries of the Aral Sea upstream from Uzbekistan have exacerbated tensions with the Uzbek government.[29] Negotiations between Israel and Syria in 2000 "broke down over the issue of access to the waters of the Galilee"[30] in the Golan Heights, whose river system provides close to 40 percent of Israel's water supply.[31] Also, water can be used more directly as a weapon of war – sabotaged or otherwise manipulated to affect a military's supply lines and raise the political heat by indirectly targeting the civilian population.[32] Finally, climate change and population growth are likely to further strain access to freshwater for many parts of the world; future conditions may be unprecedented and there are no guarantees that past patterns of interstate cooperation over water resources will persist.

Land

According to the World Food Programme, almost one billion people in the world today are not getting enough food. This is at odds with the resource base; the world technically produces enough food right now to feed the global population.[33] Ironically, the undernourished are concentrated in rural areas of agriculturally-based economies, which highlights that today's problems of land and food are complicated and have to do with who actually has access to food, as well as to the technologies (such as irrigation) that can improve food production and land use. As a recent World Bank report noted, "Today, agriculture's ability to generate income for the poor, particularly women, is more important for food security than its ability to increase local food supplies."[34]

On the other hand, if current trends for population growth, consumer preferences, environmental degradation, freshwater availability, and climate change continue, there is a strong possibility of absolute food supply shortages in this century, and that presents serious security risks. "As the global population continues to rise, and the demand for resources continues to grow, there is significant potential for conflicts over natural resources to intensify in the coming decades," including conflicts associated with competition over fertile land, warns the United Nations Environment Programme in a recent report.[35] Rights and access to land have long been an emotional and politically sensitive issue "central to identity, livelihoods, and food security."[36]

Indeed, the links between stability and food are particularly direct. Most recently, riots and civil unrest erupted in some 40 countries between 2005 and 2008 over high food prices, causing fatalities and exacerbating grievances in already precarious states such as Bangladesh, Haiti, Kenya, Mexico, Mozambique, and Pakistan.[37] Although the crisis in food pricing has subsided somewhat, prices are still 24 percent higher than they were in 2005 and the risks of unrest continue.[38]

Increasingly, there is also a link among land, food, and geostrategic pressures. In an effort to

secure domestic food stocks and increase access to resources for biofuel production, a number of capital-rich, resource-scarce governments and private corporations have been acquiring or leasing large tracts of land in less developed countries, including some experiencing endemic food insecurity. Although capital-rich countries have long invested in farm production in developing countries, these deals are somewhat different. First, they tend to focus not on cash crops, but on staple food items the producing country may lack itself.[39] Complicating the issue further, most of these investor countries and corporations intend to export their entire production back home, leaving no agro-dividends for the local consumers who by and large need food.

These agreements could exacerbate existing tensions, spark violence, or destabilize the host country. According to the International Food and Policy Research Institute, for example, South Korea's Daewoo Logistics Corporation negotiated to secure 1.3 million hectares of Madagascar's arable farmland for grain and palm oil production for Koreans, a deal that contributed to civil unrest in the country and culminated in the overthrow of Madagascar's government in early 2009.[40] Current agreements in Africa, in particular, could aggravate existing tensions and hostilities given that these states are already plagued by severe localized food insecurity and political fragility.[41] Similar deals include an arrangement for Saudi Arabia to grow barley and rice in Ethiopia; China to grow palm for biofuel in the Congo; and Egypt, South Korea, and the United Arab Emirates to grow wheat in Sudan.

Access to arable land and food will continue to be a source of tension around the world, as will the consumption of the other resources mentioned in this section (energy, minerals, and water). In the coming decades, however, it may well be that the consequences of high consumption rates of all of these resources will be far more problematic for global and U.S. security.

CONSEQUENCES

Climate Change

In 2007, the Intergovernmental Panel on Climate Change (IPCC) – a consortium of hundreds of scientists from around the world established in 1988 by the UN and the World Meteorological Organization to provide objective data – released nearly unanimous findings. Those findings noted that it is "unequivocal" that the climate is and will continue to change, and that human generation of greenhouse gases is responsible for most related changes since the 1950s.[42]

In 2008 alone Cyclone Nargis killed 100,000 people in Burma, record snowstorms cost the Chinese economy billions of dollars and stoked civil unrest, massive floods inundated Midwestern U.S. cities, and hurricanes crippled oil and gas production in Mexico and nearly destroyed Galveston, Texas.[43] These weather events may or may not be connected to global climate change, but the IPCC projects that these are the types of events that are increasing in frequency and severity as a result of global climate change.

It is possible that climate change effects will be even more dramatic than currently anticipated. Certainly, a failure to cut greenhouse gas emissions now will mean worse effects later in the century.

Also, climate scientists have long recognized that climate change projections could be conservative, given the possibility that additional heat-trapping gases could be released from the ocean and from frozen Arctic soils as the climate warms. Recent observations support the contention that climate change estimates have been too low, with scientists underestimating several key indicators, such as loss of sea ice and precipitation changes. To the extent that scientists have underestimated climate change, security risks associated with climate change could be worse than anticipated, which will challenge global preparedness.[44]

Climate change will affect national security in the broadest sense, potentially touching everything from economic growth to social stability.[45] More narrowly, global climate change may spur sudden onset (i.e., hurricanes and floods) and slow onset (i.e., droughts and famines) disasters around the world, provoking humanitarian crises that will require military and other governmental responses. Climate change will alter the military operating environment, as well, requiring advanced planning and ongoing reevaluation.[46]

In the climate policy community, actions taken to limit the degree of future climate change are called "mitigation," whereas actions taken to tolerate the effects of climate change are called "adaptation." Based on human emissions to date, Earth is destined to see some degree of change over the coming decades. Mitigation can reduce the potential severity of future change, but as some climate change is already underway and proceeding faster than scientists had predicted as recently as the IPCC's Fourth Assessment report in 2007, the nation should consider adopting a comprehensive adaptation strategy that anticipates a range of future scenarios.[47]

Biodiversity

Many scientists today believe that Earth is on the verge of the most significant mass extinction of plant and animal life in 65 million years, perhaps in the entire history of the planet, and certainly in the history of human life on the planet.[48] Human societies around the world depend on access to diverse species – a condition called "biodiversity" – in ways that are obvious, and not so obvious. The need for food from plants and animals may be clear, but consider that the Ecological Society of America estimates that 80 percent of the global population relies on medicines derived from natural resources – mostly plants, but also fungi, bacteria, and reptiles. One third of all food consumed by humans relies on pollination from wild bees, bats, butterflies, and more than 100,000 other animal species.[49] Diversity of plant life tends to assure good soil structure; eroded soils are less productive for agriculture and can lead to siltation and pollution of freshwater resources.[50] Biodiversity is also critical to the ability of ecosystems to recover from damage and to maintain functions that serve humans, such as water purification and storm surge absorption. Biodiversity loss is likely to be highly destabilizing, in that it will constrain access to a full range of natural resources, including food and potable water.

Biodiversity can also be an indicator of other kinds of national security problems. In the near-term, the environmental degradation that causes

species extinction tends to be highly correlated with military threats; the factors that lead to poor stewardship of natural resources (such as weak governance and poverty) also tend to provoke instability, insurgencies, and conflict. In some cases, biodiversity loss and the related environmental degradation may actually provoke violence and unrest: the United Nations Environment Programme (UNEP) estimates, for example, that natural resource stress is a notable factor in approximately 40 percent of current conflicts around the world.[51]

At the same time, conservation of natural resources can be integral to stability. A 2003 UNEP report, for example, found that some 80 percent of the Afghan people depend on severely degraded natural resources for their sustenance and livelihood, and that any recovery of the Afghan economy and polity would depend on restoration of these resources (i.e., by planting trees in heavily deforested areas and implementing strategies to prevent further soil erosion).[52] In a March 2009 speech about Afghanistan, President Barack Obama asserted that "it's cheaper…to help a farmer seed his crops than it is to send our troops to fight."[53] The farmer cannot seed his crops, however, if the land is barren.

CONCLUSION

While each focus area covered in this concept paper is a natural security challenge in its own right, these challenges also are thoroughly intertwined with each other. Any solution to the country's energy insecurity is likely to involve water and non-fuel minerals and even land-use challenges; climate change and biodiversity cut across all concerns, with broad effects on resource vulnerability. Without an integrated, national-level approach that links together natural security challenges and consequences, the United States runs the risk of trading one dependency for another and exacerbating consequences.

There are many ways the United States could address natural security more comprehensively, but most simply by incorporating a more holistic view of resource challenges into existing institutions and processes. The nation has a plethora of strategy documents that shape our national security and foreign policy, for example, including the National Security Strategy, the National Military Strategy, the National Defense Strategy, the National Strategy for Homeland Security, the National Intelligence Strategy, Diplomacy: the U.S. State Department at Work, and other more focused strategy exercises – any and all of them could incorporate natural security more thoroughly. Most of our institutions of governance already have competencies in this area, but perhaps lack the direction or coordination to pull together a comprehensive look at natural security. It may be that new requirements and a shift in emphasis are all that is needed to change the country's understanding of and framework for addressing these issues. There will also have to be a far more robust approach to cooperating with the private sector, which will play an integral role in achieving natural security.

At the same time, operationalizing concerns about natural security may be difficult. First, the nation has a crowded domestic and national security agenda, ranging from health care, the economy, and education to fighting two wars and adjusting to a changing global strategic environment. Second, the consequences of a failure to act to improve energy and materials security or deal with climate change and biodiversity may not be fully understood for decades. By the time the consequences are clear, however, it will be too late to act. With climate change, for example, humanity has already emitted enough greenhouse gases to the atmosphere to warm the planet beyond the warmest temperatures to have occurred in more than 100,000 years. Although this warming is already unavoidable and irreversible, two or three more

decades will pass before the full amount of warming is measurable at the Earth's surface. Continued greenhouse gas emissions will lock in additional unavoidable warming.

The challenge of sequencing natural resources within the full spectrum of U.S. challenges is one reason why the Center for a New American Security believes that it will be important to define these as national security concerns. The national security community, and military strategists and intelligence analysts in particular, form one of the few sectors of society that is accustomed to working in a world of uncertain and distant threats, with long timelines. The Department of Defense by necessity plans for a full range of future contingencies, and it uses such planning for updating doctrine and training and for acquiring systems and equipment, and for setting priorities and strategies. While it can adjust to changes in conditions in the short term, the Department of Defense is unique in that it regularly looks decades into the future to inform present decisions – including budgetary decisions of great magnitude.

From oil to critical minerals to water, the global competition for natural resources in the 21st century will generate economic dislocation, tension, instability, and even conflict. At the same time, the consequences of rising resource consumption, such as climate change and mass extinction of species, can also be a threat multiplier. Just as the nation's understanding of what constitutes a threat is changing, so is our understanding of how we achieve peace and prosperity. As this young century unfolds, the security of the United States – and most nations of the world – will increasingly depend on our "natural security."

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About the CNAS Natural Security Program

The Center for a New American Security (CNAS), a non-profit, non-partisan national security research organization based in Washington, D.C., launched the Natural Security program in June of 2009. CNAS initiated the program in order to study the near-term national security implications of natural resources supply and demand patterns, as well as the security consequences of high consumption rates. The program focuses on energy, minerals, water, land, climate change, and biodiversity, as well as the links among these resource challenges. The ultimate goal of the program is to offer practical solutions and strategies to anticipate, shape, and respond to the ways in which natural resources will shape the 21st century strategic environment.

About the Center for a New American Security

The mission of the Center for a New American Security (CNAS) is to develop strong, pragmatic, and principled national security and defense policies that promote and protect American interests and values. Building on the expertise and experience of its staff and advisors, CNAS aims to engage policymakers, experts and the public with innovative fact-based research, ideas, and analysis to shape and elevate the national security debate. A key part of our mission is to help inform and prepare the national security leaders of today and tomorrow.

CNAS is located in Washington, DC, and was established in February 2007 by Co-founders Kurt Campbell and Michele Flournoy. CNAS is a 501c3 tax-exempt nonprofit organization. Its research is nonpartisan; CNAS does not take specific policy positions. Accordingly, all views, positions, and conclusions expressed in this publication should be understood to be solely those of the authors.

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