# Sustainability and National Security

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# Sustainability and National Security

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## TABLE OF CONTENTS

Introduction ..... vii

1. **Sustainability and National Security** ..... 1
   *Jim Hartman*

2. **Sustainability: A Lens for National Security** ..... 29
   *Kent Butts and Brent C. Bankus*

3. **The Department of Defense offers a Strong Offense for Promoting Sustainability** ..... 57
   *Kristan Cockerill*

4. **Sustainable Security and Fragile States** ..... 85
   *Steve Hearne, Jeremey Alcorn, and William Goran*

5. **Sustainability and Environmental Security** ..... 127
   *Odelia Funk*

6. **Building Resiliency into the National Military Strategy** ..... 177
   *David Carstens*

7. **The Consequential Challenges of Climate Change** ..... 201
   *Corry Juedeman*

8. **Sustainability and States: Climate Change and Sovereignty** ..... 233
   *Rymn J. Parsons*

9. **Pursuing the Delta: Maximizing Opportunities to Integrate Sustainability in the Funding Process** ..... 263
   *Kimberly A. O'Keefe*

10. **U.S. Nuclear Energy: National Security and Sustainability** ..... 305
*James J. Raftery, Jr.*

11. **Sustainability National Security Military Lands Management: The Ecological Foundation of Sustainability** ..... 367
*William W. Doe III*

12. **Promoting a Sustainability Ethic in Future Army Leaders at West Point** ..... 393
*Marie C. Johnson and Mark A. Smith*

13. **Army National Guard Launches Sustainability Initiatives** ..... 417
*Joseph Knott and Monica Slade*

14. **Building Green** ..... 447
*William Goran, Thomas Napier, Richard Schneider and Annette Stumpf*

**About the Authors** ..... 483

# INTRODUCTION

In a world that has finite resources and is increasingly experiencing high competition for these resources, the military has embraced sustainability as both a vital strategic security element and as a mission enabler. This book addresses how security organizations throughout the world are or could be approaching sustainability. Military forces must have the land, air, water, and energy/fuel to train and operate today, and into the future. How can these resources be assured, how can conflict over scarce resources be avoided and when can cooperation over resources issues be used to promote peace? Sustainability is a powerful concept being readily applied by both the business and international affairs communities. Many of the sustainable practices the military is either currently applying or seeking to institutionalize are modeled after a growing number of corporations that aim for continual improvement, to gain a competitive edge in globalized markets, and ultimately long term success. Sustainability is further providing a platform for multi-state cooperation on transnational resource issues.

Mission accomplishment is the true determinant of military success or failure. Corollary benefits of sustainability include: reducing risk to our war fighters; readiness enhancement and sustainment; increased efficiency; reduced operational and total life cycle costs; a reduction in environmental and logistics footprints; and, enhancing the quality of life for soldiers, sailors, airmen, marines, families, and surrounding communities.

This book explores the sustainability concept at the strategic, operational and tactical levels. At the strategic level the book explores the importance of focusing international and national priorities on identifying and preserving the resource base necessary to maintain security and stability and discusses the importance of proactively mitigating threats to these resources. At the operational level it examines the great savings that can be achieved

by applying sustainable principles and practices throughout military installations, systems, and operations; Operational Energy is a fine example. At the tactical level sustainability is reducing risks to military war fighters by reducing the logistic burden of transporting fuel and water to the tip of the fighting spear, and by minimizing the overall logistics footprint at base camps. In the field, the military is additionally a catalyst for the enhancement of sustainable communities through its application of green technologies and human capacity building.

Sustainability is simply a management approach applying a systematic framework with a focus on the wise use of resources (economic and natural) while acting socially responsible. Through the application of sustainable practices and principles demonstrated in this book by various organizations the military is not only getting stronger, but playing a vital role in driving new innovation and technologies critical to the military's future success.

Unsustainable practices worldwide are increasingly leading to adversely changing conditions in meteorology, potable water availability, sea levels, crop and fish yields, disease rates, and species survival rates. The aforementioned conditions have an aggregate effect of destabilizing weak nations. In essence unsustainable principles and practices are a threat multiplier.

There are several examples throughout this book that demonstrate the transformation of militaries to a sustainability based approach has been a natural evolution rather than a radical event. Doctrine, strategic planning, decision making, acquisition and procurement processes, building design and construction, facility and tactical operations, and institutional behaviors are all aligning to support sustainability. Although there is still much more to do, it should be evident from this book that sustainability offers a critical lens for examining national security objectives at the strategic, operational and tactical levels.

Dr. Jim Hartman's chapter, "Sustainability and National Security," examines the evolution of the Army's sustainability program and its contributions to the national strategic security objectives. The growing world population and imbalance of natural resources are expected to affect US, as well as Army, interests. Dr. Hartman asserts sustainability is the nexus to ensure future security, which can only be achieved through the development and implementation of sound business practices. Dr. Hartman opines the Army, as a large institution, is well suited to lead a whole of government approach to sustainability.

Dr. Kent Butts and Brent Bankus' chapter, "Sustainability: A Lens for National Security," postulates sustainability begins at the local level, but has strong implications at the strategic level. Dr. Butts and Mr. Bankus argue the ambiguity of China's motives to secure natural resources in Africa and the Middle East in order to obtain 'soft power' to directly and negatively affect U.S. interests around the globe. Dr. Butts and Mr. Bankus address maintaining the Bretton Woods Agreement, as well as the 1987 UN Brundtlant report to meet present needs without compromising the needs to future generations" in the interest of a U.S. sustainability strategy. This chapter takes a view of U.S. interests at the national, as well as regional, level and the implications for the future if sustainability issues are not examined through a wider aperture by U.S. leadership.

Dr. Kristan Cockerill's "The Department of Defense promotes a Strong Offense for Promoting Sustainability" addresses the Army's historical role in preserving the environment. In 1890, President Benjamin Harrison directed the U.S. Cavalry to secure and protect the recently developed Yosemite National Park. The Army maintained control of Yosemite for 26 years until the establishment of the National Park Service in 1916 and preserved its vast wealth of natural resources. She argues the Army has a long history, both good and bad, when it comes to envi-

ronmental sustainment and presents a strong argument that the Army's sheer size, budget and location enable it to become a global leader in sustainability. Dr. Cockerill postulates the role of the commander, and the ability to enforce regulations at the local level, will enable new practices to be shared with other government and civilian organizations.

Steven Hearne, Jeremy Alcorn and William Goran's chapter, "Sustainable Security and Fragile States," presents a noteworthy argument as to how environmental factors exacerbate current social, and economic problems in a weak state and the potential for government/region unrest to likely affect U.S. security interests.

Dr. Odelia Funke's chapter "Sustainability and Environmental Security" also addresses the affects of the environment on security issues within and external to, the state. Dr. Funke makes a strong case for environmental issues facing the United States, as a superpower and Russia as a former superpower. An expert in Russian affairs, Dr. Funke presents a strong case for Russia's vast wealth of natural resources and the low priority placed by the Putin/Medvedev government(s) and the deleterious effects if environmental issues are not addressed immediately. Dr. Funke balances her discussion by addressing both the good and not so good approach by the U.S. government to the environmental interests and offers immediate and near term solutions to current issues.

Colonel Dave Carsten's chapter, "Building Resiliency into the National Security Strategy," argues a cultural shift must take place in order to become more adaptable to address issues of climate change and natural disaster. Colonel Carsten posits experts both within and outside of government must be consulted in order to develop a policy that is both flexible and resilient to the challenges presented by regional conflicts and humanitarian disasters. Colonel Carsten addresses recent regional and environmental events, and subsequent missions placed on the Department of Defense, as a foundation for future policy development.

Commander Corry Juedeman, U.S. Navy, in her chapter entitled, "The Consequential Challenges of Climate Change," compels us to consider the U.S. military may find itself overextended to provide humanitarian relief in multiple settings. Commander Juedeman posits the effects of climate change will continue to multiply in the future, particularly in fragile nation states with an abundance of natural resources of strategic value to U.S. interests.

Rymn Parson's "Sustainability and States: Climate Change and Sovereignty" takes a legal, as well as environmental approach to migration, whether forced or unforced, and the abilities for surrounding countries to sustain a large scale cross-border movement of people. Parson postulates environmental dispossession leads to climate migration as a result of a lack of natural resources. Parson makes a compelling case that international law, and a state's sovereign right to control migration, has not kept pace with large scale emigrations. At issue are the individual rights of migrating individuals as well as the authority and obligations of the state, in an international context, as a result of environmental dispossession.

Colonel Kimberly O'Keefe's chapter, "Pursuing the Delta: Maximizing Opportunities to Integrate Sustainability in the Funding Process," addresses the 2010 Army Sustainability Campaign Plan as an organizing principle integrated into missions "to institutionalize sustainability in doctrine, policy, training, operations and acquisitions." While a tall order, anticipated budget cuts will challenge leaders at all levels to implement sustainability practices. O'Keefe posits many sustainability initiatives can be achieved through innovative leadership, but argues a tipping point exists if funding is not available.

Colonel Jim Raftery's chapter, "U.S. Nuclear Energy: National Security and Sustainability," examines national priorities concerning the future of nuclear energy as it relates to energy security, sustainability and independence.

Colonel Raftery posits nuclear energy must have a role in America's future energy policy; however, the affects of the Three Mile Island incident and the devastating destruction of the Fuchashima Daiichi plant as a result of the March 2011 Tsunami, presents an appetite suppressant for policy makers to pursue an increased nuclear role as part of a future national energy strategy.

In the chapter titled, "Sustainability and National Security Military Lands Management: The Ecological Foundation of Sustainability," Dr. Bill Doe, a widely published author on the issue of military land management, discusses the Army's historical roots of land stewardship and refers to the 'ecology of place' as the organizing principle of sustainability. Dr. Doe opines military properties have become 'islands of diversity' supporting a wide range of threatened and endangered species in habitats as disparate as the Army's current and future battle space

Dr. Marie Johnson and Lieutenant Colonel Mark Smith's "Promoting a Sustainability Ethic in Future Army Leaders at West Point" builds on the Army Environmental Strategy of developing a "triple bottom line" of Mission, Environment and Community in order to instill this culture in future Army officers at the Military Academy. Both Johnson and Smith argue the Army is the perfect choice to develop a sustainability ethos and to serve as an innovator for new technologies and practices. Johnson and Smith assert the Army's global presence and ability to enforce regulations through a chain of command will enable the development of new practices at a faster rate than in civilian agencies. Their work at West Point will serve to develop a new breed of officer with sound environmental practices to serve the Army.

Lieutenant Colonel Joe Knott and Monica Slade of the Army National Guard address, "Army National Guard and Sustainability Initiatives." Knott and Slade opine the National Guard is a community based operational force that must co-exist environmentally with the communi-

ties surrounding Armories and training areas. Knott and Slade address the concept of Enterprise Sustainability where the operational mission, or the natural setting to train Soldiers, will not decline in the future. They offer many examples of innovative programs underway, in several states, to preserve the environment as partners within the local communities.

In the chapter entitled "Building Green," William Goran, Thomas Napier, Richard Schneider and Annette Stumpfe address the Army's adoption of the Leadership in Environmental and Energy Design program. The future Army goal is to have 25 Net Zero installations, energy, water and waste, by 2030. While a large undertaking, the chapter discusses a potential solutions way and addresses cultural changes in order to achieve mission success.

This anthology shares a myriad of ideas and innovative practices which will reduce energy costs and have a reduced affect on the environment in our training areas, both here in the United States and abroad. It is our intent that this will assist practitioners, both current and new, of energy security and environmental sustainability in order to build upon existing programs to reduce the Army's annual $4 billion in energy consumption.

Since 1993, the Center for Strategic Leadership has published many articles and hosted many conferences in regards to Energy and the Environment. We are honored to publish this timely compilation of ideas to foster additional dialogue, future publication and recruit new practitioners of environmental sustainability.

# 1

## Sustainability and National Security

*Jim Hartman*

> "Having deployed over one million men and women in support of this Nation's longest ever fought war with an All-Volunteer Force, the Army is stressed. With an eye toward rebalancing the Force, sustainability has proven an effective tool for meeting operational requirements, while sustaining facilities and ranges, improving quality of life and reducing the burden on the natural and man made systems on which we depend. Army leadership has also come to understand the potential for sustainability to strengthen national security." McHugh 2010

## Introduction

The U.S. Army organizationally embraced the paradigm of sustainability over six years ago as the seeds of sustainability were sown by pioneer installations such as Fort Bragg and Fort Lewis at the onset of the new century. Today, the Army continues to apply sustainable practices and principles while driving innovative technologies to enhance mission capabilities. This chapter examines the evolution of the Army sustainability program, and how sustainability is contributing to national security strategic objectives. Global demographic and natural resource trends are not only disturbing but now pose a threat to U.S. national security, prosperity, and the American way of life. A growing world population coupled with resource imbalance and global climate change will continue to fuel aggression against the United States as well as present governance challenges to weak nations important to global stability. Competition for scarce resources is clearly being addressed by U.S. national strategists. They continue to contemplate how to enable long-term national economic growth and posture the nation to reduce its dependency on

foreign imports such as oil from volatile regions, further undermining U.S. policy objectives. U.S. national strategists monitor China's military buildup fueled by near double digit economic growth that is highly dependent upon a vast stream of resource imports. They are also witnessing a growing wave of political unrest around the globe centered on autocratic nation-states unable to provide their citizens with a stable food supply or offer any hope of prosperity. Climate change is exacerbating food shortages – each Celsius degree increase in global temperature has been postulated to reduce global grain yields by approximately ten percent (Brown 2011). The availability and management of water now appears to be the limiting factor on global food production. Water tables are falling on every continent and over the next twenty years the United Nations (UN) estimates that three billion people could face water scarcity while in the same time period water for agriculture needs to increase 60% to feed an additional two billion people (Glenn et al. 2010). The United States is not immune to resource scarcity and environmental degradation. Sustainability through a holistic approach focuses on resource optimization for long term availability and provides a platform for multi-state cooperation on transnational resource issues. As stated recently by Admiral Mike Mullen, Chairman of the Joint Chiefs of Staff, "We must recognize that security means more than defense…until we restore a sense of hope in challenged regions, we will see again and again that security without prosperity is ultimately unsustainable" (2011). Sustained or long-term economic growth requires that human capital and natural resources be prudently managed.

## The Concept of Sustainability

Sustainable development, or its shorthand version sustainability, was rooted with the 1972 UN Conference on the Human Environment which debated which was more important: environmental protection or human development. The debates at Stockholm gave birth to the notion that both environmental protection and economic development were inextricably linked. That idea was refined through extensive discussions in UN circles over the many years that followed (Blackburn 2007).

In 1987 the Brundtland Commission, a group appointed by the UN to propose strategies for improving human well-being without threatening the environment published its report containing the definition of sustainability most widely used today: Development that meets the need of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development 1987).

In 1997, John Elkington, introduced a definitional term drawn from financial accounting: the triple bottom line (TBL). By this he meant that to reach sustainability, one must achieve not only economic "bottom-line" performance but environmental and social performance as well. The TBL of economic performance, environmental quality, and social justice was an approach of preserving capitalism while addressing the global decline in natural resources and an emerging middle class in developing countries.

The concept of sustainable development led to the first Earth Summit – the UN Conference on Environment and Economic Development (Rio de Janeiro 1992)- and to Agenda 21 – a blueprint or global action plan for sustainable development in the 21st century

that included 27 principles to guide that effort. The UN Commission on Sustainable Development (CSD) was established by the UN General Assembly in December 1992 to ensure effective follow up of the Earth Summit.

The momentum of the Rio Earth Summit was maintained nationally through Executive Order 12852, establishing the President's Council on Sustainable Development (PCSD), which existed for six years between June 1993 and June 1999. The PCSD was chartered to:

- Develop and recommend a national sustainable development strategy that would foster economic vitality
- Advise the President on domestic implementation of policy options to reduce greenhouse gas emissions without debating the science of global warming
- Advise the President on policies and approaches that promote "sustainable communities"
- Advise the President on policies that foster U.S. leadership in sustainable development internationally

Subsequent international conferences, including the 2002 World Summit on Sustainable Development (WSSD) in Johannesburg, South Africa, have reaffirmed the concept and commitment to sustainable development. The focus of the WSSD was on implementation of the Earth Summit agreements that were addressed in the Johannesburg Plan of Implementation (JPOI), which included targets and timelines to achieve specific results by stated dates. Some of these targets and timetables reaffirm commitments that were previously agreed to in the UN General Assembly's *Millennium Declaration* in 2000.

In the broadest sense, sustainability can be viewed as the ability of man to live within the natural carrying capacity of planet earth. Otherwise stated, sustainability is a systems-level phenomenon based on the balance of human activities and the earth's natural processes. Unsustainable practices worldwide are increasingly leading to adversely changing conditions in meteorology, potable water availability, sea levels, crop and fish yields, disease rates, and species survival rates. The aforementioned conditions have an aggregate effect of destabilizing weak nations. In essence, unsustainable principles and practices are a threat multiplier. The UN Office for the Coordination of Humanitarian Affairs and the Internal Displacement Monitoring Center estimated that in 2008 climate-related calamities drove 20 million people from their homes – more than four times the number displaced by violent conflict (Sherbinin et al 2011). Additionally, large reinsurance companies estimate the annual economic loss due to climate change could reach $300 billion per year within a decade (Glen et al 2010).

From a corporate standpoint, sustainability is a management approach that is systems based with focus on the optimum use of resources (human and natural) while being socially responsible. Social responsibility is heavily tied to the ethics base of an organization and the organization's branding. A healthy productive work force and community are pivotal to a successful organization as is its reputation. The pricing of commercial goods is further influenced by a corporation's reputation and brand. In a world where the price gaps between similar items are continually shrinking, the corporate brand can be the decisive factor in consumer selection and purchasing. It follows then that branding heavily influences pricing, market value and market shares. The market value of a cor-

poration and its ability to borrow money stimulate a corporate growth. Corporate America has found sustainability to be an effective business model producing dividends. As stated by Dr. Alan Hecht: "The business world now clearly sees sustainability as a means to reduce long-term risk, enhance competitiveness, and to reduce cost. Furthermore, government policy now sees sustainability as essential to both domestic well-being and international security. Current environmental, economic and social pressures are challenging businesses and federal and state agencies to determine how to make sustainability operational" (Hecht 2010).

Sustainability connects the Army's activities of today to those of tomorrow with sound business and environmental practices. Many of the sustainable practices the Army is currently using and seeks to institutionalize are modeled by a growing number of corporations that aim for continual improvement and ultimately long term success. Mission accomplishment is the true determinant of military success or failure. Sustainability then can be viewed as simply a mission enabler allowing the military to: enhance readiness; maximize operational capability; reduce total life cycle costs of Army systems, material, facilities, and operations; enhance the quality of life of soldiers, their families, and the community; and be a model citizen.

In an Army context sustainability refers to sustainable operations, installations, systems and communities all enabling the Army mission (Office of the Assistant Secretary of the Army for Installations and Environment 2004).

## The Sustainability Nexus to U.S. National Security

Natural resources serve as a vital component of economic development, and they are closely intertwined with political stability and security of nation-states. Recognizing that national prosperity is heavily tied to a sustainable natural resource base and that a growing competition for key resources (such as fossil fuels and rare earth minerals) along with the impact of climate change can pose national vulnerabilities and stimulate global conflict, the highest level of U.S. policy now addresses sustainability. The principal U.S. strategic documents, overviewed in this section, promote a more holistic understanding of security. The national security framework is essentially transitioning from the legacy model of containment, deterrence, and control towards a sustainability based strategy. A recent white paper on a new national strategy narrative developed by aides of Admiral Mullen outlines a blueprint for this transition focusing on three sustainable investment priorities: human capital, sustainable security, and natural resources (Mr. Y 2011). The emphasis on human capital is squarely on a refocus on education, health, and social infrastructure. Sustainable security relies on the use of a more holistic, whole-of-government approach to security, essentially expanding the roles of civil agencies and promoting stability as much as ensuring defense. While an investment in long-range sustainable management of natural resources is called upon to meet the expanding global demand for resources triggered by population growth coupled with and increasing per capita consumption of resources as a result of global development.

The 2010 National Security Strategy (NSS) emphasizes America's commitment to retaining its global

leadership role and a need for America to employ an adaptive blend of diplomacy, defense, and development to advance our national interests – security of the United States and its allies; a strong U.S. economy; respect for universal values; and, the ability to meet global challenges. Our Armed Forces and American innovation serve as foundations of American power. The NSS lists the following as the challenges of our times: countering violent extremism and insurgency; stopping the spread of nuclear weapons and securing nuclear materials; combating a changing climate and sustaining global growth; helping countries feed themselves and care for their sick and resolving and preventing conflict, while also healing its wounds. The NSS also places an emphasis on the development of clean energy to power new industry, unbind us from foreign oil, and preserve our planet. Recognizing that there exists a tandem of development challenges—such as adaptation to global warming; the control of epidemic disease; and the knowledge to increase agricultural productivity, particularly in Africa—the NSS calls on the United States to increase multilateral efforts to transition to a low-carbon trajectory, support the resilience of the poorest nations to the effects of climate change, strengthen food security, and pursue "game changers" for development in vaccines, weather-resistant seed varieties, and green energy technologies.

The 2010 Quadrennial Defense Review (QDR) specifically recognizes that the Department of Defense (DOD) must address climate change and energy because of their significance to national security and mission readiness. As stated in the 2010 QDR:

> Energy security for the Department means having assured access to reliable supplies of energy and the ability to protect and deliver sufficient energy to meet operational needs. Energy efficiency can serve as a force multiplier, because it increases the range and endurance of forces in the field and can reduce the number of combat forces diverted to protect energy supply lines, which are vulnerable to both asymmetric and conventional attacks and disruptions.

Climate change presents multiple challenges to military facilities and operations. In 2008, the National Intelligence Council judged that more than 30 U.S. military operations were already facing elevated levels of risk from rising sea levels. The projected opening of Arctic waters will require a reassessment of security in the region along with capabilities to include search and rescue and spill response as key fossil fuels become accessible in what many are labeling as the final frontier. Finally, the 2010 QDR points out:

> Assessment conducted by the intelligence community indicates that climate change could have significant geopolitical impacts around the world, contributing to poverty, environmental degradation, and the further weakening of fragile governments. Climate change will contribute to food and water scarcity, will increase the spread of disease, and may spur or exacerbate mass migration. In addition, extreme weather events may lead to increased demands for defense support to civilian authorities for humanitarian assistance or disaster response both within the United States and overseas.

Whereas, diverse military challenges arise from climate change, so do opportunities. DOD environmental security initiatives with foreign militaries to enhance their capabilities of responding to natural di-

sasters and to better adapt to climate change represent a nonthreatening way of building trust.

The 2011 Quadrennial Diplomacy & Development Review, or inaugural QDDR, follows in the footsteps of quadrennial reviews by DOD in taking a comprehensive look at how the U.S. Department of State and the U.S. Agency for International Development (USAID) can become more efficient, accountable and effective in advancing the interests of the American people. As Secretary Clinton has said, "To lead in this new century, we must often lead in new ways." The QDDR calls for the State Department to reorganize structurally to meet new challenges through the establishment of an Under Secretary for Economic Growth, Energy, and the Environment to enhance agency effectiveness on these interconnected global issues; and, a new Bureau for Energy Resources to unite diplomatic and programmatic efforts on oil, natural gas, coal, electricity, renewable energy, energy governance, strategic resources, and energy poverty. The QDDR indicates that for the United States, development is a strategic, economic, and moral imperative – as central to our foreign policy as diplomacy and defense. As such, six specific areas are the focus of development efforts:

- sustainable economic growth,
- food security,
- global health,
- climate change,
- democracy and governance, and
- humanitarian assistance.

Emphasis is placed on a need for high-impact development, a shifting from aid to investment, helping host nations build sustainable systems. By doing so America is stated to be better postured to prevent fragile states from descending into chaos, spur economic

growth abroad, secure investments for American business, open new markets for American goods, promote trade overseas, and create U.S. jobs. Ultimately, sustainable development helps countries become more capable of solving their own problems and share in solving common global problems.

The 2011 National Military Strategy (NMS) reaffirms that our military power is most effective when employed in support and concert with other elements of power as part of whole-of-nation approaches to foreign policy. The ongoing shifts in relative power—two rising Asian global powers and a number of emerging Middle East regional powers—and increasing interconnectedness in the international order indicate a strategic inflection point. This requires America's foreign policy to employ an adaptive blend of diplomacy, development and defense. The NMS points out that states with weak, failing, and corrupt governments will increasingly be used as a safe haven for an expanding array of non-state actors that breed conflict and endanger stability, particularly in Africa and the broader Middle East. Population growth and urbanization in the Middle East, Africa, and South and Central Asia are expected to contribute to increased water scarcity and could present governance challenges. The uncertain impact of global climate change combined with increased population centers in or near coastal areas may challenge the ability of weak or developing nations to respond to natural disasters. Energy-state relationships will intersect geopolitical concerns as state-run companies will control an increasing share of the world's hydrocarbon resources and the persistent challenge of resource scarcity may overlap with territorial disputes.

Another military strategic perspective on the future security environment of the United States is provided in the *Joint Operating Environment (JOE) 2010,* developed by the U.S. Joint Forces Command. The JOE is speculative in nature and in no way constitutes U.S. government policy. Rather, the JOE seeks to provide the Joint Force an intellectual foundation to build on the concepts to guide future force development over the next twenty-five years. In the broadest sense, the JOE examines three questions: what future trends and disruptions are likely to affect the Joint Force over the next quarter century; how are these trends and disruptions likely to define the future context of joint operations; and, what are the implications of these trends and contexts for the Joint Force? Trends that have been selected for inclusion in the JOE are based upon three major ideas or themes:

1. How a trend might enhance or erode the power of a specific state?
2. How a trend might enhance or erode the power of the overall state system of relations relative to non-state actors?
3. How trends contribute to the emergence or suppression of global networks or ideologies that transcend the international system as we currently perceive it.

The JOE delineates the following trends as influencing the world's security: demographics, globalization; economics, energy, food, water, climate change and natural resources, pandemics, cyber technology, and, space.

As per recent U.S. Intelligence Community assessments of threats to U.S. national security, delivered to Congress by the Director of National Intelligence (DNI) in February 2011, the United States no longer

faces one dominant threat but rather numerous potential threats to national security. While terrorism, proliferation of weapons of mass destruction (WMD), and the wide spectrum of intelligence threats (i.e., espionage, cyber intrusions, organized crime, and the unauthorized disclosure of sensitive and classified U.S. documents), remain at the forefront, the DNI recognizes the ever expanding nature of national security threats by detailing challenges to global energy security and fresh water scarcity. The uncertainty of future crude oil production levels to meet expected demand growth, especially in China and other large emerging market economies, translates to a continuing threat of a return of heightened price volatility throughout the remainder of the decade according to the DNI. With more than 260 river basins being shared by two or more countries, the increased pressure generated by growing populations, urbanization, economic development, and climate change on shared water resources could increase competition and exacerbate existing tensions over these resources. In the absence of mitigating action, fresh water scarcity at local levels will have wide-ranging implications for U.S. national security. This scarcity will aggravate existing problems—such as poverty, social tensions, environmental degradation, ineffectual leadership, and weak political institutions—and thereby threaten state or regional stability. A whole-of-government approach, using the best modeling expertise, will be needed to assess the impact of water and other resource scarcity on state stability.

The impact of resource scarcity on national security—particularly energy, water and food—along with climate change has further become a focus area of the U.S. CNA Corporation, involving a Military Advisory

Board of distinguished retired generals and admirals. CNA has released two reports, each the result of a year-long study, outlining the multifaceted nature of the national security threats posed by climate change and by the energy posture of the United States. Included within these reports are specific recommendations to reduce America's vulnerabilities and bolster national security. Conditions created by climate change – drought, flooding, extreme weather events of the magnitude of Hurricane Katrina, loss of coastal regions, reduced water supplies, decreased agricultural productivity, crop failures, and pandemics – have the potential according to CNA to cause multiple chronic, destabilizing conditions to occur globally. These events threaten the legitimacy of many governments in Asia, Africa, and the Middle East causing protracted conflicts over dwindling resources. This may spur mass migrations causing political instability and the possibility of fueling terrorist activities. This may require a growing need for U.S. military missions ranging from humanitarian assistance, to peacekeeping, to the need to respond to conflicts over resources in regions critical to U.S. national security. CNA views America's dependence on fossil fuels as a threat to the U.S. military, diplomatic mission and economy. CNA states that the military dependence on, and inefficient use of, oil reduces mission effectiveness, puts U.S. troops in harm's way, and extracts a heavy price in lives, resources, and dollars. Dependence on oil is further stated to hamper foreign policy decision and reduce America's leverage internationally. In 2008, the United States spent an estimated $386 billion on foreign oil. This massive transfer of wealth to other nations – some of which wish to harm us – often puts the United States in the position of funding both sides of conflicts and undercuts the global fight on terror.

## The U.S. Army Sustainability Paradigm Shift

The Army is a large and complex organization with soldiers in nearly 80 countries and stewards of over 14 million acres of land. The Army's organizational structure consists of two independent pieces: the war fighting or operational Army; and the institutional Army that supports the operational forces by providing training, facilities, and equipment to prepare and sustain soldiers. The Army relies on two basic types of facilities to conduct its mission – installations and forward operating bases (FOBs). Installations are the platforms from which the Army rapidly mobilizes and deploys military power, training the force and reconstituting it upon return from deployment, and sustaining military families. FOBs support expeditionary or contingency operations and are critical to U.S. troop surges and extended operations in multiple theaters but particularly now in the U.S. Central Command (CENTCOM). Although them are vital in waging asymmetric warfare, building and sustaining them in remote areas necessitates huge expenditures of resources and they have become the focus of a significant logistical effort that is vulnerable to enemy attack. The Army's logistical tail is a handicap. In fiscal year 2010 the Army's fuel costs topped $2.7 billion, 70% of which was for theater operations. In Afghanistan, the military is enduring one casualty for every 24 ground resupply convoys; 70 to 80% of the resupply weight for those logistical convoys is composed of fuel and water (Bohannon 2011).

Increasing environmental pressures – such as extended regional droughts and proposed regional nonattainment designations for air quality – along with restrictions to military training evolving from a high

density build up outside key Army installations and the loss of critical buffer space was the genesis of the Army's sustainability program. This phenomenon hit a tipping point for the Army at Fort Bragg in the 1990's where the continued existence of realistic Army training was jeopardized by the preservation of critical habitat for an endangered woodpecker species. The 160,000 plus acre installation lies within six counties in the Sandhills of North Carolina, and is the home of airborne and special operations forces. In 2001, Fort Bragg initiated a consensus-based effort with the local community that developed a twenty-five year installation goal-centric sustainability plan and further resulted in the creation and implementation of Sustainable Sandhills, a regional sustainability program that is home to over 250,000 people in North Carolina —including active and retired military personnel and their dependents along with a civilian work force. From compatible land use planning, to food waste studies, to affirmative procurement, to reducing energy and water demand, to renewable energy sources, to alternative fuel and alternative fuel vehicles, to Leadership in Energy and Environmental Design certified buildings, teams associated with Sustainable Community goals are actively moving forward at Fort Bragg. Following the success at Fort Bragg, as of 2008, integrated strategic and sustainability planning (ISSP) has spread to 21 Army installations that have undergone this process (Office of the Assistant Secretary of the Army for Installations and Environment 2010).

In October 2004, riding the success of Sustainable Fort Bragg and using it as a blueprint, the Army released its hallmark sustainability document, *The Army Strategy for the Environment,* which represented a paradigm shift for the Army moving it from a program

that was predominantly compliance based to a program based on sustainable principles and practices. According to the strategy, the Army's environmental mission is to "sustain the environment to enable the Army mission and secure the future," or more succinctly, "sustain the mission, secure the future." The vision articulated in the strategy, "sustainable operations, installations, systems, and communities enabling the Army mission," provides a useful approach for thinking about the environment that recognizes "the interdependence between our mission, the community, and the environment." To achieve its vision, the new strategy advances six goals:

- Foster a sustainability ethic;
- Strengthen Army operations;
- Meet test, training, and mission requirements;
- Minimize impacts and total ownership costs;
- Enhance well-being;
- Drive innovation.

The Army strategy is not prescriptive. The execution document or roadmap for implementation of the *Army Strategy for the Environment* is the *Army Sustainability Campaign Plan (ASCP)* published in May 2010. The *ASCP* serves to integrate sustainability efforts across Lines of Operation (materiel, readiness, human capital, and services and infrastructure) consistent with the Army enterprise architecture; it assigns responsible organizations for accomplishing overall strategic goals and objectives, and directs those strategic tasks necessary to implement the plan. The Army has listed four tenets of sustainability within the *ASCP*:

- Developing, producing, fielding, and sustaining materiel that is more energy efficient, is capable of using renewable energy resources,

minimizes the uses of hazardous materials, and generates less waste.

- Ensuring the Army has sufficient access to training and testing resources, and incorporating sustainability into operational planning and execution, so the Army can continue to effectively train today and in perpetuity.
- Expanding Army commitment to sustainability by instilling sustainable practices into all levels of Soldier and civilian education programs.
- Providing services and operating facilities in a matter that reduces consumption of energy, water, and other resources, promotes the use of renewable energy sources, enhances quality of life, and continues to protect the environment.

The Army uses the Global Reporting Initiative (GRI) guidelines for sustainability reporting and was the first U.S. government agency to do so. Army Sustainability Reports were released in 2008 and 2010.

The Army is also incorporating sustainability into the operating procedures for forward-deployed forces under a program called *Green Warrior*. *Green Warrior* reduces the Army's logistics tail, enhances soldier safety and improves efficiency at base camps, and ultimately results in a more stable and sustainable country upon redeployment. Building sustainable capacity in Afghanistan is being demonstrated by Agribusiness Development Teams led by the Army National Guard (ANG). ANG soldiers from farm-belt states are teaching Afghanis modern livestock and farming techniques. Whereas the UN Environmental Program (UNEP) has been laying the foundations for sustainable development in Afghanistan its efforts have been limited largely to the capital city of Kabul because of security reasons. The Army through *Green*

*Warrior* and the Agribusiness Development Teams are driving sustainable practices throughout Afghanistan including contentious areas.

Additionally, Army Combatant Commands such as the U.S. Southern Command (SOUTHCOM) have embraced sustainability. At an *Army Sustainability & Environmental Security Roundtable* conducted at the U.S. Army War College (USAWC) in November 2010, Colonel Norberto Cintron, Command Engineer, U.S. SOUTHCOM, described to roundtable participants the Command's use of environmental security and disaster preparedness efforts as part of a well developed Security Cooperation Program to build capacity and create lasting defense security cooperation between South American, Central American and Caribbean states, and the United States. Colonel Cintron emphasized that climate change is now a compelling environmental security issue that threatens stability within the South and Central Americas, and the Caribbean largely through the decreasing availability of a safe water supply. Disturbing trends in the loss of key glaciers in South America to rising temperatures, the rapid urbanization in Latin America and the Caribbean where over 70% of the population is now urban, and the widening disparity in incomes between social classes were highlighted by Colonel Cintron as significant threats to both sustainability and regional security. Colonel Cintron quoted Thomas Friedman (New York Times columnist and Pulitzer Prize winning author) in saying: "If we've learned anything from September 11, it is that if you don't visit a bad neighborhood, it will visit you." He further added that SOUTHCOM has touched all 32 countries within its area of responsibility over the past year to emphasize environmental security and sustainable communities through a series of capacity building venues of

which many were focused on climate change adaptation. Sustainability is definitely focusing military planners at taking a long-erm systematic view that balances vital natural resources (such as water, fertile soil, fuel and food sources, and material inputs for industry) with economic resources, and the needs of both military and surrounding communities.

The Army has also launched a Net Zero effort as a cornerstone to support sustainable practices at Army installations. Net Zero installations are to consume as much energy or water as they produce and eliminate solid waste to landfills. The Army's Net Zero installation strategy: applies a holistic approach founded on five interrelated steps – reduction, re-purposing, recycling and composting, energy recovery, and the last resort of disposal – that are linked through a hierarchy. This includes six Net Zero pilot installations in each of the energy, water and waste categories along with two integrated installations (Fort Bliss, Texas, and Fort Carson, Colorado) covering all three categories that are striving towards Net Zero by 2020; and identifies adding another 25 installations in each category in fiscal year 2014. The Army fully intends on leveraging installation Net Zero accomplishments into contingency base operations. Lowering emissions—heat, light, noise, and waste—will reduce the operational signature and logistics support tail.

**Summary**

The world has changed significantly over the past fifty years and the pace of change in the past decades is unmatched in history. The impact of man on natural resources and systems, the speed and breadth of information transfer, the interconductivity of state/

government economies, and the ability of small groups to wage asymmetric warfare or lead pro-democratic movements clearly demonstrate that we no longer live in a closed system where man can control his own destiny largely through brute force, technology, and unilateral actions/decision making. As stated by Admiral Mullen, "Frankly, in this small, flatter, and faster world, I think any nation that believes it can, in a very clinical way, control events does so at their own peril" (Mullen 2011). What we do know is that the status quo will no longer work and guarantee U.S. prosperity and security. Furthermore, those societies that have hung onto outdated value systems and beliefs throughout history in many cases have collapsed largely by failing to recognize their conductivity to natural systems and through poor decision making of leadership groups (Diamond, 2005). America must take the long-term view, applying both policy and practices that effectively balance security, prosperity, environmental and societal requirements. An alternate management approach that looks at the interconnection of all the component parts, works in harmony with natural systems that highly successful technologies mimic, optimizes human and natural resources, and leverages diversity is sustainability. The future Army will need enhanced capabilities with a smaller logistical footprint and lower resource consumption rates to sustain a wide range of operations in diverse locations (Association of the United States Army 2011). America's military has embraced sustainability and because of its scale – the U.S. Army alone is comparable to a major corporation in terms of funding, assets and global reach (only large U.S. oil companies and Wal-Mart exceeded its revenue stream in 2009) – it could become an agent of change for governance institutions and the country.

As Thomas Friedman has stated: "Pay attention: when the U.S. Army desegregated, the country really desegregated; when the Army goes green, the country could really go green; green is the new red, white and blue."

## Conclusion

America and its military has been the model of excellence for over the last two hundred years. The core competencies of this great nation have been its education system, military readiness, and superior technology. These competencies have been enabled by an abundance of natural resources and the spirit of the American people. Change is in the air and necessary to ensure America's security and prosperity. The military and in particular the U.S. Army has adopted the multi-dimensional approach of sustainability – balancing the needs of its mission with the environment, surrounding communities, and resource stream – to ensure Soldiers of the future have the resources they need to train, a healthy environment in which to live, and the support of local communities and the American people.

The Army has a solid foundation for its sustainability paradigm shift with an overarching strategy, senior leadership support, and a campaign plan to change the Army culture. Army behavioral change shaped by education, policies and doctrine is and will continue to stimulate resource conservation, the repurposing of materials, and improved efficiencies. Behavioral change within the Army starts as early as boot camp, and within academia for new cadets. Future senior leaders and current senior leaders will be exposed to the concepts of sustainability through diverse educational opportunities including: the core

curriculum of the U.S. Military Academy; USAWC student research papers, fellow papers, and electives; virtual training leading to accredited degrees such as offered by the Arizona State University School of Sustainability and the Warner College of Natural Resources (WCNR), and Continuing Education at Colorado State University; and, various orientation courses for new commanders.

The Army will develop sustainable facilities and equipment through leadership, doctrine, innovative research and development, diverse partnerships, and sustainable practices promoted through its Net Zero initiative. A coordinated effort across federal agencies can further serve to break down traditional silos to further advance and support a potential convergence of sustainability by business and government (Hecht 2010). The Army because of its scale has a role in stimulating the markets for sustainable based products and technology through its procurement policies and practices. The full support of government and industry partners is essential for the development and integration of sustainable technologies, processes and practices – the Army cannot do it alone (Association of the United States Army 2007).

As stated by the Honorable Ms. Katherine Hammack, the Assistant Secretary of the Army for Installations, Energy and Environment:

> Through innovation, adaptation, exploration and evaluation, we are creating a culture that recognizes the value of sustainability measured not just in terms of financial benefits, but benefits to maintaining mission capabilities, quality of life, relationships with local communities and the preservation of options for the Army's future (Bohannon 2011).

The challenges of the future require the military and its leaders to possess agility to ultimately be successful. This agility is the product of rigorous education, appropriate application of technology, and a rich understanding of the social and political context in which military operations are conducted (The Joint Operations Environment 2010). Sustainability and the systems approach it applies serve as an enabler of military operational agility. In the final analysis, sustainability is simply about being better today and in the future by applying a systems-thinking approach with a focus on resource optimization. It is about being better through the enhancement of mission capabilities while reducing both financial burden and risk.

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# 2

# Sustainability: A Lens for National Security

*Kent Hughes Butts and Brent C. Bankus*

## Introduction

At the strategic level the concept of sustainability has significant value as an explanatory variable in national security issues. Sustainability, which had its roots in the tactical level management of installations and factories, is an important strategic concept for the private sector and a potentially game changing strategic concept for U.S. national security policy. Strategic planning for U.S. national security should include variables such as the pillars of the Bretton Woods Accords, economic vitality, military strength, strong alliances, threat management, geopolitics, sea lines of communication, and resource access. Sustainability contributes to the United States understanding of the national security implementation of each.

It can identify vulnerabilities in the U.S. resource base and suggest regions or countries that should receive National Security Strategy (NSS) priority in order to mitigate shortfalls. At the same time it provides a framework for analyzing the vulnerabilities of peer competitors, explaining their geopolitical strategies designed to correct those vulnerabilities and identifying areas of mutual vulnerability and corresponding, potential for regional resource competition (Africa and the Arabian-Persian Gulf). Sustainability brings a valuable perspective to crafting national security policy roles and missions for the elements of national power. This chapter argues that sustainability is a valuable lens for viewing the national security landscape of the United States and should be a foundation for developing U.S. national security policy.

## Common Definitions

Most definitions of sustainability relate to processes in pursuing resource sufficiency. In view of the U.S. Environmental Protection Agency (EPA), which treats sustainability, as a holistic concept, "Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment." The EPA's view is that good stewardship of natural resources is required for there to be a future for humanity. Without the intelligent use of natural resources such as water, survival of future populations will be at risk as the already stressed world population grows towards 9 billion and precipitation patterns change (EPA 2011). Robert Gillman, editor of the *In Context Journal*, uses the biblical context of sustainability, stating that "sustainability refers to a very old and simple concept (The Golden Rule)...do onto future generations as you would have them do onto you" (Washington State University 2011).

In the business community, sustainability refers to creating the conditions necessary to maintain the function of the organization indefinitely. It recognizes that the output of the organization turns on a dependable supply of resources: human capital, funding, natural resources and technology. When economists address the allocation of scarce resources, they are describing the factors of production or conditions necessary to insure the successful achievement of organizational objectives or outputs.

In order to develop successful policies the question that must be asked is whether those factors of production can be maintained over time? The Coca Cola Company produces beverages in all but two countries around the world. It understands that quality prod-

ucts require access to clean water resources. Coca Cola created the Global Water Resource Manager position and wrote a water strategy to insure that it has a sustainable supply of clean water for its manufacturing plants. Sustainability guides its business decisions (Rozza 2010).

The United Nations (UN) has been a leader in conducting studies that addresses natural resources and population trends; their thoughts on sustainability are similar to those of the EPA. In their 1987 report, commonly called the Brundtland Report, the UN World Commission on Environment and Development defines sustainable development as development which "meets present needs without compromising the ability of future generations to meet their needs" (United Nations World Commission on Environment and Development 1987).

The application of sustainability to state security was encouraged by the 1987 Brundtland Report. The report defined the importance of sustainable development to regional security, and pointed out the dangers of unconstrained development and the chronic failure of many Western development programs that had benefited corrupt leaders and over harvested scarce or vulnerable renewable resources. In 1994, the UN Development Program published the *Human Development Report*, which defined the elements of human security. This report defined state security in terms of human security (freedom from want and freedom from fear) and encouraged the national security community to analyze the contribution human security made to building state stability. The idea that state security was related to human security and environmental sustainability provided a new framework for analyzing state security, failed states, and the underlying conditions

that terrorists seek to exploit. Sustainability of a state's resource base was essential for state governments to meet demands placed on the political system. Sustainability was also an objective for policymakers seeking to maintain regional security.

This chapter suggests that sustainability should be a lens through which U.S. national security is viewed at two levels. At the national level, it should inform national security policy designed to insure the freedom, vitality and security of the United States, guiding the policies to insure access to the resources necessary to sustain the U.S. economy and defense capabilities. Is China purchasing the available petroleum and strategic mineral deposits and limiting what the United States and its allies can obtain on the free market? Will defense technology be lost if U.S. magnet manufacturers are forced to move to China to ensure access to supplies of heavy rare earth elements? Will the piracy and terrorist activity in the Horn of Africa interfere with the shipment of Middle East oil to Europe and the United States?

At the regional level, it should also inform the application of the elements of national security to international security objectives. The sustainability of regional governments counted upon to support U.S. national security should be a common objective of the elements of national power. In Afghanistan 80%of the people depend directly on natural resources for their livelihood and 75% of the country is at risk of decertification (UNEP in Afghanistan 2011, 5).

Is the economy of a valuable ally, Egypt for example, sustainable? Will the food security of the country fail because its climate is changing and the rainfall that provides 95% of the country's water supply is no

longer reliable? Will the military that once defended its state borders be forced to deal with violent intra-state conflict between the resource haves and have nots? Will the development promised by donors be sustainable, or result in harvesting a renewable resource, such as fish, at a rate that destroys the carrying capacity of the fishery? Sustainability means developing resources in a way that ensures the availability of resources for future generations or operations while meeting current demands placed upon the political system by the population seeking to satisfy their human security needs. Sustainability can also be applied to political systems and foreign policy, providing new insights for national security political development, why states fail, and why populations support terrorist organizations.

The United States is not autarchic; it depends on foreign trade for approximately 60% of its petroleum supply and 80% of its most strategically important minerals (manganese, platinum group metals, cobalt and the rare earth elements). 61% of the 18 minerals on which the United States is 100% import dependent are produced in China (USGS Mineral Commodity Summary 2011, 6). To sustain its economy and defense capability the United States must have these resources. It is therefore vulnerable to instability or loss of influence in resource producing countries, or to supply cutoff. Second, the sustainability of the potential systems, economies, resource base and human security of countries essential to U.S. national security objectives is critical. Sustainability is an important lens through which to view national security. It informs the analysis of U.S. security vulnerabilities and the countries necessary to mitigate those vulnerabilities, and it provides valuable insights on the viability

of alliances, supply sources, state stability and regional stability. Thus, sustainability affects U.S. National security at both the national and regional levels.

Africa is a strategically important continent for the United States and typifies these levels of resolution. It is one of the few alternatives to the politically unstable Middle East for conventional petroleum reserves. Africa has long been recognized as the world's treasure house for strategic minerals, such as uranium, chromium, cobalt, platinum group metals, and manganese. It has large areas of fertile soil with abundant rainfall suitable for plantations. It borders several strategically important chokepoints along sea lines of communications (SLOCs) such as the Horn and the Cape routes. Importantly, its growing number of failed states is giving rise to ungoverned spaces into which extremist, anti-U.S. groups are expanding and establishing training bases. State and regional stability in Africa is particularly important to U.S. interests. Instability and failed states put resource access at risk, threatens the security of bordering states, and creates the potential for SLOCs to be penetrated by pirates, or terrorists seeking to create news worthy events (Gettleman 2011). Thus, at the national and regional levels, the importance of Africa to U.S. national security is defined by sustainability. Examining these security issues through the lens of sustainability can suggest essential policy options for dealing with evolving trends in the international security milieu.

**Population and Affluence**

Several key sustainability based trends are affecting the availability and adequacy of global resources in ways that threaten the national security of the United States and other import reliant states such as Chi-

na. Population growth is often mentioned but rarely given the recognition that it deserves as an element of security. In 1900 there were 1.6 billion people in the world, and 99 years later there were 6.1 billion. Recently, Carl Haub, a demographer for the Population Reference Bureau, remarked, "[c]urrently, world population is growing at the most rapid pace in history," and an additional three billion people are expected by the year 2100 (El Nasser 2011).

Burgeoning populations in the two industrializing giants of China and India are driving their interest in African resources. The U.S. Census Bureau estimates that by 2025 India will overtake China as the most populous country in the world with the combined population of both nations at approximately 3 billion, and by 2050 India will surpass China with 1.657 billion people and China at 1.304 billion people (2point6billion.com 2011). Approximately half the people in the world will live in these two countries, which are competing for power and influence. Both countries have growing middle-class populations seeking a more affluent lifestyle and a poverty stricken lower tier that is putting sustainability pressure on the government. This means that their populations want more meat in their diets, access to technologically sophisticated communications products, and automobiles.

**Natural Resources**

The resources necessary to meet the growing demand for affluence are increasingly found in Africa, where the Chinese, in particular, have created multiple, multi-billion-dollar bilateral trade relationships with resource rich African countries. There is a legitimate concern that the Chinese agreements will enrich

African leaders while failing to provide sustainable development and political stability. For example, in March of this year, the "watch dog" group Global Witness warned, "[t]he huge potential of a multibillion-dollar deal between the Democratic Republic of Congo (DRC) and China risks being undermined because the agreement is opaque and key terms are ill-defined. Neither the Congolese nor the Chinese parties have properly explained how the minerals are to be priced, nor what infrastructure is to be built and at what cost. This ambiguity makes it very hard to measure whether pledges are being met." This is not an isolated case; China is brokering these types of natural resource agreements across Africa and became a target of opposition political campaign rhetoric in the 2006 Zambian presidential election (Terra Daily 2011).

China's foreign policy experience as a world power is limited. At the national level it recognizes that it cannot sustain the economic growth necessary to maintain social stability from domestic sources and has created a geopolitical strategy (its "Go Out" strategy) to gain access to foreign resources. At the regional level, however, China has been widely criticized for bilateral relationships that are not sustainable and reinforce African problems with corruption. It is a problem that could threaten China's long term access to resource imports.

Nevertheless, China's resources for infrastructure agreements help sustain both China and the DRC's national security objectives and gives them control of resources. China will provide the DRC's 60 million people massive road and rail infrastructure, schools, health clinics, hydroelectric dams and two universities. In return China will gain approximately 600,000 tons of cobalt, 10 million tons of copper and access to

other resources such as columbium-tantalum, cassiterite and the DRC's vast rain forest (Global Witness 2011).

The recognition of natural resources as contributors to instability and conflict has been slowed by the fact that most conflicts are underpinned by pre-existing or multiple issues. The failure of scholarly research to determine a link between resources and conflict in all regions often leads to the reductionist assertion that resources cannot cause conflict at all. Policy makers disagree. Ariel Sharon wrote, "People generally regard 5 June 1967 as the day the Six Day War began . . . That is the official date. But, in reality, it started two-and-a-half years earlier, on the day Israel decided to act against the diversion of the Jordan [River]." Further evidence of the link between resources and conflict was provided by the UN Environment Programme (UNEP). The UNEP stated in their 2009 report, *From Conflict to Peacebuilding,* that "[s]ince 1990 at least eighteen violent conflicts have been fuelled by the exploitation of natural resources. Looking back over the past sixty years at least forty percent of all intrastate conflicts can be associated with natural resources (UNEP 2009)." This is particularly true on the continent of Africa, where eight of the 16 active UN Peacekeeping missions are located (United Nations 2011). Many of these have their roots in the unsustainable exploitation of resources. This is an age old story for the continent and can be traced back to at least 1885 at the Berlin Conference where the European colonial powers divided Africa into spheres of influence, providing access to areas of raw materials to fuel their growing economies. The agreement did not take into account the undocumented lines of demarcation separating the various ethnic groups that had

existed for centuries in some cases. European powers did not consider the sustainability of future independent African states. This purposeful omission would plague both the colonial powers and the new African nations and influences the sustainability and geopolitics in the region today. As a consequence, many newly independent nations evolved into "strong man" governments, backed by mineral resources wealth and a military that lacked the expertise to properly provide for the basic needs of their populations. The Cold War exacerbated this problem with one or both of the Super Powers bartering resources for weapons, while eroding the sustainability of their government, economy and culture. At the regional level, creating sustainability remains a challenge.

The vulnerability of the United States and its allies to import supply disruption was critical to the geopolitical strategy of the Soviet Union and is well known to Chinese geopoliticians crafting tenets of its "Go Out" strategy. A quote long attributed to Soviet President Leonid Brezhnev from 1973 speaks volumes of the state of affairs between the Soviet Union and the United States during the height of the Cold War: "Our aim is to gain control of the two great treasure houses on which the West depends—the energy treasure house of the Persian Gulf and the mineral treasure house of Central and Southern Africa" (Nixon 1980, 23). The United States, Europe and Japan remain vulnerable to the cutoff of strategic resources. As did the Soviet Union during the Cold War, China has already embargoed the West from shipments of rare earth elements.

China does require African minerals for its dynamic economy. However, China does not trust the Western managed world financial and trade systems

and is reducing its exposure by pursuing a policy of equity ownership of mining and energy resource deposits and companies. Thus, China's trade agreement with the DRC, which produces over half of the world's cobalt, has national security implications for the United States (USGS 2011, 47).

**National Security Concepts**

As a mandate of the Goldwater-Nichols Department of Defense Reorganization Act of 1986 the Unites States requires a NSS that defines the U.S. national security interests, defines a strategic concept for protecting those interests and establishes objectives to achieve that strategy. Resources and the environment have been included in the NSS since its inception. As President Reagan said in his 1988 NSS: " The dangerous depletion or contamination of the natural endowments of some nations-soil, forests, water, air…create potential threats to the peace and prosperity that are in our national interests, as well as the interests of the affected nations (NSS 1988)." The growth of populations is pressing against the availability of resources and creating sustainability problems for, as President Reagan said, both the United States and the affected countries. If resources are important to the conflict and stability equation, should they not be considered in formulating the use of the elements of national power to achieve the goals of the national security strategy? Recent national security policy concepts recognize that it is much less costly to prevent conflict than to fight wars and are suggesting new foreign policy approaches to use the elements of national security to create sustainable conditions of government and economics.

## Smart Power

In 2007 a bi-partisan committee at the Center for Strategic and International Studies (CSIS), headquartered in Washington D.C., published a report *CSIS Commission on Smart Power, A smarter, more secure America.* The report outlines a strategy on how America can best rebuild its sagging reputation in the world through a synergistic strategy. The concept emphasizes the use of all the elements of national power loosely translated into engagement programs. Sustainability would provide valuable guidance in applying the smart power concept. Developing countries often lack the capacity to manage their natural resources; much of the world's population lacks access to clean water, and clean water is a limit to industrial development. Working closely with allies and all elements of government, including the military, to build the capacity of a country to manage its watershed, teach dry land agricultural techniques build and maintain infrastructure to prevent flooding and preserve agricultural land, insures that the factors of economic and social productivity are maintained. Such an integrated approach prevents counterproductive competition among developers, and takes advantage of potential synergies in countries that may have a decided lack of capable governmental agencies. The report outlines five different areas to include alliances, partnerships, and institutions; global development; public diplomacy; economic integration; and technology and innovation.

## Soft Power

Soft power refers to the use of other elements of national power besides the military element. These

may vary but generally include Information, Diplomatic, Legal, Intelligence, Financial or Environmental for the development of a foreign policy. Soft power is a term coined by Dr. Joseph Nye in 1990. Dr. Nye has been the Dean of the Kennedy School of Government at Harvard, Chairman of the National Intelligence Council, and Assistant Secretary of Defense in the Clinton administration. He describes soft power as "the ability to get what you want through attraction rather than through coercion." Essentially Nye purports the use of other elements of national power such as allies, economic assistance and cultural exchanges to develop a comprehensive foreign policy instead of the long and sometimes overused military element of power as the cornerstone of America's foreign policy (Jones 2011).

Sustainability offers a framework for assessing the value of different potential approaches to foreign assistance. Viewing the governments of developing countries as political systems that will succeed only if they meet the demands placed on them by their populations allows one to identify factors of economic and political production necessary for these governments to maintain legitimacy. Such a lens should allow, for example, developers to avoid programs that harvest natural resources at an unsustainable rate, and favor programs that provide renewable resources and environmentally aware waste management. The United States has put itself at a disadvantage by reducing the budget of the State Department (DoS), cutting its budget by $3.5 billion in April, 2011. China on the other hand is engaged in an all out effort using soft power to garner fuel and other natural resource markets to fuel its economy and increased the funding for the China Development corporation from $200 billion to $300 billion (Nye 2011). In his 2011 article, Steve Jones

described soft power as "a nation's use of co-operative programs and monetary aide to persuade other nations to ascribe to its policies." In July 2010, President Obama signed into law the Dodd-Frank Wall Street Reform and Consumer Protection Act. Of particular note is Section 1504 of the act, which is focused on discouraging powerful leaders of developing countries from accepting payoffs from resource developers who are not interested in managing scarce natural resources, often non-renewable resources, for the benefit of future generations (Orrick 2011).

While the United States is cutting its funding for diplomacy and development, the Asian giants are making soft power a key tenet of their foreign policy. A prime example of the use of soft power is the competition in Asia between China and India. In his article, "*India's Edge Over China: Soft Power,*" author John Lee points out that India and not the economic giant China, seems to be winning the battle for influence in the Southeast Asia region for several reasons. India, as the world's largest democracy is appealing. It approaches nations void of recent political violence. As a flourishing democracy, India has demonstrated that even with internal political issues, it can succeed (Lee 2010).

**The 3-D's**

Coined during the Bush Administration, and reiterated by Secretary of State Hillary Clinton of the Obama administration, the "three Ds" (Defense, Diplomacy and Development) provide the elements of national power to create a comprehensive U.S. foreign policy (Finney 2010). While the U.S. Department of Defense (DOD) is well postured to execute an integrated strategy other U.S. Government entities such

as the DoS and the United States Agency for International Development (USAID) are less so. Neither is properly funded or resourced to fully execute its national security mission. This is one of the reasons Secretary Clinton introduced the Quadrennial Defense and Diplomatic Review (QDDR) and as the Center for a New American Security puts it, the QDDR is "a process intended to reassess State and USAID's roles in the 21st-century world and define new priorities, resources, and reforms going forward" (Center for a New American Security 2011).

As elements of national security, DoS and USAID are now involved in promoting regional sustainability and stability, preventing conflict and the erosion of the resource base, as is DOD. Through the Joint Staff and service doctrine, stability operations have been given high priority by DOD and not just in Iraq and Afghanistan. Through their Theater Engagement and Security Cooperation programs, the Combatant Commands have been actively engaged in building the capacity of host nation militaries to support their civilian governments' sustainability programs for nearly two decades. Responding to the requests of regional militaries, these programs have addressed: water security; agriculture; climate change adaptation and environmental security. Many activities have been in partnership with DoS and USAID.

The DOD aims to conduct operations in a war torn country or region at the same level of effective sustainability as the management of installations and has been proactive in addressing challenging sustainable resource issues "in the field" using a whole of government approach in both Iraq and Afghanistan. Often accomplished through Civil Affairs channels, DOD has incorporated a series of programs and activities aimed at supplying expertise to local governance to

ensure the sustainability in water, energy and agriculture when the United States and its allies depart.

In both Iraq and Afghanistan, the United States and its allies have made use of a variety of "teams" that have made inroads in creating a more security and productive environment such as the Provincial Reconstruction Teams or PRTs. While predominately composed of military personnel, PRTs also have representatives from other United States Government departments such as USAID, DoS and the U.S. Department of Agriculture. Since their inception first in Afghanistan in 2002, then Iraq in 2005, the teams first focused on improving the infrastructure to address the basic needs of the population with initiatives such as access to clean water, and building a sustainable agriculture industry.

These teams have progressively improved their focus areas providing a modicum of governmental legitimacy, particularly in the partially inhabited regions of Afghanistan and enhancing sustainability. Further, a variety of other "team" types of organizations have been utilized for specialized missions, with Agribusiness Development Teams or ADTs as subject matter experts designed to assist the host nation farming industry to increase crop yields. These units, sponsored by the National Guard, reflect the variety of civilian acquired skills that have been a welcome addition to U.S. overseas campaigns since the early 1900s.

**Environmental Security**

Environmental Security is an element under the larger rubric of Human Security outlined in the 1994 *United Nations Development Program's Human Development Report*, and has been incorporated into the thought processes of decision makers when defining

state security. No longer is state security simply defined by military might or the occupation of territory, but, as a result of the 1994 report, that definition has been expanded to include the human security element of which environmental security is a part. The U.S. government definition of environmental security is that environmental issues become national security issues when they affect U.S. national security. For example, in Botswana water, particularly in the Okavango River Region of Northern Botswana, is a national security issue. Because approximately 75% of the land of Botswana is part of the Kalahari Desert, water is a precious commodity for humans and for fauna. The tourist industry depends on seasonal rains to provide flood waters to the inland Okavango Delta region, a favorite grazing area for the many animal herds that frequent the area. The tourist industry in that area of Botswana is a major employer and foreign exchange earner. The destruction of the delta region would severely impact Botswana's economy and hence is a national security issue.

## Geopolitics

The relationship of political power to its geographical setting is often overlooked by policymakers and national security professionals (Gray 1999). From the landing at Normandy, where offensive maneuvers were complicated by organizations of hedgerows, to the 1973–1974 Organization of the Petroleum Exporting Countries' oil embargo, important security policy decisions have been complicated and U.S. interests placed at risk by the policymakers' ignorance of geo-

graphic relationships (Kissinger 2009). The imbalance of resource supply and demand accounts for the phenomenon of comparative advantage and thus, underpins trade relationships. The current control of the world rare earth element market by China illustrates the importance of understanding resource geopolitics and the potential political power available to countries that *are* aware and design geopolitical strategies to take advantage of geography. Sustainability is a critical concept to crafting a resource-based geopolitical strategy.

**Summary**

Sustainability has greatly enhanced the management of military installations, and the engagement strategies of the Geographic Combatant Commands. It contributes markedly to the country plans of USAID and may be seen reflected in the objectives of the QDDR. Yet, it has not surfaced as an overarching concept to help frame U.S. national security policy, and as a result it is not consistently applied or synchronized across the 3Ds or considered by policymakers addressing regional security issues.

Regional instability has been the chief threat to U.S. national security interests since the end of the Cold War. The ability of the United States to influence the behavior of regional states essential to protecting U.S. national security objectives quite often turns on the sustainability of that country's economy and political system, which in turn will depend upon the sound management of a dynamic resource base. Former colonial powers, India and China, both understand the importance of regional stability and addressing sustainability as a way to promote their influence with

regional states. China, for example, has multiple billion-dollar bilateral development projects with resource rich African states or states and organizations that control the region's transportation network and economies (Enrich 2011). These relationships are guided by a geopolitical strategy that recognizes the importance of resource access to the Chinese economy and the tenure of the Chinese Communist Party, and are appealing to the regional states because they develop the social and physical infrastructure necessary for government sustainability.

It is time for national security policymakers to make sustainability a foundation for U.S. national security policy. The Cold War vulnerability of U.S. security to a lack of resource access and the failure of strategically important regional states is being rekindled by key trends in the political landscape. Population growth, long highlighted by intelligence community publications, is driving the world population from 2 billion in 1927 to a projected 9 billion by 2054 (United Nations, Population Division Department of Economic and Social Affairs). Peak oil is already a recognized term in the United States and rising peer competitor China has made resource access and *control* one of its key geopolitical variables. The scramble for economic resources is well underway and the Unites States is vulnerable. The concepts of soft and smart power, resource geopolitics and environmental security all recognize the importance of sustainability at a strategic level. Integrating the three U.S. elements of power (Defense, Diplomacy and Development) to proactively address sustainability issues as they affect U.S. national security, is essential to preventive defense and geopolitical strategies designed to preserve U.S. vitality and security for future generations.

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# 3

# The Department of Defense offers a Strong Offense for Promoting Sustainability

*Kristan Cockerill*

## Introduction

In 1890, President Benjamin Harrison directed his Secretary of War to assign U.S. Calvary troops to the recently created Yosemite National Park. "The Cavalry's mission was to take charge and protect this new area, to preserve the magnificent timber and vegetation, to protect the fish and game, the vast mineral deposits the natural wonders of the region and to maintain this magnificent area in its natural condition. It was the U.S. Cavalry's job to protect this natural heritage from all who sought to wantonly exploit it" (Corey nod). This was not an easy assignment, as the local public did not fully support the park and resented the Calvary's infringement on their grazing, hunting, trapping, and logging habits (Meyerson 2001). The Calvary managed the park until 1916 when the National Park Service was established. In his book, detailing this compelling period in U.S. history, Harvey Meyerson (2001) notes that the military rescued our national parks and quotes John Muir: "Blessings on Uncle Sam's soldiers! They have done their job well, and every pine tree is waving its arms for joy."

To many the notion of the military being the guardians of environment is oxymoronic and, indeed much of the military's history is marked with tales of environmental devastation in the name of national or global security. Yet there are also significant historical and current examples of the U.S. military protecting the physical environment as part of its mission. A century after the Calvary worked to protect Yosemite the Army Environmental Policy Institute published a report with environmental management "good news" stories from more than 50 Army installations and other facilities. These reflected widespread and diverse

initiatives being pursued throughout the U.S. Army to improve its environmental performance (Stine and Cockerill-Kafka 1992).

In the 21st century, attention has expanded from environmental protection toward ideas of sustainability, which recognizes interrelationships among national security, economics, and the environment. Acknowledging these linkages, the *2010 Quadrennial Defense Review* included climate change and energy issues as destabilizing forces and therefore priorities for the military (DOD 2010b). In response, the Department of Defense (DOD) (2010c) published a Strategic Sustainability Performance Plan with the following goals:

- Reduce fossil fuel use
- Improve water resources management
- Reduce Greenhouse Gas (GHG) emissions
- Minimize solid waste
- Minimize chemicals of environmental concern
- Sustainable practices become the norm
- Sustainability built into DOD Management Systems

Each of these goals has environmental and economic implications and hence is relevant to ensuring national security. This plan is intended to enable DOD to "continue its culture of excellence in environmental and fiscal stewardship and improve national security, both home and abroad" (DOD 2010c, i).

**The military is a sustainability resource**

The DOD employs more than three million people manages more than 5000 sites, and its 2010 budget was $680 billion. By any measure it is larger than numerous small nations or multinational corporations.

Its sheer size is perhaps its greatest asset in becoming a world leader in sustainability. "DOD offers a combination of local expertise and management and high-powered national level financial and technical resources …" (Butts 1999, 123). Those three million employees include experts in everything from archeology to communication to water resource management. They employ their expertise at sites in every physiographic province from the arctic to the tropics. DOD employees work in manufacturing plants, administrative offices, wildlife reserves, and manage the equivalent of small cities on various installations, bases and posts around the world. Taken together, these facilities use resources on a large scale and are always an economic driver within their communities. This largesse makes the DOD an excellent host for implementing sustainability practices because there is simply more 'bang for the buck' when implementing efforts at this scale. In addition, DOD facilities are often highly visible within the larger community and offers opportunities to serve as models for and/or partners in implementing sustainability efforts off-base. While all federal facilities are required to adhere to Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, DOD is in a unique position to be the flagship agency in meeting the spirit of this sustainability-driven mandate.

Globally, DOD's expertise, technical capability, and financial backing make it an obvious candidate to become a leader in helping other countries develop sustainable practices. This has both altruistic and self-serving attributes. Assisting other countries develop capacity has long been a function of the U.S. military, and while critics (sometimes within DOD) acknowledge this function may be better served by civilian

organizations, the reality is there are not civilian capabilities which can match DOD (Serafino et al. 2008). The focus on sustainability suggests a long-term role for DOD in other nations is to help prevent the need to shift from civil assistance to military action by ensuring natural resource and economic conditions do not degrade to the point that they engender conflict. Nothing in this chapter is intended to suggest there is a 'silver bullet' to prevent conflict or to prevent damage when conflict arises. War damages people, other species, and landscapes. The reality, however, is conflict has always been part of human history. Therefore, having a strong military is desirable. Rethinking how the military operates, however, is also desirable, is feasible and is happening.

**Commander's Role**

Although it is large, the DOD is also capable of rapidly mobilizing to implement programs it deems important. This is in large part because of hierarchical military structure and the power commanders are entrusted with in order to command. This is not to imply commanders do not face bureaucratic obstacles; they certainly do. There is a substantive difference in leadership roles and responsibilities when comparing the DOD and other government agencies or with most private entities. As an example, when newly employed with the U.S. Army the author expressed surprise at the rapid success a water conservation program had at a specific post. In response, an installation environmental manager noted when a post commander says, "conserve water" the people under his/her command listen and obey. In later work on the Environmental Management Good News publications

(Stine and Cockerill-Kafka 1992; Cockerill et al. 1993), it became abundantly clear none of these initiatives would have been possible without the commander's support and/or direction.

From a philosophical, ethical perspective, Drucker (1989) argues commanders have environmental responsibilities during peacetime and war, both for utilitarian reasons (the environment offers necessary resources) and for moral reasons (all life has inherent value). During peacetime, Drucker also notes, commanders have roles similar to elected officials, as they manage large tracts of land and facilities similar to cities. His evidence could readily be expanded to support a commander's responsibility to promote the sustainability initiatives which are now becoming prevalent throughout the DOD.

The responsibility facing military leaders coupled with their ability to quickly implement a specific project or program offers yet more support to the argument that the DOD is well positioned to become a leader in sustainability.

**Leadership Sites**

Many pages and pixels have been dedicated to reporting on military efforts relevant to sustainability. These reports; however, are often limited to the environmental ring of the sustainability triumvirate and further are typically single focus (e.g. energy, land use). They do not offer a more holistic view of military efforts. To see how the economic, environmental, and national security aspects of military activities come together to enable the military to lead society on a sustainability quest, it is helpful to look at the breadth of efforts and the even broader possibilities throughout DOD.

## Islands of biodiversity

The need for the Calvary to manage Yosemite in the early 19th century finds its modern reflection in the need for the DOD to manage the 30 million acres under its purview. The impetus to sustainably manage much military land stems from a pragmatic need to ensure viable training facilities. The military has long espoused the need to 'train as we fight,' and as technology has changed 'how we fight,' pressures on training ranges increased and deterioration in land quality was noticeable by the 1980s (Diersing et al. 1992). In response programs like ITAM —Integrated Training Area Management —were developed and implemented to assist land managers in evaluating land condition and using this information to improve management (CERL 1995). Managing military landholdings presents unique challenges as well as opportunities. This prompted Colorado State University to develop a certificate program in Sustainable Military Lands Management. According to the University website the certificate "will help you understand the importance of military lands management and the cultural and ecological significance of sustaining these lands" (Colorado State 2010).

This educational program recognizes sound land management has a sustainability impact beyond military training needs. Specifically, military lands are unique places of high biodiversity and home to many threatened and endangered species (Stein et al. 2008; Warren et al. 2007). In fact, the density of imperiled or endangered species is three times higher on DOD lands compared to the National Park Service, the second ranked agency for endangered species density (Stein et al. 2008). Additionally, numerous species

appear nowhere but on military lands (Nature Serve 2004). These threatened species are attracted to military installations as a refuge from an increasingly urban environment. Because they are largely undeveloped, defense lands are often the only place left where a species can exist.

These conditions make military lands attractive research locations to better understand what promotes biodiversity. Military sites provide a 'lab' to study how various land use patterns affect biodiversity. For example, Warren et al. (2007) suggests the heterogeneous nature of the disturbance patterns on military training lands allows for increased biodiversity. This information is relevant and important to *any* land manager attempting to rehabilitate habitat, not just those managing DOD facilities. As human population increases, pressures on other species will only sharpen and hence, military lands will increasingly be islands of biodiversity which DOD has a responsibility to protect and to study.

**Purchasing Power and Social Change**

Since the early 1990s, multiple executive orders focused on green procurement and waste reduction. Within the DOD numerous initiatives encourage more environmentally friendly purchasing. In 2002, the Defense Logistics Agency (DLA) began identifying which products in the Federal Catalog System met definable environmental standards and more than 4,000 items are so designated (Stack 2009). In 2004, the DOD issued a Green Procurement Policy, which sets a goal of 100% compliance with all federal requirements for purchasing environmentally friendly products and services. In the 2008 update of the procurement policy, the DOD stressed the policy about roles and

responsibilities and stated all members of the department are responsible to manage resources and energy consumption (DOD 2008).

Because DOD is the largest government purchaser of contract goods and services (Hutton and Solis 2010), there is tremendous opportunity to catalyze change through procurement, not only within the department, but also more broadly across domestic and international markets. Defense facilities and operations require a large and diverse array of products and services. Therefore, if sustainable procurement (broader than 'green' procurement) were the norm it would have a marked effect on the demand for less-damaging goods. There are opportunities to pursue leadership and to create, or expand, markets in many areas. For example, the U.S. Department of Commerce reports that the DOD purchased more than $1.8 billion in textiles and apparel in 2002. If these items were sustainable (e.g. made from recycled material, produced with limited chemical input, and produced without child labor) this would generate a strong market for these materials.

Many of the three million DOD employees work in administrative settings and use significant amounts of paper. Ensuring DOD procures paper with at least 50% post-consumer recycled content, as federal law mandates (10 U.S.C 2378), would have a considerable effect. The law, however, allows exemptions based on cost and availability, subverting the idea of environmental and economic conditions are interrelated. This contributes to the Catch-22 of increasing recycled content in any product. Paper, with high post-consumer recycled content, remains more expensive and less readily available, at least in part, because the market for it is less stable. If the DOD were to ignore these ex-

emptions and purchase only the high-recycled content paper, the market would become more stable because DOD is such a dominant consumer.

Manufacturers previously were reluctant to pursue green or sustainable options for many products because the market had not been proven or is small and hence the per-item cost remains high. With a robust and consistent buyer, manufacturers can take advantage of economies of scale and green or sustainable products can become more cost competitive with traditional items. The DOD has the opportunity to serve as the 'tipping point' for any number of products and services to enable economies of scale to make remunerative sense so the environmental and social benefits can be realized, both for the DOD and society.

As a significant purchaser, the DOD is subsequently a significant disposer of material. The military has had solid success in reuse and recycling programs. In Army Environmental Management Good News publications, more than 10 different installations highlighted their success with recycling efforts (Stine and Cockerill-Kafka 1992; Cockerill et al. 1993). The DLA Disposition Services operates programs which enable the private sector to purchase surplus defense products, extend the lifespan of these products and conserve resources. The DLA also operates large recovery and recycling programs. For example, over a 30-year period, the DLA recovered nearly $300 million in precious metals (DLA 2009; Joy 2010). As with purchasing power, the DOD plays a strong role in ensuring there is sufficient recyclable material in the marketplace to encourage private sector entities to develop technologies and processes to turn these used materials into new products. Additionally, waste reduction/recycling offers opportunities for installations to work closely

with their local communities, strengthening those ties and in some cases providing economic benefits to the local area. These efforts are directly linked to national security, as resource extraction is highly damaging to the environment and resource availability is essential to enabling the DOD to achieve its mission at home and abroad.

**Building Sustainably**

As one of the nation's largest landlords, the DOD manages several hundred thousand buildings. Recognizing these buildings are one of the greatest resource consumers, the department implemented several policies to improve energy efficiency, reduce operating costs, and reduce resource appetite (e.g. DOD Instruction 4170.11 and DOD Unified Facilities Criteria 4-030-01). In 2010, Deputy Under Secretary of Defense for Installations and Environment, Dorothy Robyn, issued a memorandum emphasizing key points from these policies. Specifically, all new construction beginning in fiscal year 2012 must meet the Silver designation of the Leadership in Energy and Environmental Design (LEED) green building rating system – or an equivalent set of standards. The Silver LEED standard will also apply to renovation and repair where possible. Additionally, the department will utilize life cycle and cost/benefit analyses when making design decisions for any construction. This last requirement is crucial, as often short-term costs are affiliated with using more sustainable products/materials, but may have long-term benefits. There are also situations where a product perceived to be more sustainable is actually equally or more harmful than current products when viewed over the entire life cycle. A life cycle assess-

ment will help identify these opportunities to act with a more complete and long-term view (see section on life cycle assessment in this chapter).

Developing 'green building' practices is connected to material reuse and recycling, as the military is using recycled plastic 'wood' for new bridge and installation construction projects (Bland 2009; Lombardi 2009). This meets the intent of the various construction policies and contributes to encouraging a market for recycled materials on a large scale. It also highlights sustainability initiatives are interconnected.

**Renewable Energy Use**

The size and nature of DOD activities result in very high energy demands. In fact, DOD is the largest single consumer of total U.S. energy consumption (French 2005). In fiscal year 2009, DOD spent $3.6 billion on facility energy (covering 1.93 billion square feet of facility space) and $9.6 billion on fuel for vehicles and other equipment (DOD 2010a). The LEED certification places significant emphasis on energy conservation, offering one driver for implementing efficiency measures.

Perhaps more pressing, is the fact energy availability poses a significant risk to military readiness and raises economic and security risks worldwide. As a 2010 report from the Pew Charitable Trusts stated, …"the Department of Defense and the military services are stepping forward not only to understand these challenges, but also to demonstrate leadership in responding to them" (4). Throughout the DOD are numerous and diverse policies and projects to encourage energy conservation and to identify alternatives to current energy sources. The popular press is rife

with stories about military efforts addressing energy issues. There is consensus among these documents that the military will need to make significant, even radical changes to ensure it can remain effective. In response, the DOD is at the leading edge in pursuing several initiatives, and has tremendous potential to expand this lead. The Department's commitment to conservation is evident as military operations received 16 of 31 energy and water management awards from the Department of Energy in 2010. As Secretary of Energy, Dr. Chu, stated: "Today's award winners show what is possible when it comes to implementing energy efficiency and renewable energy projects in the federal government and beyond" (DoE 2010, 1).

In 2009, DOD facilities obtained 3.6% of electricity from renewable sources, exceeding the Energy Policy Act goal of 3% (DOD 2010a). The department also purchased more than 3400 vehicles which rely on alternative fuel, including hybrids and electrics, and completed the infrastructure for 16 E-85 and/or B-20 alternative fueling stations. At the time of this writing, the DOD website featured a page called "DOD Goes Green" with the majority of the stories emphasizing energy (http://www.defense.gov/home/features/2010/1010_energy/). There is also a blog dedicated to the military and its energy use (http://dodenergy.blogspot.com). Many of the activities reported in these media are not military specific and can provide models for non-defense communities, including using golf carts instead of cars, installing solar panels and constructing 'green' roofs. The Army is striving for "net-zero" energy consumption by 2030. "Net-zero energy means an installation or building produces as much energy as it consumes, resulting in a net usage of zero" (Lopez 2010, 1). This offers far-reaching oppor-

tunities to work closely with local communities and to promote "net-zero energy" both on and off post.

The DOD is also pursuing major efforts which are unique to the military. For example, in 2009 the Navy commissioned the U.S.S. Makin Island, the first amphibious assault ship equipped with a hybrid electric drive propulsion system (Thompson 2010). The Air Force and the Navy are testing vegetable and animal fat based fuels in their fighter jets to help ensure their fuel source is domestically available (Graham 2010; Biello 2010). The Marines and the Army have collaborated on testing foams when applied to temporary structures in order to increase energy efficiency, especially relevant to cooling the structures (The Pew Project 2010; Lovins 2010).

While these initiatives are impressive, there are still more opportunities available. For example, Lovins (2010) estimates adopting already existing energy efficiency technology can cut DOD mobility fuel requirement by two-thirds, maybe even three-fourths. Energy use is perhaps the area where economies of scale can have the greatest affect on encouraging markets beyond installation borders. Alternative energy struggles to be competitive with more traditional energy sources, largely because infrastructure is expensive to change. A large-scale shift within the military could subsequently enable more alternative energy options being made available to many communities.

**Water**

Embedded in many documents about energy there are references to water management. While water and energy resources are tightly linked (the overused phrase 'water-energy nexus' is the focal point of many

studies), they contain unique attributes. Perhaps most relevant is all life depends on water. There are alternative energy sources; however, there is no substitute for fresh water. Thinking about water and energy together is appropriate, and as repeated throughout this report reflects sustainability issues are interrelated. Many of the documents and reports cited here; however, do not explicitly draw the connections between energy needs and water demand. Current attention is focused on energy, with water treated as an aside. The DOD (2010c) *Quadrennial Defense Review*, for example, does not address water as an independent issue as it does with energy. Yet, water is predicted to contribute to social unrest in the coming decades as humans put increasing demands on the finite quantities available on Earth. Troops will always need fresh water wherever they are deployed and helping other nations better manage their water resources may be a growing requirement to ensure stability, especially in arid regions. This is recognized in the DOD *Strategic Sustainability Performance Plan.* As it is doing with energy, the military has the capability to become a leader in promoting water conservation, improved water management strategies, and in identifying alternative technologies and products which are less water intensive.

**Life Cycle Assessment**

Relevant to all topics already presented is the idea of conducting life cycle assessments (LCA). The Environmental Protection Agency defines LCA as:

> A technique to assess the environmental aspects and potential impacts associated with a product, process,

or service, by:

- compiling an inventory of relevant energy and material inputs and environmental releases;
- evaluating the potential environmental impacts associated with identified inputs and releases;
- interpreting the results to help you make a more informed decision.

Life cycle assessment has become routine in many corporate sectors and is now a field of study at many universities and research institutes, with concomitant professional organizations and journals (see American Center for Life Cycle Assessment, International Society for Industrial Ecology, International Journal of Life Cycle Assessment, Journal of Industrial Ecology).

The concept of looking at a product or process throughout its life cycle is not new to DOD, as life cycle *costing* has been used since the 1960s (Guinee et al. 2011). Durant (2007) offers a thorough discussion of efforts (largely unsuccessful) to implement environmental life cycle cost accounting in DOD. With increased emphasis on sustainability, employing full life cycle analyses is imperative as it offers a way to better understand resource use, environmental impact, cost, and even social impacts (social LCA) for various products or processes. Thinking about products and processes in a more holistic way is core to the idea of being sustainable. Lovins (2010), for example, offers evidence for assessing energy needs throughout the life cycle (end to end; tooth to tail) of any products and/or technologies because adopting a technology that is more efficient at the front end, but requires increased logistical support will not be more effective overall. Bogard et al. (1999) conducted an LCA on the potential for replacing lead with tungsten or tin in some ammunition and found favorable environmen-

tal, health, and cost results. The Army Environmental Policy Institute (AEPI 2009) report, *Green Chemistry and Engineering Opportunity*, clearly describes 'green chemistry' is premised on a life cycle approach to reduce hazards. The report highlights opportunities for employing these principles in designing and selecting appropriate remediation technologies. AEPI has also assessed managing risk from nanomaterials using a life cycle framework (Lloyd and Scanlon 2009). Additionally, life cycle assessment is mandated for all new DOD construction (Robyn 2010).

This is not to suggest conducting an LCA gives decision makers the "perfect" response. There will always be uncertainty in data surrounding the inputs to an assessment. Additionally, there will always be tradeoffs to be made— the least polluting option may be the most water intensive, for example— hence decision makers will still face difficult choices. Granted its limitations, LCA presents a valuable tool and Fava et al. (2009) report growth in LCA is only expected to continue, with emphases on "the integration of life cycle approaches into greener buildings, the development of life cycle-based carbon footprint protocols, and the rapid development of requirements (often referred to as private requirements) from retail companies demanding environmental performance of consumer goods" (491). This is good news for the military because there may be an existing LCA which the DOD can consult in making procurement decisions for anything from uniforms to solar panels.

While LCA tools and techniques are already well-established, the DOD still has much to offer, especially in assessing military specific materials and products. Additionally, there is potential for DOD to take a lead in broader applications of LCA to incorporate more

economic and social factors. This is especially relevant in assessing security issues related to particular products, materials, and/or processes.

**Reality Check**

If the DOD is serious about being a leader in sustainability this must be reflected in funding priorities. While the DOD (2010c) Strategic Sustainability Performance Plan lists several large-scale investments, including $1.2 billion dedicated to energy security technology, this ranks at the lower end of funding when compared to significant weapons systems. Because sustainability initiatives can be viewed as a force multiplier, or even a new type of 'weapon' in the DOD arsenal, it should be funded as such.

Related to funding is the flexibility necessary to ensure sustainability initiatives can be realized. There is a litany of well-intentioned efforts throughout DOD to improve environmental conditions expressed in formal memoranda and press releases, but were either never funded or hamstrung by funding restrictions, or 'red tape' and hence did not achieve their goals. For example, a 1992 report found a significant restriction to encourage more recycling, due to commanders not having the latitude to work with the private sector to obtain markets which would offer the best price (Funke et al. 1992). Almost two decades later, Lovins (2010) reported there are bureaucratic/logistical barriers to fully implement procedures to enable better assessments of long-term costs and savings from energy-related initiatives.

The size of DOD offers the potential to take advantage of economies of scale to make many sustainable efforts viable, to benefit both the military and broader

society. Yet, this size has also created a bureaucratic behemoth with at least four heads. By definition, becoming sustainable requires a more tightly integrated system to simultaneously consider the economic, environmental, and national security linkages. This cannot be done on a Service-by-Service basis, as it is counterproductive for a single Service to lead in a sustainable effort if other Services are enabling, or promoting, unsustainable practices. Duplicity of effort and spreading limited dollars across four services to address similar problems is not an efficient approach.

Therefore, a 'purple force' approach is necessary if DOD seeks to lead on this front. While DOD has demonstrated interdependency in operations, it is still largely service segregated in its acquisition efforts (Matisoo 2008). This is a significant obstacle to inculcating the sustainability concepts as the 'norm,' which the Strategic Sustainability Performance Plan specifies is a goal for all Services to achieve. Confounding this further is while there does need to be purple approach, a totally centralized management structure will also not enable DOD to achieve all of its sustainability goals. It is imperative to find a balance between a central infrastructure while simultaneously taking advantage of local/regional or service specific opportunities.

## Conclusions

The Department of Defense has an impressive record of environmental initiatives and is on a trajectory to become a leader in sustainability by integrating these environmental initiatives with economic and social concerns as a way to protect national security. This emphasis on sustainability should not be

surprising, as the military has often been at the forefront of significant societal and technological change (e.g. racial integration, robotics) (French 2005). Environmental sustainability offers yet another venue for the military to take a leadership role in American society. This chapter offers a sweeping, but limited, view of all that is happening throughout the DOD to promote sustainability. Despite the breadth of endeavor, there is still much room to expand efforts to become a global leader in sustainability. Using tools like LCA can highlight the interconnectedness among environmental, economic, and social issues relevant to a product or service. It will also make clear there is no perfect option. Because of its size and diversity, DOD is well-positioned to lead us to a more sustainable future by offering the economies of scale to make wholesale changes in our energy, water, and resource uses. These have far reaching implications for both local and global economies as well as for helping to reduce threats of conflict.

Durant (2007) posits we did not well prepare for the military necessities of a post Cold War world. The current push toward a sustainability-focused military offers an opportunity to not repeat history by fully embracing all evidence of interrelationships among the environment, social, and economic conditions, which are central to the military responsibility to protect national security. This requires a continued shift in the military culture such that the final goals in the Strategic Sustainability Performance Plan (sustainability practices are the norm and sustainability is built into the DOD management systems) are realized. Achieving this requires the DOD to more thoroughly integrate efforts across the Services and fund sustainable initiatives appropriately. The Services working

at cross-purposes, or duplicating efforts, will not meet sustainability criteria. If not funded adequately, then sustainability is not a priority. If it is not a priority, these goals will not be realized.

The rhetoric for DOD to become a global leader in sustainability is in place. Now it is a matter of will to successfully achieve this mission.

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# 4

# Sustainable Security and Fragile States

*Steven Hearne, Jeremey Alcorn, and William Goran*

Fragile states, populated by some two billion people, are emerging as one of the greatest threats to international security, as reflected by the U.S. National Security Strategy. Why certain states fail, while others succeed, continues to perplex researchers. Environmental stressors, in concert with social, economic, and institutional factors, are being recognized as contributors to fragility and, if left unabated, will contribute to increase social unrest and violent conflict. However, the complexity of the causal pathways makes these relationships challenging to articulate.

Early and accurate identification of unsustainable practices can help structure successful interventions in addressing fragility in a more comprehensive manner requiring employment of appropriate elements of U.S. national power. Various approaches have been proposed to provide early warning of state failure, but, to date, the importance of environmental and natural resources have not received adequate consideration. This chapter explores these issues, and the need to reinforce sustainability principles in U.S. security discourse and to engage fragile states across the full spectrum of operations in support of U.S. national interests abroad. The environment will be shown to be an important component of national, regional, global stability, and security. Finally the need for a common conceptual framework to better assess sustainable security and fragility will be explored.

**Human-Environment Interactions**

The environment plays a critical role in human and societal welfare. It provides a foundation which supports the most basic level of physiological needs (Maslow 1943). Sustainable human societies depend on critical services which are supplied by natural eco-

systems. Prior research generally concluded environmental stress is an important, but indirect, contributor to instability and conflict, acting in combination with other economic, political, and social contextual factors to produce its effects (Homer Dixon 1999; NATO 1999). Recent research by the United Nations Environmental Programme (UNEP) is supportive of this conclusion, suggesting "environmental factors are rarely, if ever, the sole cause of violent conflict … the exploitation of natural resources and related environmental stresses can be implicated in all phases of the conflict cycle" (UNEP 2009, 5). This same report found over the last 60 years at least 40% of all intrastate conflicts have a link to natural resources. These causal relationships have important consequences to policy makers considering how and when to intervene to resolve conflict, ideally in its early stages before conflict escalates to a point where peacekeeping forces may be needed to provide stability and security.

A simplified framework (Figure 1) is proposed to describe the causal relationship between change in human and environmental systems, state fragility, and conflict (Hearne 2011). At the center of this framework is nation-state capacity, resilience and low-level social unrest which are used to characterize a states' fragility as a precursor to violent conflict and political instability. This framework accounts for internal socioeconomic, political, environmental risk factors, external shocks—both natural and manmade—and bordering conflicts which may confront a nation-state. It also suggests external stabilizing factors (e.g., participation in regional organizations and bilateral and multilateral aid) may prevent a country from reaching the critical tipping point into political instability, evidenced by economic crisis, increasing violence and more armed conflict. International response to such

instability can result in costly humanitarian and military interventions.

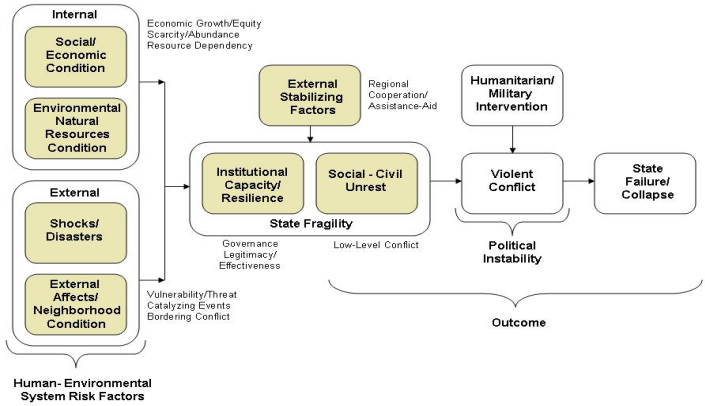


**Figure 1. Human-Environmental System and State Fragility: Simplified Conceptual Model**

## Security and Sustainability

The term "security" can be defined simply as the freedom from danger, fear, or anxiety, but it remains a rather vague concept. It has been suggested that security is as much of a state of mind as a physical aspect of the environment (Mr. Y 2011).[1] Consideration of the physical aspect of security raises several important questions: what referent object is being threatened, who is being protected, what threats or insecurities are being addressed, and what are appropriate responses (Renner 2006)? A comparison of differing security approaches (Table 1) helps answer these questions by summarizing the specific

1. Mr. Y is a pseudonym for Captain Porter and Colonel Mykleby narrative published by the Woodrow Wilson Center, which provided the authors the opportunity to frame U.S. national policy decisions and discussions based on three sustainable investment priorities: human capital, sustainable security, and natural resources.

focus, concerns, threats, and responses by major security type (Hearne 2009).

| Type | Focus | Concerns | Threats/ Vulnerabilities | Responses |
|---|---|---|---|---|
| Traditional Security | The State | Sovereignty and Territorial Integrity | Challenges from other states and non-state actors | Diplomatic intervention<br>Economic crisis response<br>Military intervention<br>Humanitarian Support |
| Environmental Security | The Ecosystem | Protection of Natural Infrastucture | Resource scarcity/depletion<br>Resource degradation – pollution/waste<br>Demographic changes<br>Shocks – natural, manmade | Multinational governance<br>Conflict prevention<br>Conflict resolution |
| Human Security | The Individual | Integrity of Individual<br><br>[freedom from fear]<br>----------<br>[freedom from want] | Personal security – violence, hazards<br>Political security – repressive state<br>----------<br>Economic security – poverty<br>Food security – famine, contamination<br>Health security – injury, disease<br>Community security – cultural integrity<br>Environmental security–scarcity, abundance, waste | Preventive diplomacy<br>Disaster planning<br>Humanitarian support<br>Aid investment |
| Sustainable Security | The Generational Quality of Life | Global Sustainability | Unsustainable environmental, social, economic, and institutional systems<br>Inequitable resource distributions<br>Marginalization of the majority world<br>Unplanned development/ urbanization<br>Nonadaptive and nonresilient systems | Institution building<br>Security sector reform<br>Military professionalism<br>Energy sector efficiencies<br>Economic investment<br>Adaptive management of natural resources |

Source: Adapted from Liotta 2005; Liotta and Owen 2006; Khagram et al. 2003; Abbott et al. 2006

**Table 1. Comparison of Security Approaches: Traditional and Non-Traditional**

The referent object in "traditional security" is focused on the nation-state and is, therefore, more understandably responsive to immediate external threats and challenges from other states. Although the Cold War, Vietnam, and other major events shaped con-

temporary U.S. national security policy, not surprisingly, the attacks of September 11, 2001 refocused the national security strategy on the asymmetric threats posed by non-state actors (White House 2006). It has been argued a balanced approach be used to address such threats in an effort to improve the human condition and address the root causes which support and favor terrorism as a tactic of choice (Richmond and Franks 2005). Such an approach supports broadening the concept of security to better address the military, political, economic, societal and environmental insecurities which lie at the root of conflict.

**Non-Traditional Security Frameworks**

The term "environmental security" has been intensively studied and hotly debated for nearly two decades. It is first mentioned in the 1991 National Security Strategy and subsequent strategies where environmental degradation and natural resource depletion were viewed as having long-term security implications (White House 1991 and 1995). Environmental security has been defined as:

> the freedom from natural and anthropogenic environmental threats and vulnerabilities that have the potential to adversely impact on national security interests and, if left unchecked, could contribute to increasing intrastate or broader regional instability and to the outbreak of conflict (Hearne 2008, 223).[2]

Another non-traditional security concept which has gained significant prominence since the mid-1990s is "human security." Human Security suggests the fo-

2. Scarce resources (water and fertile land) contributed to the conflict in Darfur; timber revenues have fueled conflict in Liberia; and severe deforestation contributed to flooding and severe soil erosion in Haiti (UNEP 2009).

cus of traditional state-centric security be redefined and redirected to the individual, with an emphasis on underlying social, political, and economic reforms. Human security is interpreted both narrowly and broadly, focusing on seven categories of threats (Table 1) which addresses both freedom from fear and want (UNDP 1994). Environmental security is treated as one of the seven main categories of threats within this construct. Human security is increasingly shaping foreign and domestic agendas. The European Union has developed a *Human Security Doctrine for Europe* (Liotta and Owens 2004). The U.S. Department of State is currently reorganizing in accordance with its Quadrennial Diplomacy and Development Review and established an Under Secretary for Civilian Security, Democracy, and Human Rights to reportedly promote stability and security in fragile states and advance human security (Warner 2011).

**Sustainable Security**

It has recently been proposed that field security be expanded to encompass the more comprehensive concepts of sustainability and sustainable development. Not surprisingly, a new term, "sustainable security," has been suggested to facilitate critical integration of state, human, and environmental security and to address the three major pillars of sustainability: society, economy, and nature (Khagram 2003). Sustainable security focuses on the root causes of insecurity and the threats affecting the generational quality of life (e.g., unsustainable land practices, inequitable natural resource distribution, and energy-sector inefficiencies). It recognizes long-term responses are needed to address such threats. For example, early national security strategies were supportive, and emphasized

"decisions today regarding the environment and natural resources can affect our security for generations" (White House 1991). Considering this emphasis on long-term resolution of root causes of insecurity, greater political commitment and resources are needed, but is problematic given the political short-term focus in the United States and current budgetary realities (Abbott et al. 2006).

In 2005, then United Nations (UN) Secretary-General Kofi Annan reinforced the broadening of traditional security frameworks to incorporate the concept of sustainability by asserting "we will not enjoy [sustainable] development without security, we will not enjoy security without [sustainable] development, and we will not enjoy either without respect for human rights" (Toepfer 2005, xvi). More recently, two senior serving military officers conclude the strategic environment has become significantly more complex and different than it was in the past. They also call for a longer generational view of security to be promulgated in a "National Prosperity and Security Act" to integrate policies across the "whole of government," employing basic tenets and principles of sustainability (Mr. Y 2011). Specifically, outlined are three major sustainable investment priorities: "human capital" (e.g., education, health and social infrastructure), "sustainable security" (e.g., promoting stability as much as ensuring defense), and "natural resources" (e.g., investing in long-range sustainable management of critically important natural resources).

**Instability, Fragility, and Environment Change**

The complexity and scale of U.S. national security challenges continue to accelerate. It is no longer the situation of a single superpower or even multiple

competing powers seeking to undermine U.S. interests. The U.S. Government (USG) and military now face far more disparate and nuanced sets of interlinked challenges, which are not easily resolved through traditional military hard power or diplomacy. U.S. and NATO efforts in Iraq, Afghanistan, and Libya demonstrate predominance and difficulties of facing unconventional enemies with conventional military forces. The Department of Defense (DOD) acknowledged this shift with issuance of DOD Directive (DODD) 3000.5 in 2005, and changed policy to make stability, security, transition, and reconstruction (SSTR) missions equal in importance to combat operations. DOD policy now requires development of capabilities to effectively support USG missions across full spectrum of conflict and operations which support civilian security, provide services, restore infrastructure, and provide humanitarian relief (DOD 2009). U.S. policymakers and thought leaders are undergoing a paradigm shift from a "traditional" national security framework toward one based on human security and now increasingly includes energy, natural resource, and environmental components (Rumphrey 2008; DOD 2008). Policy and doctrine are starting to catch up with realities faced daily by U.S. regional combatant commands and in-theater warfighters. These new strategic approaches require interpretations because the range of global missions relating to human security are vast, stretching the capacity and resources of the United States, its allies, and the international community.

**Fragility Concept and Its Emergence**

Over the last decade, the concept of fragility has emerged within the academic, international, and U.S. policymaker communities as a practical application of

the human security concept. Fragility is an unusual term of convergence grown out of disciplines of "international relations" (i.e., security studies and conflict studies), "comparative politics" (theories of state and democratization), and "development economics" (Carment et al. 2008, 351; Carment et al. 2010, 9, 11, 12, 14, 16). Given this concept's interdisciplinary nature and rapid emergence, the debate over its definition will likely continue within certain communities, just as debate continues about what constitutes sustainability. This said, one of the fragility concept's highly useful attributes is the ability to integrate relevant key concepts across disciplines. Like most security-related concepts, the core question when defining fragility comes down to an object-of-reference question: The fragility of what?

Early on, this concept focused on fragile states and built upon efforts to address state-centric failure and instability. The U.S. Agency for International Development (USAID) became an early adopter of the term fragility. Its 2005 Fragile State Strategy suggests, "fragile states refer generally to a broad range of failing, failed, and recovering states," "that are vulnerable," and not "already in crisis" (USAID 2005, 1). Likewise, recognized thought leaders, such as Marshall, Goldstone, Carment, and Hewitt, leveraged their previous research and experience with state conflict and instability, such as the Political Instability Task Force (PITF) and Peace and Conflict Ledger, to further develop the fragility concept and its characterization. For example, Marshall and Goldstone developed the State Fragility Index (SFI) and suggest state fragility exists where the state "lacks effectiveness or legitimacy in a number of dimensions; however a state is likely to fail, or to already be [considered] a failed state, if it has lost both" (2007, 14).

With its international relations and development roots, this concept grew in relevance and use within the international development community. For instance, the Organisation for Economic Cooperation and Development (OECD) developed the following state fragility definition for its *Principles for Good International Engagement in Fragile States and Situations* report:

> [s]tates are fragile when state structures lack political will and/or capacity to provide the basic functions needed for poverty reduction, development and to safeguard the security and human rights of their populations (OECD 2007: 2).[3]

However, as USAID applied the fragility concept, it broadened this definition, not only to describe the state but also to encompass the "relationship between the state and civil society, especially in terms of how that relationship is perceived by individuals and groups within that state" (USAID 2009, 8). Although seemingly a small change, this conceptual enhancement helps to more precisely differentiate instability and fragility as well to set relevant boundaries in a manner which better inform policymaking and resource prioritization. Fragility became an effective descriptor of the relationship between a state and its populace further broken down by legitimacy and effectiveness across security, political, economic, and social dynamics. In this form, it is gaining acceptance within the development community and traction across the USG.

3. Subsequent OECD publications adopted a fragility definition similar to the definitions of USAID and Army FM 3-07, which focus on the fragility of the dynamic relationship between capacities of the state and populace (OECD 2008).

Given DODD 3000.5 and recent SSTR experiences, the U.S. Army had ample drivers to become a leader and early adopter as it started incorporating this broader understanding of fragility into doctrine. In 2008, U.S. Army Field Manual (FM) 3-07's Stability Operations Framework was oriented upon the "Fragile States Framework" that defines a fragile state as a

> country that suffers from institutional weaknesses serious enough to threaten the stability of the central government … aris[ing] from several root causes, including ineffective governance, criminalization of the state, economic failure, external aggression, and internal strife due to disenfranchisement of large sections of the population. Fragile states frequently fail to achieve any momentum toward development [and can] generate tremendous human suffering, create regional security challenges, and collapse into wide, ungoverned areas that can become safe havens for terrorists and criminal organizations (HQDA 2008, 1-10).

The U.S. Army and USAID view fragility as a broad "continuum" or "spectrum" of failed, failing, and recovering states. They have adopted definitions for fragility which not only include the narrower state fragility concept but likewise embrace the broader social fragility construct. Their scope is mission focused yet retains enough flexibility it can help operationalize a sustainable security framework in a manner that is useful in dealing with realities of 21st century security challenges.

**U.S. Government, DOD, and Army Relevance**

Over the last few years, the conceptual discourse on fragility has been moving from the realm of academic research to practical application. During this matura-

tion process, USAID effectively made the case of why and how fragility is highly relevant in the context of a U.S. "whole of government," approach particularly within the backdrop of recent Presidential directives and policy reviews, such as:

- National Security Presidential Directive (NSDP-44)
- Presidential Policy Directive (PPD) on Global Development
- 2010 National Security Strategy (NSS)
- 2010 Quadrennial Diplomacy and Development Review (QDDR)
- 2010 Quadrennial Defense Review (QDR)
- 2011 National Military Strategy (NMS).

These policy drivers recognize the necessity for better coordinated planning, programming, and coordinated use of USG hard and soft power—or "smart power"—and strongly advocate its utility and place in full-spectrum operations. The first paragraph of DOD's 2011 NMS emphasizes this new imperative, the necessity for ensuring stability, and key objectives to "strengthen international and regional security" and "counter violent extremism," which squarely asserts the increased relevance and operational need to reduce fragility (2011, 1 & 4).

This smart power framework suggests the U.S. Army's doctrinal inclusion of fragility for SSTR purposes is highly appropriate but may still be too limited in scope. Operationalizing the term requires and complements expansion from SSTR operations to humanitarian assistance and disaster relief (HADR) and engagement missions. In doing so, fragility's relevance for U.S. Army missions becomes evident as fragility monitoring and early warning approaches show promise to proactively support U.S. regional commands' situational awareness and visibility of

non-traditional threat areas prior to instability or conflict. For example, awareness of countries which are becoming increasingly fragile could aid in the development of theater security cooperation (TSC) plans and prioritization of engagement activities. Fragility-based early warning and scenario planning tools could be used to prepare for contingency planning, assess capability gaps, program for, and partner with other USG agencies to address key shortfalls (e.g., proactively prepare integrated responses to events such as the "Arab Spring" of 2011).

**Comparison of Fragility and Instability**

Conflict and instability are often cited as a symptom or downstream consequence of state fragility. For instance, Carment et al. and AEPI found robust statistical relationships between fragility, instability, and conflict (2008; 2010). While occurrence of armed conflict is often the primary focus within academic and defense practitioner communities, instability is generally focused on occurrence of "severe political conflicts and regime crises" at the country level (Marshall 2009). The PITF proposed a strategic working definition where intrastate political instability is the occurrence of revolutionary wars, ethnic wars, adverse regime changes, genocides, and politicides (Bates et al. 2003). Current instability research efforts focus on conflict risk and the study of causal linkages.

Although instability risk approaches allow national security practitioners to move further back on the conflict spectrum and provide six to 24-month early warning, these models do not provide sufficient warning and depth of contextual information to understand the breakdown of state governance or the preceding relationship between a nation's government and

citizenry. Few of these instability models anticipated popular uprisings throughout much of North Africa and the Middle East (e.g., Tunisia, Egypt, Libya, etc.). Despite numerous case study analyses, little of the quantitative conflict and instability research over the past decade shows direct statistical linkages to natural resources or environmental factors. However, this is not surprising due to instability's conceptual limitations and the poor availability and applicability of environmental data at a country level of analysis (AEPI 2010). The research focus on instability concepts, coupled with a growing interest in the utility of human security, helped spur the emergence of complementary fragility concept within the U.S. national security community.

Highly fragile states often rank similarly on both instability and failed state lists, but fragility should be considered a broader set of descriptive metrics and dynamics (AEPI 2010). AEPI found fragility provides a conceptually clearer relationship (Figure 2) and temporal alignment with natural resource factors (2010). While not only conceptually broader, fragility approaches can incorporate longer-term (two—10-year trends), country-level performance statistics (effectiveness), and measures of popular perception (legitimacy). While moving temporally closer to what is termed Phase 0 "shaping" operations on the conflict spectrum, fragility approaches provide a great breadth and depth of security, political, economic, and social dynamics. These can more effectively inform USG assessments, policymaking, intervention planning, and resource prioritization. USG agencies, such as USAID, are finding paired instability and fragility approaches are complementary when used together. In the near term, they provide improved situational

awareness in responding to emerging stability crises, but the fragility component also informs proactive, shaping engagement activities.

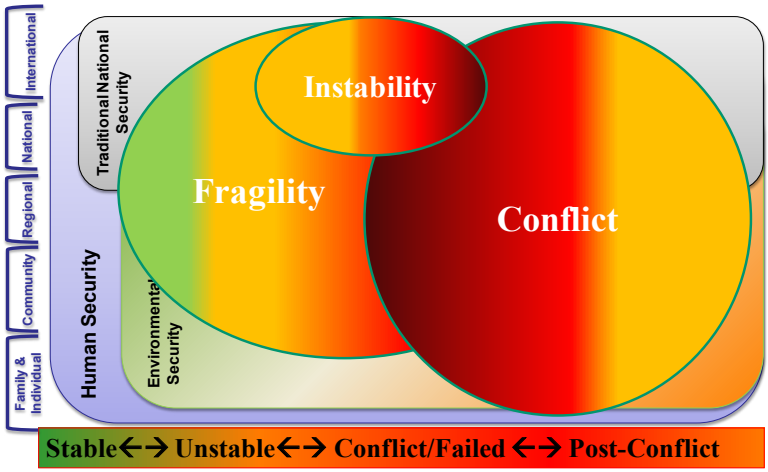


**Figure 2. Concept Mapping on Object of Reference vs. Spectrum of Conflict**

## Quantitative and Qualitative Approaches

Over the last two decades, conflict, instability, and fragility research communities have focused on inductive or data-driven analysis of quantitative nation-state data sets. Often using the occurrence of conflict, risk of instability, or fragility rating as dependent variables, these statistical approaches have typically examined some combination of security, political, economic, and social panel data as independent variables. Conversely, several international and U.S. agencies utilize or opt for more qualitative approaches which rely on case studies, subject matter expert input, etc., to provide deductive or explanatory analysis. These are based upon field assessments, literature reviews, and professional experience. For example, the USG

has developed and institutionalized the Interagency Conflict Assessment Framework (ICAF), which engages qualitative inputs and diverse participants into a structured dialogue to develop a common frame of reference and situational awareness to better address counterinsurgency, conflict prevention, and international engagement planning (Irmer 2009). The Environmental Law Institute (ELI), United Nations Environmental Program, and University of Tokyo are also finalizing some 150 qualitative case studies to share experiences and lessons learned in managing natural resources in post-conflict countries to support transitions to peace (ELI 2011).

Both analytical approaches have relative pros and cons (Table 2). Goldstone and AEPI assert a hybrid system using both will provide a robust, triangulated analysis approach, which enhances accuracy and maximize utility for instability and fragility early warning (2008; 2010).

**Early Warning Approaches and Systems**

Building on DODD 3000.5, the 2009 issuance of DOD Instruction 3000.5 explicitly requires the Under Secretary of Defense (Intelligence) and Defense Intelligence Agency to develop instability indicators and warning capabilities, to incorporate all sources (e.g., traditional and social sciences), and to maintain both classified and open-source products for interagency and partner nations (DOD 2009). AEPI, Mata and Ziaja identify numerous instability risks and fragility monitoring approaches but note many are limited in their actionable early warning capabilities (2010; 2009). As such, recent U.S. Army efforts seek to identify and augment useful early warning systems of instability incorporating appropriate and available source data,

| | Quantitative | Qualitative |
|---|---|---|
| **Strengths** | High Predictive Capacity<br>*(especially political crisis and instability)* | Rich Contextual Information<br>*(simple for desk officers to absorb)* |
| | Immediate Policy Value<br>*(useful for priority setting and "watch lists")* | Strong Planning Applications<br>*(evaluation applications built in)* |
| **Weaknesses** | Incomplete Data - Reliability<br>*(crisis-affected countries lack data points)* | Often "One-On Snapshots"<br>*(may become quickly outdated)* |
| | Limited "On-the-Ground" Insight<br>*(graphs, charts, country lists may not be useful to account for interventions)* | May Oversimplify Situations<br>*(conflict and fragility complexities)* |
| | Less Sensitive to Short Term<br>*(focus on shifting trend conditions)* | Basis Is Personal Judgment<br>*(more subject to personal bias)* |

Source: Adapted from OECD 2009 and Goldstone 2008

**Table 2. Comparison of Qualitative vs. Qualitative Approaches**

including remote sensing, statistical data, and qualitative and unstructured data (e.g., cultural and natural resources).

The U.S. Army, DOD, and USG are developing numerous approaches and tools (Table 3) but, in many cases, without a common lexicon and broader practitioner applicability. The vast majority of these approaches and systems focus on conflict and instability prediction or post-conflict progress monitoring. Currently, the only official USG fragility approach is the USAID Fragility Alert Lists, but its reports are listed as "unclassified but sensitive." Of the systems identified, very few of the academic and USG fragility early warning approaches are known to have explicitly incorporated energy, natural resources, and environmental factor dynamics (AEPI 2010).

| Capability Name | Organization | Focus | Op Phase Applicability | Natural Resources |
|---|---|---|---|---|
| Global Model for Forecasting Political Instability | PITF | Instability | Phase 0-I | No |
| Forecast and Analysis of Complex Threats (FACT) III | U.S. Army Center for Army Analysis (CAA) | Instability | Phase 0-I | No |
| Integrated Crisis Early Warning System (ICEWS) | DARPA | Instability | Phase 0-I | No |
| Instability and Fragility Alert Lists | USAID | Instability and Fragility | Phase 0-V | No |
| State Fragility Index | Center for Systemic Peace | Fragility | Phase 0-V | No |
| Environmental Indivations and Warning (EIW) | U.S. Intelligence Community | Natural Security | Phase 0 | Yes |
| USACE Measuring Progress in Conflict Environmnets (MPICE) | USACE | COIN Progress Monitoring | Phase III-V | Potentially |
| Climate Change and African Political Stability (CCAPS) | University of Texas, Austin (DOD Minerva) | Natural Security/ Climate Change | Phase 0 | Yes |
| SERENGETI* | USAFRICOM | Human Terrain Geospatial System | Phase 0-V | Potentially |

* SERENGETI is not a monitoring or early warning system; however, it can be used as an early warning system because its data collection and management function provides much of the needed data and infrastructure.

**Table 3. Select Conflict, Instability, and Fragility Monitoring and Early Warning Systems[4]**

## Natural Resources and Fragility

The U.S. Army, USAID, and other USG agencies recently increased focus on the intersection of fragility and natural resource sectors and their interrelationships. Practitioners are increasingly concerned about

4. Per Joint Publication 3-0, Phase 0 is to shape operations, Phase I is to deter, Phase II is to seize the initiative, Phase III is to dominate, Phase IV is to stabilize, and Phase V is to enable civil authority.

degraded natural resources on conflict, instability, and fragility. Fragility offers a useful bridging concept between conflict instability and natural resource challenges and opportunities, particularly in the direct interactions with social and economic dynamics. Recent USAID and Army efforts seek to build upon emerging research in this area and to develop linkages between fragility and natural resource sectors, such as energy, water, agriculture, etc.[5]

**Natural Resources and Security**

In 2008, the UN Environmental Programme (UNEP) created the Expert Advisory Group on Environment, Conflict and Peacebuilding, coordinated with the International Institute for Sustainable Development (IISD). Members of this advisory group, working with the IISD and UNEP staff, authored *From Conflict to Peacebuilding, the Role of Natural Resources and the Environment* (UNEP 2009). Also in 2009, Ms. Sharon Burke of the Center for a New American Security (CNAS) published *Natural Security*. These two references are examples of a growing awareness of and focus on linkages between natural resources and conflict. As earlier mentioned, the UNEP publication state "over the last sixty years at least forty percent of all intrastate conflicts have a link to natural resources" (UNEP 2009) and highlights civil wars in Liberia, Angola, and Democratic Republic of the Congo. It points out if these underlying issues are not managed in peace agreements or post-conflict efforts, a relapse to conflict is twice more likely to occur (UNEP 2009).

5. The academic basis identifying the relationships between the fragility and environmental factors has been provided in work by Homer-Dixon 1994, Homer-Dixon 1999, NATO 1999, Miguel et al. 2004, Hearne 2008, Buhaug et al. 2008, Burke et al. 2009, and Alcorn 2008.

In her CNAS publication, Burke defines "natural security" as "sufficient, reliable, affordable, and sustainable supplies of natural resources for the modern global economy" (2009, 9). Natural resources are broadly defined, as basic resources such as sunlight, water, land, biodiversity, and minerals in the earth, to the services humans obtain from these resources through agriculture, fishing, forestry, energy harvesting, and mining. Burke highlights several interstate tensions surrounding natural resources, such as dams in Turkey on the Euphrates River affecting Syria and Iraq, water withdrawal on the San Pedro and Colorado Rivers in the United States affecting Mexico, and Russia's use of natural gas as a political tool to manipulate Ukraine.

Burke's definition of "sufficient, reliable…natural resources for the modern global economy" supports the perspective of global populations, economies, and ecosystems are intertwined and resource degradation, resource scarcity, illegal trafficking of resources, and stakeholder exploitation of natural resource derived revenues are legitimate concerns of the international community, working through and with sovereign states. Others argue it is within the sovereign rights of nations to use and distribute their natural resources as they determine appropriate, without international interference. In a world where global connections are more tightly wound each day, nation-states are still the fundamental political unit. These debates will continue, but the interests of stakeholders beyond those represented by nation-states, whether within a nation or across national boundaries, are gaining expression, and changes in nation-states are taking place more frequently, based upon the concerns of exploited stakeholders within these states and the concerns of those

linked economically, ecologically and with other shared interests across national boundaries.

The concept of natural security overlaps with environmental security (Table 1), and the two terms may be used by some as interchangeable. Brigadier General (retired) Chris King offered, in a talk to the NATO Security Science Forum, the following definition for environmental security: "Environmental security is a process for effectively responding to changing environmental conditions that have the potential to reduce peace and stability in the world" (King 2008). While King's characterization is a process to monitor, alert, and respond to, Burke's definition is focused on the state of resources—being sufficient, reliable, affordable, and sustainable.

**Natural Resource Scarcity Pathway**

What are the pathways that natural resources issues link to conflict? One concern is scarcity or the perception of scarcity. Is there enough of a resource to meet the needs of a population? *The Limits to Growth* by Meadows et al (e.g. the Club of Rome) has been widely viewed as a Malthusian approach, presuming a "fixed" supply divided among ever-growing human populations (1972). Yet, while the global population now approaches seven billion, global food supplies continue to be sufficient, despite localized episodes of food shortages, and caloric consumption for many has increased. So, if humans have been able to expand the pie through technologies and innovations, is scarcity primarily a local and temporary phenomenon? This issue is still being debated, but one of the costs of increasing food and energy production, to meet rising demands, is the growing degradation of lands,

waterways, and oceans. The Millennium Ecosystem Assessment, in *Ecosystems and Human Well Being Synthesis*, summarized the ecosystem implications:

> Over the past 50 years, humans have changed these ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fiber, and fuel. This transformation of the planet has contributed to substantial net gains in human well-being and economic development. But not all regions and groups of people have benefited from this process—in fact, many have been harmed. Moreover, the full costs associated with these gains are only now becoming apparent (2005, 1).

These "full costs" include many undesirable developments – such as the emergence and/or rapid spread of disease and invasive species, further declines in water quality, expansion of "dead zones" in coastal waters, and the collapse of regional fisheries (Reid 2005).

**Natural Resources Access Pathway**

Another important pathway, linking natural resources and conflict, relates to access to natural resources, and/or the value obtained from these resources. Many conflicts stem from groups of stakeholders, often local populations in the vicinity of the resource, having insufficient access to the resource and/or insufficient means, through economic, social or political institutions, to peacefully address their grievances. High value products, such as rare and precious minerals and high value agricultural crops, often associated with illicit trade (e.g., coca, poppies), are especially subject to conflicts over access and wealth distribution. Recent conflicts in Africa (Sierra Leone,

Democratic Republic of the Congo), Asia (Philippines, Afghanistan), and South America (Columbia, Bolivia) are evidence of these issues.

**Uneven Distribution Pathway**

Another potential pathway to conflict, related to natural resources, deals with the uneven distribution of these resources. Minerals are an obvious example because of highly uneven global distribution. This uneven global distribution is likewise evident from oil exporting to oil importing nations. High value natural resources have long been a contributor to conflict, and rare earth minerals (e.g., lithium, gallium) are emerging as having global strategic value because of use in green technologies (e.g., wind turbines, solar panels), electronics, and modern weapon systems. A recent AEPI-sponsored study calls for the United States and allies, to become more involved in nations (e.g., South Africa, Democratic Republic of the Congo, Zambia, Zimbabwe, and Namibia) where critical minerals are mined. One group of strategic minerals – chromium, manganese, cobalt, uranium, and platinum – is largely mined from southern African nations. The study recommends developing strategic partnerships and providing assistance to mining communities (Burgess 2010). It suggests an internationally proactive approach, working with institutions in nation-states, to address one of these key pathways between natural resources and conflict.

Water is another "have" and "have not" concern, with many populations growing rapidly in water scarce areas, such as the Middle East and U.S. Southwest. These populations have a growing dependence on importing water resources. Water resources can be imported as embedded water (e.g., water used in

agricultural product production) or direct (e.g., diversion of water from northern to southern California). In either case, populations in water rich areas provide water resources to populations in water scare areas, which may lead to disputes. Water rights issues within and across national boundaries have a long history. Hamner and Wolf have compiled a database (Transboundary Freshwater Disputes) of water rights treaties, some of which provide models for addressing natural resource distribution problems across political boundaries (1997).

## Natural Resources and Enduring Conflict Resolution

Nardulli suggests that there are three key stakeholder groups which need to be satisfied in natural resources related issues (2011). First commercial sector interests seeking to earn income from the extraction, processing, and trade of a resource (e.g., agriculture, forestry, fisheries or mining). Second are indigenous populations, whose way of life is dependent on these resources, whether for trading or local use. Third, those who seek sustainable use of resources, across generations, considering a longer timeframe resource which benefits a population. Political and economic solutions which address all three stakeholder groups are most likely to gain broad acceptance and move away from social strife. With about half of Liberia's forested lands (Figure 3) and forest products accounting for much of the country's commercial exports, an agreement was reached, with significant engagement from international advisors and with Liberian executive and legislative endorsement. The Liberian gov-

ernment allocated portions of the forest lands to each stakeholder group – with 51.2% (2.3 million hectares) for commercial use, 33.3% (1.5 million hectares) reserved for conservation, and 15.5% (0.7 million hectares) reserved for the benefit of local communities (Altman et al. Pending).[6]

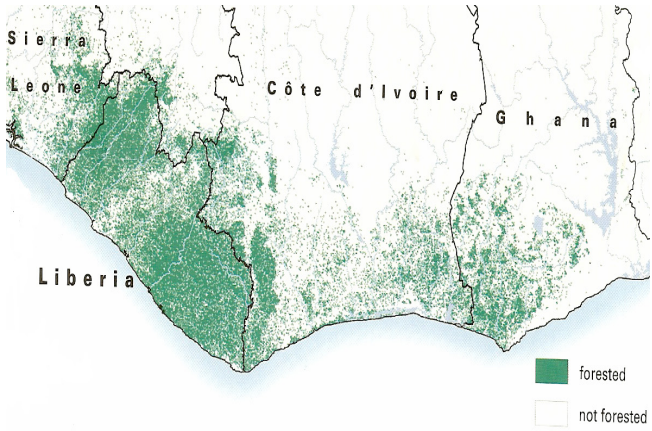


**Figure 3. Extent of Liberian Forest Cover**

## Integration with Climate Security

Given climate change affects on water, agricultural, and energy sectors, there is increasing concern within the policy and intelligence communities that nations with limited resilience and adaptive capac-

6. This information is from a draft case study that will be published in *Strengthening Post-Conflict Peacebuilding through Natural Resources Management*, which is being finalized by the Environmental Law Institute, the United Nations Environmental Programme, and the University of Tokyo (ELI 2011). The publication will include some 150 case studies on experiences and lessons learned dealing with natural resources and conflict. Edited volumes to be released soon focus on high-value resources; land; water; livelihoods; restoration, remediation, and reconstruction; and governance and institutions. The intent is to advance international discussion and understanding of the interactions between natural resources and post-conflict peacebuilding.

ity could become even more fragile (Blair 2010; NIC 2008). As such, U.S. Army and USAID efforts seek to identify fragility and environmental factor analysis approaches, monitoring mechanisms, and early warning systems as well as to assess compatibility with climate vulnerability and impact assessment approaches. In particular, these efforts again seek to identify gaps and barriers to developing "sustainable security" planning and how fragility can be used as an integrative operating concept to address climate related threat multipliers.

Within the defense and intelligence communities, there are several recent climate security studies and programs developed to assess national security implications, including:

- 2008 National Intelligence Assessment on the National Security Implications of Global Climate Change (public and classified versions)
- 2010-2011 Defense Science Board Task Force on Trends and Implications of Climate Change for National and International Security (pending release)
- DOD Minerva Funded Climate Change and African Political Stability (ongoing)
- Central Intelligence Agency, Center on Climate Change and National Security (ongoing)

USG climate security studies are focusing on links to social unrest and vulnerability relying heavily on geospatially-explicit approaches. Fragility and environmental change approaches closely align with most elements of climate vulnerability. Fragility early warning approaches can also be cross-linked in a manner relevant to U.S. military's strategic and operational planning needs, but yet cognizant of natural resource and climate change as potential threat multipliers.

## Policy Implications and Recommendations

At the strategic level, how can the U.S. military and the broader national security community aim for, facilitate, and realize sustainable security? This chapter expanded on the conceptual and policy drivers moving in this direction, but also highlights the challenges. U.S. national security narrative and policy directives need to establish sustainable security as an ultimate aim and define the conceptual framework under which this can be achieved, particularly asserting the place of fragility, natural resources, and environmental security. While U.S. policies absolutely stress the necessity for a smart power approach, interagency terms of reference, incentives, multi-agency "scaling" and resource sharing, mechanisms are still insufficiently aligned to be effective at the strategic level. The USG currently has limited human security, fragility, and environmental security monitoring and early warning capabilities, and none which systematically cover the breadth of sustainable security.[7] As such, four recommendations are offered to address these gaps:

1. Integrate fragility and natural resource, environmental security considerations more fully into U.S. security policies and strategies.
2. Expand interagency coordination frameworks and align them to incentivize action.
3. Establish an interagency community of interest to develop a common operating framework that addresses fragility and sustainable security.
4. Develop a USG early warning system for conflict, instability, and fragility that integrates

7. NATO's pilot study on environment and security had earlier suggested that "the development of early warning indicator systems, data bases, and decision support systems is feasible and warranted" (NATO 1999, 130).

natural resource and provides situational awareness for security missions.

The current NSS, QDR, and NMS all call for action on energy and climate (2010; 2010; 2011). However, these mandates do not make natural resource and environmental security considerations a priority despite increased mention in national intelligence and future threat analyses. The current means of engaging fragile states also views the "haphazard and stove-piped" approaches prompting the suggestion the United States "needs to make fragile states a higher priority in the hierarchy of national security concerns, comparable to such issues as the proliferation of weapons of mass destruction, climate change, and energy self-sufficiency" (Baker 2010, 69, 72).

The first recommendation is U.S. security policies and strategies integrate natural resource, environmental security, and related fragility considerations. While U.S. policy and strategies already emphasize the need for the United States to exercise smart power, the DOD, Department of State, USAID, and other USG agencies require more effective incentives and resourcing options. A key principle of war is "unity of effort" and 21st century security, sustainability, transition and reconstruction (SSTR), as well as conflict prevention, missions require coordinated action across and with the USG interactions as part of regional and international security organizations.

The second recommended action is to expand interagency coordination frameworks, such as ICAF developed initially for SSTR operations, and align these mechanisms to incentivize and leverage joint actions via programs, such as the USG Global Security Contingency Fund.[9]

9. FY2012 budget request was submitted to establish a Global Security Contingency Fund focused on better integrating DOD and Department of State resources to collaboratively address security challenges.

These actions would provide policy drivers and resourcing for USG sustainable security actions, but these programs would still lack a common conceptual approach and operating system. As discussed, sustainable and human security concepts require approaches aligned to current mission functionalities as well as natural resource, environmental, and climate security.

A third recommendation is to establish and support an interagency community of interest to develop a common operating framework addressing sustainable security and fragility across the USG in an effort to better align strategies and policies, functions, metrics, systems, and institutional lexicons. Currently, the lack of disaggregated data and monitoring capabilities at the sub national and local level for fragility, natural resources, and environmental factors is currently an impediment for situational awareness and threat assessments. While some nascent USG environmental and climate security capabilities are under development, many of fragility and natural resource analysis and early warning approaches are not sufficiently utilizing analytical tools and globally consistent data resources, or are not integrated into mission-oriented assessments, functionalities, and systems.

Given this, the final recommendation is to develop a USG conflict, instability, and fragility early warning system integrating natural resource, environmental factors, climate considerations in a geospatially explicit manner, providing situational awareness for planning smart power HADR, SSTR operations, and shaping Phase 0 engagement missions.

Taken together, these recommendations help align current U.S. national security policy, plans, and provide capabilities to encompass a more comprehensive

concept of sustainable security. While this non-traditional approach may represent a paradigm change to some in the national security community, it simply builds on the real world lessons learned over the last two decades of peacekeeping and SSTR operations and is consistent with strategic policy directions. Many of which have not yet been fully aligned with national resources and actions. Moreover, it enables the U.S. military to lean forward in addressing regional and global security by anticipating future tensions and planning for proactive responses in an effort to avoid costly humanitarian and military interventions later.

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# 5

# Sustainability and Environmental Security

*Odelia Funke*

Survival requires that societies adopt policies that support their ability to grow and change over time in the pursuit of key interests. While basic principles of sustainability are obvious, within modern societies planning for the future is a complex matter, and principles of sustainability must be discovered and incorporated into societal norms. Despite significant progress in our knowledge of sustainable practices, for numerous reasons it remains difficult to implement.

Conservation, or reduced consumption in the name of future need or future generations, is naturally at odds with other motivations, for both individuals and societies. Sustainability principles are often undermined by self-interested motives or political expediency, and are easily clouded with other factors, particularly appeals to protection of national interest and security requirements. Though it is in the interest of all societies to pursue policies aligned with long-term needs, individuals do not easily focus on intergenerational issues in making decisions. Severe ecological damage typically does not occur quickly, so it is difficult to demonstrate to enough people the critical importance of ecosystem health and conservation. We have not solved the problem of the commons locally, nationally, or globally.

The depletion and contamination of resources has broad ripple effects. Shortages can lead not just to economic pressures and competition but to conflicts. Depletion and contamination of resources have cascading effects, as when deforestation leads to changes in weather patterns, or when denuded lands lead to flooding and mudslides during hard rains. In severe situations the loss of homes and farmlands leads to migration of peoples, which puts significant stress and tensions on neighbors, and can trigger regional insta-

bility. These kinds of effects can spill into the international arena and with dramatic security consequences. Other nations are often pulled into the ensuing chaos, for disaster relief, dealing with refugees, or responding to new conflicts generated by these conditions.

The more scientists learn about the movement of pollutants and the intricacies of ecological balance, the clearer it is that each nation is at the mercy of one another's actions. Human life depends upon an interconnected web of life across the entire planet. Pollution and disease travel. Human survival depends upon the health of an interlocking set of natural systems, and protecting the environment ultimately requires international cooperation and coordinated action. Climate change is the most widely recognized agent for global environmental crises, but is not the only environmental threat with potentially grave, large-scale consequences for nations and regions. Overpopulation, for example, is another factor related to environmental health that undermines sustainability.

Since the purpose and legitimacy of government depends upon its ability to safeguard its people, and security is intimately bound to ecological health, it follows that the pursuit of sustainability is a key purpose of government. Environmental resources and environmental health are directly connected to national interests, and thereby to national security. "Environmental security" refers to environmental and ecological elements affecting national security. It looks beyond a narrow focus on military power and highlights the environmental components of strength and the ecological assumptions and consequences of security policies. Practices that deplete or contaminate resources mortgage future security.

This chapter will consider sustainability from an environmental security perspective. The discussion will briefly trace the environmental security concept in the West, and its influence on policy in the United States and Russia, the two superpowers in the last half of the 20th century. Russia is of interest not only as a continuing global power, but also as a nation with an unmatched wealth of natural resources, which has undergone catastrophic damage from neglect of its environmental security. Russia's attention to environmental security is important to the health of the global ecosystem and world energy supplies, but also to the global balance of power, and therefore to United States interests. Failure by either of these nations to adopt more sustainable policies will severely affect their domestic well being, but will also likely change the balance of global power in ways that diminish their ability to act.

The United States should provide global leadership in pursuing sustainable ecosystem policies, because finding sustainable products and processes to meet human needs is critical to our own well being, and is a factor for international stability. If sustainable practices are not soon adopted by the global powers, we are likely to experience an abundance of disruptive effects on the environment, on economies and societies across regional and national borders.

## Environmental Security Concept – Growth: 1980s and 1990s

In the post-WWII period, the United States and USSR faced off in a bipolar struggle wherein security, backed by nuclear weapons, became the paramount concern of foreign affairs. National security was narrowed to power relations, and power was calculated

in terms of military might and technologies (and the economy to support them). In the 1980s, some began to challenge the idea that the force on force concept should have predominant control over security issues. In 1990, the Brundtland Commission of the UN's Environmental Program conducted a study which concluded that there was a "deepening and widening environmental crisis" presenting a threat to national security, and even survival, more formidable than military might and hostile state relations. The report stated: "[t]he arms race—in all parts of the world—pre-empts resources that might be used more productively to diminish the security threats created by environmental conflict and the resentments that are fueled by widespread poverty...There are no military solutions to environmental insecurity."(Brundtland Commission 1990, 7 & 19)

In the late 1980s and through the 1990s, a wealth of environmental security studies were published, as researchers chronicled and calculated the direct and indirect costs of the Cold War security-as-power model. They argued that security assessments must take into account damages to the ecosystem, and that the defense establishment had been a major source of the toxic and hazardous wastes generated each year. The ecological disruptions and destruction wrought by war are obvious, but peacetime activities also have adverse effects, from training troops, to defense industrial processes (weapons development and testing, research, etc.), to disposal of toxic materials. Contamination from these activities can result in permanent environmental degradation. These arguments garnered increasing attention in Western government policy forums, among political activists and within academic circles.

Gross abuses and environmental degradation in the former Soviet Union—with a correspondingly reduced average life expectancy, myriad health problems, and a loss of natural resources—became widely known. The catastrophic collapse of the Aral Sea became an international symbol of the profound human, environmental, and economic consequences of ecosystem abuse. Domestic abuses by the United States government spawned negative publicity and public reactions as well. The federal government and defense establishment no longer had an unsuspecting public or an automatic acceptance of their programs and policies. Scholars and policy analysts critically examined environmental damages, including contamination from the Department of Energy's nuclear weapons facilities as well as the long-term destruction associated with armed conflict. One frequently cited example of long-term ecological damage was the consequences of the United States use of toxic chemicals, such as Agent Orange and DDT, in Vietnam. Another manifestation of growing concern and criticism was the international movement against the use of land mines. Environmental damages caused by the U.S. and USSR military and defense establishments are well documented (e.g., Funke 1993, 1994 and 2005).

Internationally, nations no longer felt constrained to align with one of the superpowers. The Bhopal, India, explosion at a Union Carbide India Limited plant in 1984 reinforced the importance of environmental protection, as part of economic as well as political policy. With the demise of the bi-polar world, leaders in developing nations had greater freedom to shape their natural resource policies.

Challenges posed by various environmental threats gained increasing international political atten-

tion, including issues related to defense facilities and weapons, but also to some civilian industries, and to managing infectious diseases. The Montreal Protocol, signed in 1987 and substantially amended in 1990 and 1992 (Ciesin), in the 1990s marked a successful effort to negotiate reductions in harmful chlorofluorocarbons, or CFCs, that damage the ozone layer. International agreements on the handling and disposal of nuclear warheads and wastes, treaties on chemical and biological weapons, and planning for coordinated responses to pandemics are other areas of successful international cooperation for mutual security.

As the Cold War ended, defense spending was cut, leaving a "peace dividend" that could be reallocated. There was a new emphasis on "waging peace." The United States and Europe focused attention on environmental restoration as part of the post-Cold War policy. The United States helped create and support an Environmental Center in Budapest, Hungary, to assist Eastern Europe recover from the massive environmental destruction resulting from Soviet industrial practices and conditions left by the retreating Soviet regime. Revelations coming from post-Soviet Bloc countries, as well as Russia, served as strong examples of the need for greater attention to environmental impacts in military as well as industrial planning. Western military and civilian departments provided expert advice on many issues, including methods for environmental assessment, prioritization, and cleanup. In 1994, the Woodrow Wilson International Center for Scholars in Washington D.C. created the Environmental Change and Security Program, which produced studies and created a forum for discussion among the policy elite of Washington (Wilson International Center for Scholars 2011). In 1990, the North Atlantic Treaty Organization (NATO), under its Commit-

tee on the Challenges of Modern Society, created an environmental program which included assistance for cleanup in Eastern Europe. NATO stated the military, "must conduct its activities in an environmentally sustainable manner" and suggested ways to promote greater environmental awareness in the armed forces (NATO 1991). Significant technical aid was given to Russia to reduce stockpiles and destroy both nuclear and chemical weapons. In addition to NATO support, Western European nations also contributed funding to help address dangerous environmental conditions in the newly formed Commonwealth of Independent States, which included massively contaminated Soviet military bases in Eastern Europe.

As the idea of environmental security gained traction in the early 1990s, the U.S. government turned to military-to-military assistance programs and alliances to help nations pursue environmental health. The U.S. Department of Defense (DOD) launched programs to teach concepts and provide assistance on a wide range of needs, including environmental preservation, reversing or controlling degradation, securing vital resources, and cleaning up from past practices. U.S. scholars explored these issues in the context of a new emerging role for the revolution in military affairs in a post Cold War backdrop (Butts 1993 and 1994). Some, inside and outside the military, opposed this "greening" of the military, either because it was deemed a threat to the primary mission of the military, or because critics feared military appropriation and distortion of environmental issues. Military leadership eventually accepted the need to incorporate environmental elements into security analyses.

The U.S. Army held the first Senior Environmental Leadership Conference in November 1988, which focused on environmental concerns to be addressed

by the newly formed Army Environmental Policy Institute (AEPI). The U.S. Army later codified the efforts of AEPI and the annual Senior Environmental Leadership Conferences in the development of the first Army Environmental Master Plan in 1992 (AEPI 2011). In 1993, the DOD established the office of the Deputy Undersecretary of Defense for Environmental Security, which would serve to develop policy for all branches of the Armed Forces (AEPI 2011).

In the 1990s, significant international academic research focused on assessing environmental factors in the outbreak of cross-border aggression and mass movement of peoples across borders, which in turn drew attention to how better environmental planning and management could reduce international conflict and increase national security. The U.S. government's 1998 National Security Strategy (NSS) clearly acknowledged the link between environmental issues and security.

**Environmental Security Concept – Decline and Durability: Bush and Obama Administrations**

During President Bush's two administrations, the concept of environmental security seemed to disappear from view. The rise of global terrorist activities, and especially the September 11, 2001 attacks, turned the national focus toward security threats to be met with military might. Indicators of this retrenchment included: dropping the clear linkage of environment and security in the NSS; reversing the DOD reorganization, which created the position of Undersecretary of Defense for Environmental Security; increasing DOD influence in crafting foreign policy; announcing a policy of 'preemptive war' (West Point speech, June

1, 2002); reversing the commitment to arms limitation and withdrawal from ABM Treaty (Owens 2009); and undertaking a massive defense build-up.

Despite U.S. government focus on military power to combat terrorism, environmental issues still appeared on some policy agendas. The Woodrow Wilson International Center for Scholars Environmental Change and Security Program continued to focus on environmental security issues. In 2004, NATO joined five other international agencies on an environmental security initiative. The U.S. military's geographic combatant commands continued to promote environmental security as a regional engagement vehicle to promote stability and build multilateral cooperation. In 2007, a highly prestigious Military Advisory Board completed a study on national security and climate change. The board, whose executive director was the Clinton Administration Undersecretary for Environmental Security, Ms. Sherri Goodman, was assisted by chairman and former Army Chief of Staff, General (Retired) Gordon R. Sullivan, found that pressing environmental problems, especially climate change, are directly pertinent to national security. These findings were particularly noteworthy because the members were retired three- and four-star generals and admirals, who had served at the highest ranks of military leadership (CNA 2007).

While there are signs that interest in the environmental aspects of security is reappearing, one should not be highly optimistic about its importance in U.S. government policy. The Obama administration, like its predecessor, is buried in other pressing matters. This administration is bogged down with multiple military incursions, and ongoing terrorism concerns, as well as responding to numerous popular uprisings

shaking Middle Eastern states. These issues demand attention and political capital. Pressing environmental issues receive less attention. In fact, strong divisions in Washington make the adoption of new environmental programs very difficult to approve and execute. Elements in an extremely divided Congress challenge many environmental programs, and thus require the administration to defend existing policies and raise the political cost and risk of environmental initiatives. Further, strong congressional pressure to balance the budget has focused on proposals to slash domestic programs, including environmental protection, rather than on costs associated with multiple wars and anti-terrorism programs. Energy policy, a key to addressing climate change, has not moved forward. Related environmental initiatives are typically couched in terms of job creation and developing new technologies. In this very constrained policy context, with many politically conservative, small-government advocates in Congress, national security thinking continues to stress military might. But there are some indications of an opening to seek new directions in both domestic and defense policy.

**U.S. Domestic Policy**

In domestic policy terms, President Obama has consistently indicated that he sees climate change as a serious threat, and wants to forge a new energy policy. Reinstalling solar panels on the While House, removed by President Reagan, provided a symbolic gesture of commitment. Similarly, the administration has given support to green business ventures to stimulate economic growth and protect the environment, such as the America Competes Act, passed in

Dec. 2010, and a Department of Energy loans program in addition to its partnership with industry to accelerate the development of cleaner vehicles. In 2009, President Obama issued an Executive Order requiring federal agencies to evaluate their risks and vulnerabilities related to climate change, and how they can mitigate those risks to achieve their missions. In 2011, the federal government published an interim rule requiring federal agencies "to foster markets for sustainable technologies, materials, products and services" to provide energy security and safeguard environmental health (Federal Register 2011).

Arguably one of the most important new efforts is the regulation of greenhouse gases, though there are congressional attempts to end this initiative, either directly or through budget constraints. During the first 2011 budget crisis, which almost shut down government, there were rumors about the likelihood of a White House deal to sacrifice programs and authorities of the Environmental Protection Agency, including its new greenhouse gas controls. The next budget battle will undoubtedly bring another foray to deny funding for the greenhouse gas control program. Despite the awareness among defense and foreign affairs experts that climate change poses serious threats to U.S. security, chances for progress on an international global warming initiative appear slim.

Two recent environmental calamities involving energy industries illustrate the difficulty of promoting sustainability concepts by addressing energy-related environmental concerns in the United States. The administration did not leverage the massive Gulf Oil spill in summer 2010 to demand change to energy or environmental policy. It wavered between environmental concerns and economic growth, equated to

job protection, as well as placating political factions. The President did not use this as an opportunity to demand a commitment to renewable energy. Administration spokespersons downplayed the health consequences of the spill. Congress did not support a bold approach or opening for policy reassessment. The 2011 disaster at Japan's Fukushima Daiichi nuclear power facility has also failed to stir much open debate by the administration about nuclear power plants. Academic and NGO (nongovernmental organization) analysts have urged a reassessment of both risk and cost implications of nuclear power, but the U.S. government seems more interested in calming public fears about nuclear outfall from Japan, and perhaps avoiding debate about the current 104 U.S. commercial nuclear power reactors (NRC 2011). Weeks after the Japanese reactors failed, news coverage about radioactive releases virtually ceased, though the plants continue to emit significant amounts of these toxins into the global environment. In both cases, pressures for securing markets, for avoiding criticism that its policies hurt industry/jobs, and the need to preserve options for domestic production, appeared to lead to great caution in government handling of the environmental and health aspects of the disasters.

**U.S. Defense Policy**

Defense planning has shown some progress toward sustainability. This can be seen as a continuation of the push toward environmental stewardship in the 1990s, or just as a move aimed at improving military readiness and effectiveness, including cost savings, as well as adhering to federal laws and regulations. But the logic of environmental security joins environmen-

tal concerns with practical needs. Pressuring the military to embrace values and practices of sustainability in the 1990s was a difficult process, but once the military embraces a new direction, it creates processes to implement that change. Those processes continue to affect military planning and practices, including the development of more complete cost accounting methods to assess resource use (AEPI and USAEC websites, e.g.). The Army "Strategy for the Environment" emphasizes that sustainability is a critical component of readiness, and that sustainability requires full cost accounting (AEPI 2010). With its formidable buying power and its reach across societal classes, the military can be a powerful force as an innovator and a mechanism for social change.

Since 2009, the DOD has been working to reduce energy consumption in combat zones. The U.S. military is the largest industrial consumer of oil in the world, using more than is consumed by 85% of the world's nations (Davenport and Dreazen 2011). Fuel, in addition to being expensive to purchase, is difficult to transport in combat zones and provides a very vulnerable target to the enemy. The military is finding ways to reduce fuel needs, which reduces weight, increases agility, and minimizes the number of very vulnerable fuel transport targets, including soldiers, in addition to reducing pollution. Efforts to develop more efficient vehicles and adopt technologies to allow low energy bases of operation in remote areas are part of the cost and risk reduction work. By 2013, the Air Force plans to certify all of its aircraft to use renewable fuels (Ricks 2011). The DOD has adopted non-combat goals, including efficiency goals at installations and commitments for incorporating green design technologies in all new construction. For exam-

ple, the Army built a solar energy plant at Fort Irwin to achieve energy independence or 'zero gain' from commercial electrical sources, at the Army's National Training Center. The U.S. Air Force also constructed a solar field at Nellis Air Force Base, Las Vegas, NV to drastically reduce electrical energy consumption at a large training installation. These kinds of actions move a major global purchaser toward conservation, reduce environmental degradation, and help mature alternate energy technologies. It demonstrates an awareness of environmental factors that never existed in the Cold War defense establishment.

The U.S. military is adopting more green processes and technologies, and more efficient resource use, but this does not equate to a national policy for sustainability. For example, the U.S. NSS uses the term 'climate change' throughout, and recognizes challenges from climate change, but fails to mention the myriad of other environmental threats to national security that affect the U.S. Similarly, it is encouraging that the U.S. Army has produced its second sustainability policy, but at the same time the DOD's 2010 Quadrennial Defense Review (QDR) acknowledges challenges of climate warming but says little about the strategic need for environmental resource stewardship. The QDR addresses international partnerships with respect to environmental issues, but it does not specifically emphasize military-to-military sharing of environmental protection issues and techniques.

Prospects for U.S. policy initiatives to resolve pressing environmental problems internationally are not high, but there is room for hope. Civilian agencies are providing support for research on alternative energy sources, and the Pentagon recognizes that climate change is a threat multiplier and is taking action

to mitigate some of the risks. Energy conservation is a military planning objective for both domestic installations and in war zones. This could spur further civilian innovations, as defense spending can both spur new development and make new technologies affordable for rest of society. In the wake of multiple environmental catastrophes, defense analysts are studying the relationship between ecological destruction and the mass movement of peoples and/or societal unrest arising from environmental events. This research started in the 1990s, and has a practical relevance that continues to be exercised. Further, the commitment to continued progress towards arms reduction, and a move away from the missile defense installations in Eastern Europe, cooled down the arms race, reduced the environmental cost of production, storage and disposal and allowed resources to be redirected elsewhere.

In the United States, sustainable practices have clear support from some economic and political elites, including visible and well-funded environmental organizations. But more powerful interests, particularly the oil industry, continue to fight any fundamental shift toward sustainability as a de facto energy strategy. The status of the climate change debate and ongoing attacks on environmental regulations amply demonstrate that environmental concerns do not currently play a decisive role in national policy. The Supreme Court's decision in *Citizens United v Federal Election Commission* guarantees massive business financing will affect the electability, and thus the policy priorities, of those seeking office into the future.

## Developments in Russia—Soviet Legacy to Putin and /Medvedev-Putin Tandem

Abuses in the Soviet era resulted in a broad range of environmental destruction that posed serious threats to human and natural resource health (Feshbach and Friendly 1991; Funke 2005, 246-275). During the perestroika reforms in the late 1980's, the environmental movement gained strength. The Chernobyl disaster in 1986 and other environmental problems provided a focal point of public concern. The Soviets finally took steps to address environmental problems and created the environmental agency, Goskompriroda, in 1988. In the following several years Goskompriroda shut down many polluting factories and canceled some nuclear tests, even stopping testing entirely in one area as result of open protests (French 1991, 105-106; Renner 1991, 149-150). Goskompriroda put a variety of environmental standards in place to limit exposure to pollutants, though there was, and continues to be, widespread violation of those standards.

## The Environmental Movement

Environmental groups were among the most visible, and vocal, sources of opposition to the regime. The emerging Russian environmental network was credited with playing a prominent role in the demise of the Soviet government. The Russian ecological party, founded in 1991, claims to be the oldest political party in Russia. In the early post-Soviet years, it seemed possible for this movement to have substantial influence in the emerging political landscape. Those hopes and expectations did not bear fruit, however, and environmental consciousness and commitment quickly waned after the fall of the USSR.

By the late 1990s, it was becoming clear that economic hardship as well as the war in Chechnya had siphoned off a large amount of domestic attention, and other political interests were consolidating control. The lack of environmental progress certainly has to do with Vladimir Putin's consolidation of power and his lack of commitment to environmental protection, but other social, economic and historical elements were also at play. The USSR had no history of strong NGOs, and environmental groups were unable to gain enough domestic funding support to be a powerful network. Thus, environmental issues are not well represented in Russia and are cannot muster substantial political pressure. Indeed, Russian power elites have shown little interest in environmental issues.

Some argue that Russians do care about the environment, but this seems to conflict with the low party membership and election results. Despite continuing environmental abuses by the powerful and dire health statistics, data show relatively few citizens supporting the green movement or the party which represents environmental protection. Its early success was partially because it provided an outlet for anti-regime sentiments. With the fall of the Soviet regime, large portions of that support left the movement. In the 1990s, Russia experienced both political and economic turmoil, including collapsing industries. Industrial pollution decreased as a result of the downturn, but people were concerned with economic survival, fearing wider industrial closures. In such circumstances, people conclude that environmental protection is a luxury only affordable in stable and wealthy societies. Environmental inaction can be rationalized with the attitude that Russia is vast, having a wealth of natural resources, and given the economic needs, if one area is damaged it is possible to move to another.

Opponents successfully blamed the liberals for the economic crisis of the 1990s, as shown by surveys conducted in 2006 (Kolesnichenko 2006). Further, because the Green movement was receiving funding from outside Russia, it was susceptible to accusations of anti-Russian sentiments. Many Russians seemed to be more interested in promises of order than in democratic freedoms. Existing attitudes, of course, might have been heavily influenced by internal propaganda, as there are significant constraints placed on the free press in Russia.

In this atmosphere of economic worries and desires to promote industrial growth, as well as intense industrial pressure, in May 2000, Putin abolished the Environmental Ministry and moved its functions into the Natural Resources Ministry. The Natural Resources Ministry is charged with promoting the rapid development of Russia's resources to fuel economic growth. The mission of the Natural Resources Ministry conflicts with environmental protection in numerous ways. Legislative changes in 2004 raised both the minimal membership required and the threshold percentage of the electoral vote to be seated as a party in the legislature. The new law disqualified the Green Party from participating as a legislative party. In 2005, the Green party transformed into a social movement, and joined liberal factions as part of the small Yabloko Party in time for the 2007 elections (European Green Party 2011; Kolesnichenko 2006).

With the environmental movement marginalized by recent legislative changes, big companies often rolled over local laws and rights, either by rules change or by violation of existing rules and regulations. Green party reports accuse companies of ignoring government orders to stop their illegal activities. In a system dominated by politically and economi-

cally powerful individuals who can bend the legal system with impunity, it is difficult for the Green agenda to survive, much less prosper. The issues the Green movement publicized were directly related to local environmental threats and abuses of power, including blatant disregard for existing law. The Greens have achieved limited success in stopping some of the activities they oppose, but many of their actions result only in delays or outright defeat by monied interests. In case after case, the powerful elite hire thugs or enlist local police to harass, mistreat, arrest or otherwise control protesting citizens. In one publicized case, a journalist opposing the destruction of a forest near Moscow was beaten almost to death. It appears that no serious search for the perpetrators has been conducted (Yabloko Party 2010, July-August, 11/9/10 items). Environmental whistle blowers faced charges of treason and were subjected to long court battles and imprisonment for publishing information, which they claimed was already in the public record (Henry and Douhovnikoff 2008, 450). There are few hopeful signs, with a weak but dedicated Green movement winning occasional battles against the powerful. The public at large appears to be apathetic, or perhaps has more immediate worries to address.

**Environmental Conditions in Russia**

As the Soviet era closed, Russia and the Commonwealth of Independent States had a host of severe documented environmental and health problems, that included a lower life expectancy. Large populations were exposed to highly toxic substances, including neurotoxins and radiation from the domestic and military aspects of the nuclear program. Inadequate con-

trols and mishandling of toxic materials also created long-term contamination of land and water resources. Mismanagement and failure to provide for safe storage or disposal of toxic materials have a lasting legacy, including increased health problems for large numbers of people. Contaminated lands are not just a problem around industrial and military facilities; dangerous contamination also resulted from the careless location of dumps. For example, a hazardous site from chemicals and radiation in a Moscow neighborhood appears to be an old dump, which will be cleaned and used as for public housing (Byodorov 2007).

Russia had massive challenges in recovering from the Soviet era, not the least of which is that it lacked sufficient economic resources to take on expensive cleanups. For the first decade after the collapse of the Soviet regime, the West was especially concerned with the new regime's ability and willingness to secure nuclear, chemical and biological weapons materials, and associated wastes. There were formidable logistical and financial challenges to securing, moving, dismantling, and safely disposing of massive amounts of materials, including decommissioned nuclear submarines. Environmental security concerns about weapons materials included leaks, accidents, sabotage, and theft, as well as avoiding proliferation, or a brain drain of unemployed experts to states or groups wanting to build weapons programs. There were fundamental worries in the 1990s that weapons materials would be stolen or sold in the confusion following the collapse of the Soviet system and establishment of new republics. Western nations, particularly the United States, offered substantial technical and financial assistance to address these pressing issues. Russia entered agreements for help in safely containing or disposing of these extremely toxic materials.

The environmental legacy of Soviet nuclear arms program affected other former Soviet Republics as well as Russia. Kazakhstan and Ukraine had very large holdings and massive contamination issues, particularly in Kazakhstan. When Kazakhstan and Ukraine became independent they became among the largest holders of nuclear weapons in the world. They agreed to send these weapons to Russia for dismantling, though handling associated nuclear wastes is a long-term problem for them. Kazakhstan inventoried wastes and locations, and noted more than 230 million tons of radioactive waste from testing, mining, processing and nuclear reactors in the country. Wastes were stored at 529 different locations (NTI, Russia and Kazakhstan 2011). Much has been done to manage these materials and issues since 1991, but the risks and costs of handling and disposal of nuclear materials remains an ongoing problem.

The breakup of the USSR left Russia with large stockpiles of biological and chemical weapons agents in facilities at various locations across the country. Its biological weapons were in violation of an existing treaty. Russia affirmed its support for treaty obligations, but safe disposal was a looming problem. The West offered assistance to help contain possible dissemination or catastrophe. Russia has confirmed disposal of materials at some plants, but the status of work at some key facilities is unknown (NTI 2011, Russia/Biological).

With respect to chemical weapons agents, Russia signed the Chemical Weapons Convention in 1997, which committed it to dispose of chemical weapons with Western assistance. Russia has made progress in dismantling/destroying these materials, but the huge and dispersed stockpiles of these toxins continue to

be a difficult and expensive problem, which will take additional years to fully address (NTI 2011, Russia/Chemical). Further, the management of cleanups overseen by Russian authorities has raised some controversy. Environmental and human rights activists have raised concerns that Russia's chemical disarmament program funds were being mismanaged, cutting safety measures and thus endangering lives (Yabloko Party, citing AP 2004).

Clean up of nuclear contamination has continued in the Medvedev-Putin years, at least partially subsidized by other nations. In 2009, Japan committed $40 million for Russia to dismantle their decommissioned nuclear submarines in the Far East, and the United States and Canada helped finance the dismantling and disposal of a nuclear submarine decommissioned the previous year. In 2010, Russia shut down its last plutonium-producing reactor, and it completed decommissioning and return of the first industrial-scale nuclear facility to green-field status, which means it can be used for industrial or social purposes (NTI 2011, Russia/Nuclear Chronology, 5/5/09, 8/114/09, 4/15/10, and 6/30/10). Though clean up of existing materials from the Soviet era has not been completed, Russia agreed to accept nuclear waste from other states. Russian state officials denied a report that depleted uranium from French power plants was stored in an open-air site in Siberia in October 2009. In February 2010, there was a report of a contract with a French nuclear energy group to store French uranium waste at a waste facility on the Baltic Sea. This kind of waste can, according to international standards, be transformed into fuel for nuclear power stations (NTI 2011, Russia/Nuclear Chronology 10/13/09 and 2/1/10).

Efforts to secure weapons facilities, increase safety within the plants, and safely destroy the weapons

stockpiles have increased global security. While issues of rogue sale, or theft, of weapons materials are not so prominent today, concerns and rumors continue, including an ongoing worry that experts might go to other states or join militant non-state groups.

Aside from issues related to weapons management/disposal, it is disappointing how little information is available on the formidable range of environmental issues in Russia. A wealth of information appeared in the 1990's. In the early 2000s, there was still news about debate of environmental protection issues of national significance, such as discussion of ratifying the Kyoto protocol, criminal proceedings against an environmental polluter, government interest in resettling people exposed to nuclear contamination, and rehabilitating territories contaminated by Soviet nuclear facilities (Yabloko Party 2003). The little environmental news available in Russian sources comes primarily from the Green movement. The Green movement remains a small network. The environmental causes publicized by the Green movement typically relate to specific local or regional issues involving abuse, misappropriation or poaching by the powerful in a specific area, rather than system-wide policies.

One finds little data or analysis relating to national environmental issues or significant cleanup activities. Data the Russian government produces varies in quality, methodological consistency and completeness; some important data are restricted and not released. One study concluded the Russian government imposes "significant logistical and political constraints" to the pursuit of scientific research and to its broad dissemination (Henry and Douhovnikoff 2008, 443, 445-48). Pollution sources continue to exceed health lim-

its, the lowered life expectancy and loss of population documented in official reports. These reports provide evidence of ongoing, serious health and environmental problems. There does not appear to be any widespread attempts to repair past damages. Worse still, available reports make it clear the number of abuses continue to grow. The full scope of the environmental problems and risks remains unclear; not only because of a lack of government data and transparency, but also because journalists have been targeted and attacked in pursuing environmental issues.

According to a 2007 interview with Viktor Danilov-Danilyan, Director of the Institute of Water Problems of the Russian Academy of Sciences, and former Minister of Environmental Protection and Natural Resources before it was reorganized, Russia, under Putin and Medvedev has not addressed serious environmental problems. Danilov-Danilyan noted Russia has what is considered to be the most polluted city in the world, Karabash in the Chelyabinsk Region, and there are approximately a dozen cities almost as polluted. Dangerous pollution levels noted in the 1990s have not been effectively addressed. About 150 cities regularly exceed maximum concentration levels of toxins in both air and drinking water. Huge amounts of industrial and household waste occupy large areas and sometimes poison groundwater supplies. 15% of Russia's territory (equal to the area of England, France, Germany, Sweden and Finland combined), some of it around industrial centers, has severely degraded ecosystems, with toxic levels exceeding standards in air and water and soil. According to Danilov-Danilyan, Russia is worse than any other developed country in environmental protection (Sinitsyna 2007 a).

Many Russians are exposed continually to unhealthy conditions. Half of all Russians, and up to as much as 70% in some areas, use substandard water. About half of the infrastructure for water distribution needs to be replaced. A project of this magnitude would take decades to complete. Russia has no national system of water management (Sinitsyna 2007b). Many regions have surface water polluted to levels many tens of times above permissible levels. Only 12-14% of Russia's lakes and rivers are clean. Groundwater is about 30% polluted and continues to deteriorate (Yablokov 2010, 2). Industrial and municipal reservoirs are often shared; both treated and untreated water is returned, increasing risk to any downstream users. Both municipal wastewater and industrial pollutants are a threat to water safety. Untreated human and animal waste is a source of pollution and periodic contamination in cities. People with immunodeficient conditions can be particularly vulnerable to parasitic contaminants. The Volga River, the longest river in Europe, is highly polluted with untreated wastewater, industrial pollutants, and spills that affect its sediment and its fish. The Volga's current environmental deterioration is the source of the ecological disaster in the Caspian Sea, which receives over 85% of its fresh water from the Volga (Henry and Douhovnikoff 2008, 443-4).

Government air pollution data are incomplete and deemed unreliable for several reasons. Independently published data are limited. According to one 2007 study, particulates alone might be associated with 6% of urban deaths, that is, 88,000 people annually (Henry and Douhovnikoff 2008, 447). One of every two people is negatively affected by airborne particulates. Official figures show that approximately 60% live in areas

of high or very high levels of air pollution (Yablokov 2010). Another contributing factor is that increased economic prosperity has brought a big increase in the number of cars, which is a major source of air pollution in urban areas.

Climate change is a deepening environmental security challenge. Much of resource rich Siberia lies in a permafrost area, which is dramatically affected by the melting that has already occurred. Changes bode significant problems for the Siberian infrastructure. Gosstandart, the government agency overseeing building standards and codes, states that foundations must either have consistently frozen or melted soil. Processes of freezing and thawing not only create settling during thaw cycles, but will eventually cause building failure. Another infrastructure concern is to stabilize transportation routes so that they do not require constant maintenance as the permafrost melts. Pipelines could also become unstable as the soil around them melts. Aside from infrastructure damage/failure, thawing will release stored methane, which will exacerbate warming. Further warming in the Arctic region corresponds with more frequent storms in the Arctic Ocean, which are predicted to lead to coastal erosion and adjustments by people living in those regions. Other concerns are that as moist soil thaws and melts away, it could cause desertification. This would be disastrous for the forests in the Siberian taiga (Angel 2007).

Forested lands face two major threats, fire and uncontrolled cutting. Data show an increase in forest fires. According to a 2007 study, seven of the previous nine years had been extreme fire years in Siberia, and the area burned was 29% greater in the 1990s than it had been in the 1980s (Henry and Douhovnikoff 2008,

446). As cover is diminished, the problem is accelerated. The extent of cutting is not well documented, as the areas involved are vast, but there have been reports of poaching for years. Satellite technologies might allow for better monitoring and management.

**Health Outcomes**

Poor environmental conditions affect the health of humans and other living creatures in polluted ecosystems. Russia's list of endangered species includes 400 animal species and 676 plant species (Sinitsyna 2007b). While specific causes are complex and difficult to demonstrate, there are known links between various environmental exposures and serious adverse health outcomes. As a prominent environmental advocate in Russia noted, "illnesses related to poor environmental conditions touch the majority of the Russian population…2.5-3 million lives could have been saved between 1995 and 2009 had it not been for dire environmental conditions"(Yablokov 2010, 8). Another article notes that two-thirds of all Russians live in ecologically unsafe areas. In Moscow, which has 31,000 industrial enterprises, among other pollution sources, about 11,000 people die each year because of environmental pollution (Sinitsyna 2007b). Russia has substantial population risks to include a decline in life expectancy rates, an increase in mortality rates, and an increase in rates of illness. Russia's population has declined by about seven million people since the collapse of the Soviet Union.

Nicholas Eberstadt of the American Enterprise Institute noted that in 2008, the life expectancy of young Russian males is lower at age 15 than for young males in Haiti, a desperately poor and undeveloped nation. He concludes that Russia has a remarkable health cri-

sis, recognized by Russia's government as its number one security issue, but one that has historically not been met very successfully (Eberstadt 2010).

Other health indicators are alarming. Russian youth have suicide rates far above those found in other developed nations. Russia still has a serious alcoholism problem. With the fall of the Soviet Union and the opening of borders, plentiful narcotics arrived and drug addiction has skyrocketed. High drug use brought run-away HIV infection. A UN office estimates 30,000 people are dying from drugs each year. The Russian government estimates that more than 530,000 (in a total population of about 142 million) in 2009 were living with HIV. The UNAIDS organization estimates the actual number to be more than double the government estimate. The government has recognized this epidemic as an issue of strategic, social, and economic security for Russia, and is mounting a substantial program to fight the spread of this disease. Critics argue the government program is misdirected and fear it will not be effective (RIA Novosti 2010).

Illness and increased mortality rates translate to security concerns. They equate to added costs for care, a less able work force (with work loss from illness) and fewer able-bodied citizens available for public service, including the military. Health problems, including exposure to toxins that affect intelligence, can translate to lowered ability to manage sophisticated socioeconomic infrastructures, or modern defense systems. Severe population problems also affect a state's ability to create and maintain its power status and appearance of strength.

## Kremlin Priorities

Environmental protection remains an unmet security need in Russia. Economic hard times in the 1990s turned the focus to reviving the economy; internal terrorism also became a major concern. It is not altogether surprising that Putin, a former KGB official, emerged in this political climate. Sustainability had not become established as a strong national goal in the 1990s, and it did not survive the rise of Putin. Yet, environmental health is of great importance to the future of Russia, especially given its heavy reliance on selling natural resources to power its economy and meet its defense needs.

Putin's government emphasized policies to reclaim Russia's great power status. Reasserting a global role meant directing resources to rebuild the military and defense establishment. Maintaining, modernizing and decommissioning defense equipment and weapons demanded substantial funding. Given the strained economic conditions coming out of the collapse of the Soviet Union, and the struggle to create new economic and political systems in the 1990s, the most likely funding source for this effort was to use Russia's rich natural resource base to fund state priorities. This policy direction had broad implications, from the needs that could not be funded, e.g., environmental programs, to natural resources associated with the rush to exploit resources and introduce new technologies.

An unreliable economic and legal framework made attracting outside funding difficult to achieve. While the Kremlin has sold national resources (e.g., oil, gas and wood) to raise funds for modernization, massive amounts of resources that might have been made available to create a more stable economy for

Russian citizens were squandered or funneled off into private hands. Those with connections or some cash were able to leverage their position to take control over large resources. An atmosphere wherein some individuals were able to sell public natural resources to enrich themselves (poaching) enabled corruption to thrive. Development was allowed to occur without regard for damages to health and the environment. It is very common to read accounts of police collaboration with those perpetrating environmental abuses, or simply stealing resources, and police harassment and abuse of those pursuing environmental justice. There is substantial evidence that bribes and corruption are systemic problems. Because it might reduce their large profits, neither government nor industry pays any serious attention to environmental safety (Yabloko Party 2011). The elite that has emerged in Russia functions as a kleptocracy (Rosefielde 2000), marked by the ability to act with impunity, including privatization and poaching of public assets, without regard for law or justice. In this atmosphere environmental protection is certainly not a priority.

Two examples illustrate the primacy of resource for economic development (Sinitsyna 2007b). One involves oil extraction in a Taiga region, where the developer is burning off large amounts of incidental gases. The regional governor called this a catastrophe, but could not prevent it. The central government will not stop this practice, or hold the developers accountable, or fine them enough to make this burning unprofitable. A second example is a World Heritage List site in the Caucasus endangered because, to facilitate development, the Republic's president unilaterally abolished the 1997 edict protecting it.

A strategy to rebuild the economy before attending to environmental problems should be put in the context of Russia's vastness, and its extraordinary treasure of natural resources. It is the largest country in the world, with only 2.4% of world population. It has 12% of global oil reserves, 35% of world's gas supply, 16% of world's coal, 14% of its uranium, 22% of its forests, and 23% of its undamaged ecosystems. It also has 2.5 million rivers (214 of which are over 310 miles long) and three million lakes, including the world's largest fresh water lake, Lake Baikal, which has 20% of the world's fresh water. Thanks to a visionary scientist, it also has the oldest seedbank, with a network of research facilities, and well over 300,000 'accessions' of plant genetic material (Sinitsyna 2007b; Roslof 2007; and Tyukhov 2007).

Russia's large oil and gas reserves are a valuable asset for financing key initiatives, including military modernization. These energy resources are important elements of an environmental security calculus in that the Russian government has used access to these critical energy resources as a foreign policy tool to pressure states to follow a policy direction, and avoided any threat of military intervention.

President Putin's success in building the economy (which was arguably due more to windfall profits from international oil prices than by his astute economic policy), reduction in violence in Chechnya and subsequent increase in Russia's global power status brought him national support. Putin was able to maintain his power, despite the requirement that he step down as president, by making an alliance to share power. Since winning the 2008 election, the Medvedev-Putin partnership (referred to as "the Tandem") has continued the basic policies of the Putin regime.

In 2011, President Medvedev touted the goal of technology development to diversify the economy so that it does not rely on the export of natural resources. Medvedev reaffirmed the government's commitment to improve the investment climate and modernize, including the development of high technology products, though he admitted that efforts to date had not resulted in tangible progress (Adelaja 2011).

Kremlin priorities for rebuilding the military and defense establishments have also hit snags. The modernization effort under Putin and Medvedev-Putin has required large budget allotments. They gave even higher priority to reorganizing and modernizing the military after the 2008 war against Georgia demonstrated its weaknesses. But the results have been very disappointing, with undelivered equipment, long delays and repeated test failures on key systems (NTI, Russia/Nuclear Chronology 2011). Whether the missed deadlines and systems failures have been the result of contract delays, and under-estimated technical complications, or whether money has disappeared into pockets in this generally corrupt environment, is not clear. One critic argued that the cost-cutting reorganization and reductions in the defense industry eliminated independent government expertise and threw this sector into chaos (Subbotin 2011). Medvedev issued strong rebukes and threats to the top officials responsible, demanding accountability. Within several days it was reported that a number of top defense ministry officials and two industry senior executives had been dismissed, and others received warnings. It remains to be seen how far Medvedev can go in holding top military officials accountable, especially given that a top official is a rival and Putin ally (Felgenhauer 2011; Grove 2011).

Rebuilding the military has not been Russia's only strategy. The Kremlin has also taken steps to increase security through other means, such as negotiating further reductions in nuclear arsenals with the United States under the New START treaty. Tensions were eased when the United States backed away from building a missile defense shield in Eastern Europe, reducing the pressure for Russian military escalation and associated costs. Similarly, Russia has supported an international agreement to keep outer space deweaponized – a position to which the Obama administration has now agreed.

The Russian military has undergone reorganization and serious downsizing in the past several years, with many officers sent into early retirement (Savelyer 2011). This raises a question of what the shakeups and spiraling costs for modernization mean for the future. The greater the investment in defense modernization, the longer the delay in addressing other pressing issues, particularly environmental security, including health and population crises. While one response might be to downsize the scope of planned modernization to reduce costs, the current regime would probably find the justification unacceptable. Their goals require great power status. Internal threats, particularly in the Caucasus, demand a capable military for deterrence as well as response. Further, another round of START arms negotiations between the United States and Russia will raise issues regarding Russia's tactical nuclear weapons arsenals that might not be negotiable for Russia unless or until modernization plans are fulfilled. Reductions in nuclear arsenals provide increased security, with reduced environmental and economic costs, while at the same time undercutting incentives for an arms race.

In the realm of nuclear energy production for domestic use, Russia signed an agreement with the IAEA (International Atomic Energy Agency) to create the world's first nuclear fuel bank. This would reduce proliferation by providing a source for about 60 countries, which might purchase low enriched uranium for industrial purposes rather than building their own capacity (NIT 2011, Russia/Nuclear Chronology 3/29/10). Russia has also announced a commitment to expand its own nuclear power production for domestic use. Whether Russian leaders will reassess that decision in the light of the Japanese disaster at the Fukushima Daiichi plant remains to be seen. Decisions about energy technologies in Russia, and in other countries, will affect the demands on and prices for Russian oil and gas. The government has given at least some research support to create affordable energy from renewable sources in the past (Tyukhov 2007). This will continue to be a major issue for Russian environmental and economic security. The reduction of the spread of nuclear materials, as well as armament stockpiles, is of benefit to the global community. It reduces risks of use, and also of mismanagement, accident, or theft.

Resources in the Arctic are another strong incentive for Russia to maintain its global power status. Melting of the Arctic's ice has opened a new trade route, and started a race for exploiting newly accessible resources. In 2010, Russia announced increased naval patrols in the Arctic Ocean to better protect its interests in natural resources in that region. Russia noted that other nations were intensely pressing their interests; a military official named China in particular. China has been strengthening ties to Norway and Iceland, and has established a research station in the

Arctic. Putin has urged nations bordering the Arctic to reach agreement on exploration of the mineral resources (Reuters 2010; RT 2010). This development highlights the security implications of establishing and protecting key natural resource rights in the Arctic. For Russia, it raises a more direct competition for resources in the region, in the context of China's 1.3 billion population compared to Russia's 142 million.

**Implications for the United States and Russia: National and Global Security**

The proposition of environmental security analysis is that survival, and therefore government legitimacy, requires that states protect citizens and provide for their security, and that environmental conditions that sustain resource availability are a fundamental component of this security.

From an environmental security perspective, both the United States and Russia face formidable challenges. There are substantial near term costs, both social and economic, to adopting more sustainable policies. Governments and political leaders—in both the United States and Russia—are not likely to make significant commitments if not pressed to do so by the public or power elites. In contrast to Russia, the U.S. public supports environmental protection, and many power elites also support, or at least do not oppose, environmental standards. The United States has a stronger legal system and violators are more likely to be held accountable; requirements to protect public health are better established as norms; some companies are able to leverage environmental requirements for market advantage or new products; and NGOs concerned with environmental issues are firmly established, bet-

ter financed and politically stronger. Russian power elites have shown no interest in embracing sustainability as a national policy principle, and environmental protection is not a significant public issue for the regime. But the future of sustainable policies in each of these states has very important implications for the other, and for global political alignments.

Global warming is bringing additional ecological challenges. Looking out to 2030, a panel of Russian experts judged that national burdens of climate change, on top of serious deterioration of its physical and human capital, will pose substantial planning, prioritization and implementation challenges for sustainability (NIC 2009). The growing effects of climate change will leave many areas vulnerable to irreversible damage and undermine Russia's valuable natural resource base. Such catastrophic developments would likely have global consequences, including reduced forestlands and wilderness areas, which act as a cleansing sink for global pollution. The energy markets upon which European nations rely could be disrupted. Political or social instability, particularly rebellion in the Caucasus, would be more difficult to contain, with repercussions spilling over into Western Europe.

If environmental insecurity undermines Russia's ability to exercise global and regional power, it will surely affect China's ambitions and Russia's ability to provide a counterweight to Chinese expansion. Russia would be less able to pursue what it perceives to be its resource rights in the Arctic, and China would likely have a much larger presence in that part of the world. Russia provides an important balance to contain China's expansion in Asia as well. A weakened Russia, particularly Russia with a dwindling and unhealthy population, would suffer severe shortages in

both intellectual capital and labor sources and be increasingly unable to maintain the integrity of the long border it shares with China. Population and resource pressures from China could prove an irresistible force. The impacts would have global significance, because of power shifts in Asia, and changes in the global balance of power. The consequences would seriously affect U.S. power and influence. A weak and inward-looking Russia is likely to feed a dynamic toward a global power shift that diminishes U.S. options, including access to the world's resources.

Some believe an improved economy will eventually bring better environmental stewardship in Russia. Others expect increasing pressures from trading partners to meet environmental standards. In either case, increased accountability would require increased collection and sharing of environmental data and greater freedom of the press. Such pressure could be effective. After the World Wildlife Fund called for a boycott of the 2014 Olympic Games in Sochi, due to environmental damages caused by construction projects, Medvedev announced that Russia would take climate change into account in preparation for the Sochi Olympic games and other international competitions. Hosting successful international games in Sochi and two other cities (Vladivostok and Kazan) is very important to the political elite in Russia, who see this as a way to project great power status and to stimulate regional regeneration (Balmforth 2010).

The United States does not have the backlog of domestic problems Russia faces, nor the ongoing environmental lawlessness. On the other hand, sustainability has not been a United States priority, which is evident in the consumption–driven economy and disproportionate use of global resources, an ongoing stalemate on energy policy, and resistance to making

commitments to address climate change. A decade of continuous U.S. involvement in global conflicts, with continuing involvement likely after most troops are withdrawn, has strained the military and drained both financial and political capital for tackling the formidable environmental security challenges that threaten national and global ecosystems.

A central concern for the United States is to develop a more sustainable energy policy. It has a vital national interest in securing and protecting energy markets, particularly oil, and has been a driving force for policies that have attracted growing international opposition from both state and non-state entities. Further, as China and India expand their economies, competition for resources is increasing, making oil markets yet more expensive. It is widely agreed that U.S. political and security interests point to the need to reduce our reliance on foreign energy, and our consumption of nonrenewable energy resources. Both military and domestic technology innovations for improved energy efficiency, though encouraging, are insufficient to compensate for the environmental burden of our economic and political policies. Environmental regulation spurred many advances a generation ago, but current challenges are more complex and costly, and political pressures have slowed regulatory requirements. The U.S. government has sought to stimulate innovation for greener technologies (see, e.g., DOE), but progress toward energy sustainability is very slow.

The environmental, economic and political challenges that will emerge in the coming decades, aside from Russia's success or decline, will undoubtedly continue to expand. Global effects from overpopulation and global warming will create increasing, potentially volatile, pressures for states in the coming decades. As extreme weather patterns become more

common, the frequency of natural disasters will increase. Natural disasters, expanding deserts, and inundation from melting polar ice caps are expected to lead to social crises in some regions. The United States will be called upon, for humanitarian and practical reasons, to respond to these crises.

While global warming promises to bring many severe global challenges, it is not the only serious threat to environmental security. An ecosystem crisis, or collapse, has historically resulted from the interaction of factors; environmental catastrophe can be triggered by climate change but also from toxic chemical buildup or resource depletion from contamination, overuse, or overpopulation, or from increased pressures as trading partners or neighboring states change important policies (Diamond 2011). U.S. sustainability challenges, for example, arise from the depletion of ancient aquifers as well as chemical use patterns that are degrading environmental quality and increasing human and animal exposures to antibiotics, synthetic hormones, and toxic substances.

The scope and intensity of environmentally related challenges will expand in the coming decades. As the number of those suffering serious disruptions and shortages increases, demands for assistance will expand, and the likelihood of desperate and hostile actions affecting the United States will increase. States, and especially great powers, need to prepare by assessing sustainability requirements and adjusting policies to maximize flexibility for dealing with dramatic changes to the global environment in the coming years. Both domestically and internationally, the need for broad-based consensus must be weighed against the urgent need for action to meet security needs. For the United States and Russia, delayed action will diminish available options.

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# 6

# Building Resiliency into the National Military Strategy

*David H. Carstens*

## Introduction

The climate is drastically changing. Global temperatures are increasing, storms are becoming more numerous and severe, and ocean levels are rising. The consequences of these changes include food shortages, fresh water scarcity, destruction of homes and a loss of life and livelihood on a previously unseen scale. The resulting social and economic unrest caused by these changes will exceed most governments' capacities to cope with the crises. This will be the spark that ignites tomorrow's regional conflicts and creates the humanitarian disasters to which the U.S. military will most certainly be drawn.

To avoid overextending the capabilities of tomorrow's military, the United States must make its allies and partners *resilient*: more adaptable to climate change and more capable of dealing with disaster response and prevention. Building resiliency into the Nation's National Military Strategy (NMS) will require a cultural shift from within, expanded partnerships with academics and scientists conducting climate change research, and reformed Security Sector Assistance. A failure to act now will only increase the inevitable military resource drain in response to tomorrow's humanitarian crises.

## Today's Reality

> Rising demand for resources, rapid urbanization of littoral regions, the effects of climate change, the emergence of new strains of disease, and profound cultural and demographic tensions in several regions are just some of the trends whose complex interplay may spark or exacerbate future conflicts.
>
> —The Quadrennial Defense Review (QDR), 2010

The QDR's prediction of future trends in an emerging complex environment is arguably more accurate than many leaders might like to believe. Whether or not we have reached the "tipping point," or that period in our history when we will be subjected to irreversible detrimental environmental consequences, is a subject of intense scientific debate (Hansen 2008). The fact is that natural disasters in 2010 killed 295,000 people and cost world economies an estimated 130 billion dollars (Barreto 2011). This 2010 data is but one point on a trend line that depicts a sharp increase in disaster reporting between 1960 and 2009 (EM-DAT 2009).

The world's exposure to natural disasters is increasing as populations expand in coastal areas and flood plains. The statistics (Figure 1) reveal that large segments of the population are more vulnerable to a dramatic increase in disasters. Data compiled by the Centre for Research on the Epidemiology of Disasters (CRED) indicates that the trend continued to increase sharply between 2000 and 2009 (UNEP 2005). The climate is changing and a confluence of worsening environmental conditions is creating the perfect storm of regional security crises and humanitarian disasters: situations to which the U.S. military will be called upon to assist based on binding cooperation agreements or because the U.S. military has the demonstrated capacity to act quickly and effectively.

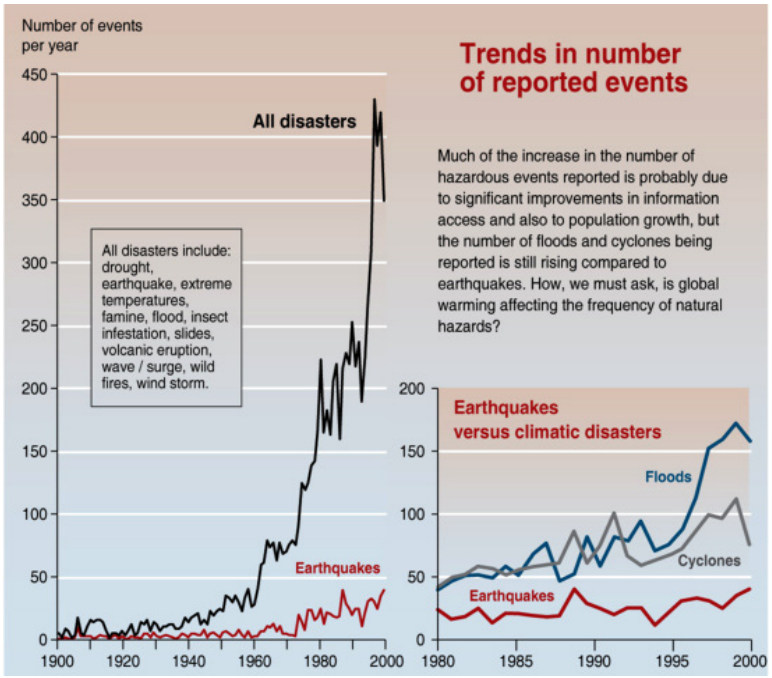


**Figure 1. Natural Disaster Trends.**
Source: UNEP 2005

Humanitarian assistance and disaster relief missions pull resources from the available force structure that might otherwise be used for defending the Nation and preparing for tomorrow's combat contingencies. In 2010, U.S. Southern Command (USSOUTHCOM) responded to natural disasters in Guatemala, Chile, and most notably Haiti where a 7.0 magnitude quake shook the country causing a reported 316,000 deaths and countless injuries and homes destroyed. To these crises, USSOUTHCOM collectively deployed over 20,220 military personnel, 24 ships, dozens of aircraft, and helped deliver millions of pounds of food and water (USSOUTHCOM 2010). The numbers of natural disasters will increase as the globe experiences the

worsening effects of climate change. This will create a further drain on available combat forces and decrease Combatant Commanders' (COCOMs) abilities to effectively plan for and execute combat contingencies.

In a landmark report issued in 2007, a panel of eleven retired senior military leaders concluded that climate change "poses a serious threat to America's national security" (Sullivan 2007). The report addressed the concern that the United States may be drawn more frequently into volatile and rapidly eroding regional situations to help provide stability before environmental conditions worsen or before extremists can exploit the situations (Sullivan 2007). One way to avoid this pitfall is for the United States to make its allies and partners *resilient*: more adaptable to the impacts of climate change and more capable of dealing with disaster response and prevention. Failing to help allies and partners build adaptive programs and preparedness will only delay the inevitable U.S. involvement to avert larger and more frequent humanitarian crises.

**Environmental Challenges and Increasing Threats**

One need only to look as far as the 2011 uprisings in Tunisia and Egypt to gain an appreciation for how resource scarcity can trigger internal unrest or even revolt against the government. While public outcry against former Egyptian President Mubarak grabbed the headlines in late January 2011, it was a dramatic rise in food prices that brought masses of protestors into the Cairo streets (Geewax 2011). From extreme flooding in Australia and Pakistan to extreme drought in parts of China, the Ukraine, Argentina and Peru, the world's major food producing countries are pressured like never before. Increased consumption by In-

dia and China is exacerbating the problem. Scientists suggest that this will only get worse. According to a 2010 study sponsored by the National Center for Atmospheric Research (NCAR), climate change will create increasingly dry conditions (Figure 2) across much of the globe in the next 30-years putting the world's food producing countries under immense stress (Dai 2010). Richard Seager, a noted climate change expert added: "The term 'global warming' does not do justice to the climatic changes the world will experience in coming decades (NCAR 2010)."

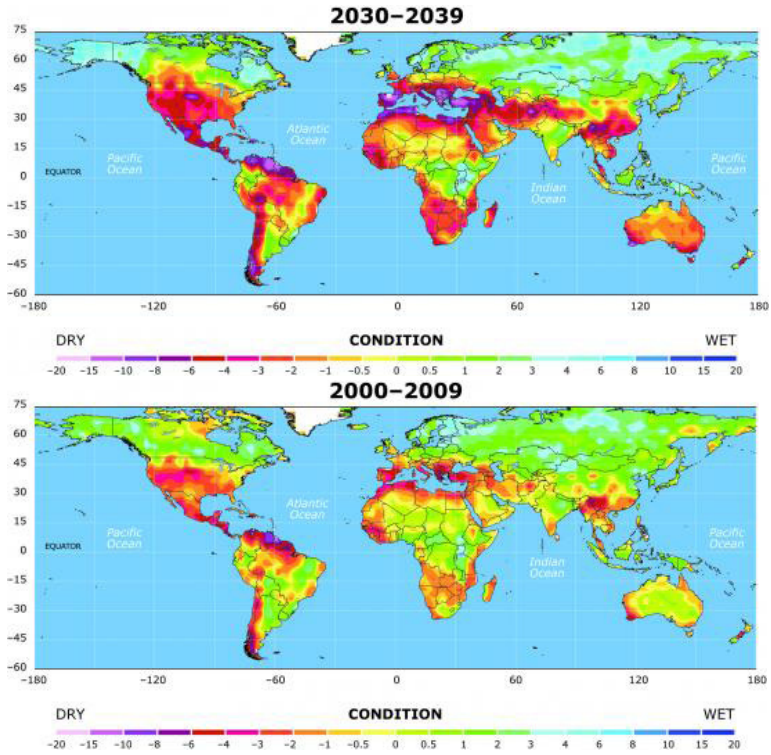


**Figure 2. Future Drought: These maps illustrate the potential for future drought over the decades indicated, based on current projections of future greenhouse gas emissions. The maps use a common measure, the Palmer Drought Severity Index, which assigns positive numbers when conditions are unusually wet for a particular region and negative numbers when conditions are unusually dry. A reading of -4 or below is considered extreme drought.**
Source: Dai 2010

As the Earth's temperatures increase, so too do concerns about water shortages. In no other area of the world are the stakes higher over water than in the Hindu Kush-Himalayan region. Scientists in India monitoring the water situation reported an alarming 38% shrinkage in the Himalayan glaciers over the last 40-years (Sethi 2009). Some experts argue that this is a phase in the natural life of the glaciated region. Nevertheless, there is ample cause for concern over this fresh water source that sustains 1.3 billion people and impacts the food and energy production for 3 billion people. The Himalayas are the lifeline for almost half of humanity (MacArthur Foundation 2010). Adding to the concern is the knowledge that three countries possessing nuclear weapons that have historical adversarial relationships border this region: China, Pakistan, and India.

According to the United Nation's (UN) Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report released in 2007, sea levels are rising and are doing so at an increased rate (Soloman 2007). Satellites have been the game changing technology in monitoring sea levels and data observed since 1993 shows that the oceans are rising at a rate of around 3mm/year (Soloman 2007). At that rate, assuming the factors of increase brought on by warming ocean temperatures and melting ice caps, sea levels in even the most conservative models could rise by one meter or more by the end of this century. What will this do to countries across the globe in the long term (20 years and beyond)? Consider Vietnam: in a projection released by the Vietnamese government, more than one-third of the Mekong Delta, where 17 million people live and nearly half of the country's rice is grown,

could be submerged (Figure 3) if sea levels rise by three feet in the decades to come (Mydans 2009).

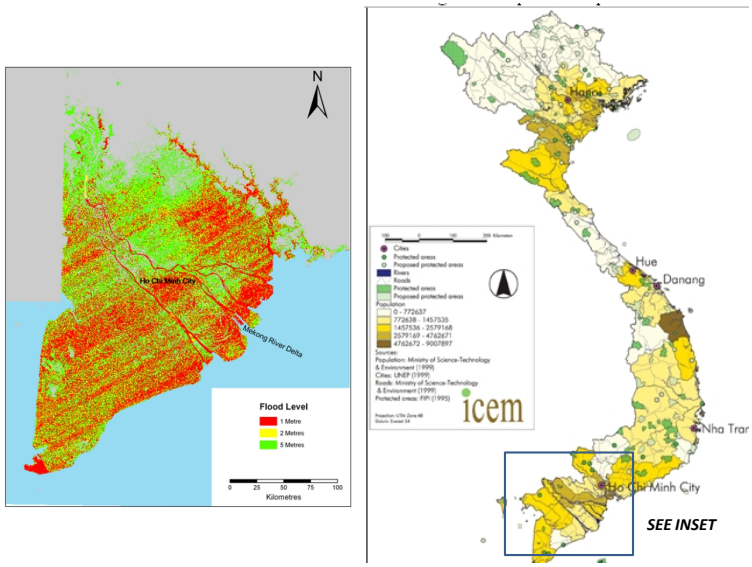


**Figure 3. Flood Predictions Vietnam.**
Source: Boateng 2009

The impacts on neighboring countries like India and Bangladesh are equally grim. Bangladesh is considered by many to be the "ground zero" of climate change with 80% of its 160 million plus inhabitants living at sea level (Banerjee 2010). In preparation for the likely mass migration of millions of Bangladeshis to higher ground, India is building a 2500-mile long wall along its border with its water threatened neighbor (Banerjee 2010). The wall and threatening policies designed to contain the population will surely bring cross-border tensions to the boiling point as nearly one-fifth of Bangladesh is threatened by rising sea levels.

Typhoons, hurricanes and their associated storm surges present the greatest near term (next 10 years) danger to countries with populations living in low lying coastal regions. Climatologists predict a dramatic increase in these events that could ultimately drive hundreds and thousands of residents from their homes (Mydans 2009). Central India has witnessed a 50% increase in the number of extreme weather events over the last 50-years (Chandrasekar 2011).

In summary, the consequences of climate change include destruction of coastal settlements and a loss of life and livelihood on a scale that could eclipse anything seen to date (Boateng 2009). In the near term, countries across the globe will face a larger number of storms of increasing intensity. In the long term, drought and rising ocean levels will create more catastrophic impacts. As one example, in Vietnam alone, a staggering 11% of the population might be forced to displace from coastal residencies in the coming decades (Dasgupta 2007). The numbers of climate refugees fleeing from Bangladesh could be even higher.

The level of immense social and economic upheaval that food/water shortages due to drought and forced migration due to sea level rise will put on countries impacted by climate change is incalculable. The resulting social and political unrest will exceed governments' internal capacities to cope with the crises in all but the most advanced countries. Even Japan, a nation with the world's third largest economy and arguably possessing the most resilient infrastructure in regards to earthquakes, is hard pressed to deal with the aftermath of the natural disasters that hit the country in March 2011. Although the Tohoku earthquake and tsunami were devastating, the impacts pale when compared to the estimated combined effects of climate

change on whole societies over the next several decades.

**Shifting the Culture**

In developing a strategy that emphasizes resiliency, the military must undergo a cultural transformation. General Casey, former Chief of Staff of the Army, spoke in 2010 about an Army "out of balance" (Casey 2010). Arguably, all of the Services are out of balance with only enough time and resources to continue planning based on the assumptions of the current wars. A mention of climate change in the 2010 QDR was a groundbreaking beginning to this dialogue. The 2011 NMS identifies "the uncertain impact of global climate change" as a challenge to both governance and natural disaster response in developing nations. Given the weight of current scientific data, the NMS grossly understates the grave impact that climate change will have on regional stability and national security. A much more aggressive approach is required to fully integrate a climate change response framework into the NMS that better addresses national security challenges.

COCOMs must begin to address the near term effects of climate change as a growing regional threat and design a coherent approach to adaptation and preparedness into their Theater Campaign Plans. For this issue to be taken seriously by Capitol Hill lawmakers, COCOMs need to more fervently identify climate change as a force protection issue. A failure to confront these risks now will cost lives and will require additional force deployments to deal with crisis response in the future.

The military must redefine what is being taught to its next generation of leaders. Most of the junior Officers who entered Service after 9/11 are focused on the lessons learned of the current war. The spark igniting tomorrow's conflicts may be less about terrorism and peer competition and more about resource scarcity and re-location of whole societies due to sea level rise. The military needs to embrace this eventuality and begin to build climate change adaptation and disaster preparedness as core competencies. Existing Joint and Service specific military planning courses must be updated to include these new core competencies into the curricula.

The military must also appropriately resource educational institutions and organizations that have the mandate to train a new generation of subject matter experts on dealing with the challenges caused by climate change. These centers of excellence need to be capable of partnering across a broad range of expertise that possesses cutting edge insights into the issues of climate change. The new breed of military "Resiliency Warriors" educated at these centers should be identified and managed under a separate functional area within their respective Service human resource systems. Integration of these subject matter experts into the strategic and operational levels of command is fundamental to the success of creating viable Theater Campaign Plans that address climate change adaptation and preparedness.

**Leading**

The Department of Defense (DOD) has the will and demonstrated capacity to lead in the area of sustainability. In 2008, The Nature Conservancy (TNC)

recognized this in its recommendations to the new U.S. Presidential Administration:

> Just as DOD has served as an engine of progress in developing and taking full advantage of information technology, it can serve as an engine of technical and policy advance related to reducing green house gases, reducing reliance on fossil fuels, greatly improving energy efficiency and conservation, and attaining energy security (Barnes 2011).

Developing adaptive capabilities and disaster preparedness in allied and partner nations, however, falls more into the area of security sector assistance, and in that arena, DOD is clearly a supporting organization. The Department of State (DOS) is responsible to lead integrated U.S. government (USG) reconstruction and stabilization efforts as directed by National Security Policy Directive (NSPD) 44. Yet, even in this supporting role, DOD must shoulder more than its share of the leadership burden in a strategy of building the capacity of the Nation's allies and partners to adapt to, prepare for, and respond to climate change. While DOS understands the foreign policy objectives as well as the cultural/political context of a particular country, it is DOD that has the logistical resources and expertise in planning and execution to drive the mission. DOD also has the experience of bringing different organizations together and forming a cohesive team.

This imperative is not about spending more money. Instead, the portion of the U.S. budget earmarked for Foreign Military Financing (FMF) and DOD's Global Train and Equip Program (Section 1206) needs to be spent more prudently as a means of confronting tomorrow's climate change impacts. Two key objectives

of FMF are to maintain regional stability and to improve response to humanitarian crises (U.S. Department of State 2011). Working within these objectives, given the overwhelming data that suggests adverse environmental conditions will trigger tomorrow's crises, a larger portion of FMF and Section 1206 funding must be jointly focused on building climate change adaptation and disaster preparedness programs in allied and partner nations.

In the case of Vietnam for example, a country that is already experiencing the detrimental effects of climate change, a portion of FMF dollars might be best spent giving the Vietnamese a means to access large data repositories of previously classified imagery and the training to interpret this imagery in order to assess the long term impacts of erosion on coastal communities. This type of soft engagement may prove more beneficial to the Vietnamese in the long term and less contentious than conventional military training and equipping to neighbors such as China.

**Partnering**

The DOD should continue doing what it does best: engaging other militaries. The focus in doing so should be expanded to include assessing allied and partner nations' military capabilities to deal with climate change adaptation and disaster response and prevention, and then systematically building their capacities to adapt and respond to these challenges effectively. Most foreign militaries are not restricted by legislation such as Posse Comitatus and they can play a larger role in support of civilian authorities. The Posse Comitatus Act is a United States federal law (18 U.S.C. § 1385) passed on June 18, 1878, after the end of Reconstruction, with the intention of substantially

limiting the powers of the U.S. federal government to use the military for law enforcement. The Act prohibits most members of the U.S. federal uniformed services from exercising nominally state law enforcement, police, or peace officer powers that maintain law and order on non-federal property (states and their counties and municipal divisions) within the United States. However, most foreign militaries have no such broad sweeping limitations on their use. The DOD must look through the optic of allied and partner nations' military mandates, and not their own, when exploring new ways to support climate change adaptation and disaster response and prevention initiatives abroad. Brigadier General (Ret.) Bob Barnes, a Senior Policy Advisor for TNC expressed similar views during his testimony before the Defense Science Board on January 13, 2011. More importantly, BG (Ret.) Barnes stressed the need to help partner nation militaries "move beyond disaster response to prevention" (2011).

Admiral Mike Mullen, former Chairman, Joint Chiefs of Staff, recognized that DOD cannot address the complex issues of climate change unilaterally. "We cannot, nor should we do this alone," he remarked in 2010. The Admiral went on to say that partnerships within the interagency, with industry, and with allies and partners will be "essential as we push the bounds of what is possible and affordable" (Mullen 2010). In this light, the U.S. Agency for International Development (USAID), U.S Forestry Service (USFS), and the U.S. National Oceanic and Atmospheric Administration (NOAA), are a few examples of potential government partners that DOD must begin to engage more broadly with regard to the issue of climate change.

The most beneficial partnerships for DOD may be with academic and scientific institutions. These non-

governmental organizations represent the vanguard of work on climate change. The International Research Institute for Climate and Society (IRI), part of The Earth Institute at Columbia University, is one such example of a potential partner for DOD. IRI works with local communities across the globe to develop and evaluate climate risk management strategies. They possess both top driven analytical assessment tools and bottom up driven feedback from local communities on climate change requirements, all of which are necessary to shape adaptation programs (Zebiak 2010). IRI has what DOD lacks: an understanding of tomorrow's environment and a strategy to deal with it.

There is already a funding vehicle in existence to take advantage of the academic capacity of institutions such as IRI. The Minerva Initiative, launched in 2008 by former Secretary of Defense Robert Gates, is a DOD sponsored university-based initiative designed to harness social science research and apply it to areas of strategic importance to the United States (U.S. Department of Defense 2011). When unveiling the program, Secretary Gates clearly articulated his desire to find untapped elements of National power in the halls of academia (Gates 2008). The problem is that Minerva has limited funding that is further at risk due to current budget constraints. What funding does exist is spent on a very broad range of issues. The single Minerva Initiative award granted in 2008 under the project title of *Climate Change, State Stability and Political Risk*, was given to an institution that conducts research almost exclusively on Africa. Finally, while the Minerva Initiative may ultimately create a consortium of social scientists conducting research on issues relevant to U.S. National security, these individuals and institutions are not directly responsive to the emerg-

ing requirements of the COCOMs: the decision makers who need the information most.

Similar invaluable partnerships exist in the private sector. The Rockefeller Foundation is a prominent philanthropic organization fully engaged in climate change adaptation projects. In 2007, the organization pledged $70-million to help cities around the world confront the dangers of increased flooding, severe droughts, and the spread of infectious diseases (Jensen 2007). The Rockefeller Foundation is involved both in climate change research as well as the funding and management of actual climate change adaptation projects focused on a combination of top driven assessments and local level requirements.

What all of these organizations lack is the unity of purpose that comes with direction. There is no established authority for bringing these sectors together. What is needed is a responsive network of academics, scientists, engineers, and philanthropists who can provide a way forward on climate change adaptation to the Chief of Mission and COCOM in a specific country.

To help drive climate change adaptation and disaster preparedness planning using this broad range of available resources, COCOMs should turn to organizations such as the Center for Excellence in Disaster Management and Humanitarian Assistance (COE DM/HA). The power of this relatively small organization rests in its broad authorities. It is a DOD organization with a global mandate that reports to the regional COCOMs (Goodman 2010). While their mission is primarily to educate, train, conduct research, and assist in international disaster preparedness, their role could be expanded to include climate change adaptation planning. The COE DM/HA could help

DOD bridge the cultural divide of working with organizations comprised of academics, scientists, and engineers. Civilians with a wide range of public-private partnership experience make up the ranks of COE DM/HA and speak the same language as those engaged in climate change research. Further, COE DM/HA can bring the whole of DOS/USAID to the table to ensure that adaptation program recommendations match foreign policy objectives.

**Reforming Security Sector Assistance**

Both Secretary Gates and Admiral Mullen openly acknowledged that engagement across the globe would be greatly enhanced by an all out reform of security sector assistance. An imperative to drive a unified resiliency strategy is the "dual-key" approach, one of several security sector assistance reform options mentioned in the 2010 QDR. Under such a proposal, projects addressing resiliency would be jointly approved by the Chief of Mission and COCOM in the field, followed by approval by the Secretary of State and Secretary of Defense. This is the only way to truly avoid redundancy, maximize the impact of limited resources, and ensure that climate change adaptation and preparedness measures are addressing the assessed security shortfalls of both the DOS and DOD.

As part of this reform, planning timelines must also be compressed. Agility is key when responding to unpredictable climate conditions. The Cold War era planning system that currently drives security sector assistance project approval is far too slow. The DOD can learn from organizations like The Rockefeller Foundation's Asian Cities Climate Change Resilience Network (ACCCRN). ACCCRN is successfully imple-

menting an aggressive two-year approach to move beyond climate change adaptation problem identification to implementation of effective urban resilience building projects. How? "The natural tendency is to invest in the thing…but there never is just one thing," said Maria Blair, former Managing Director for the Rockefeller Foundation, "The key," she went on to say, "is to embrace uncertainty and navigate within it" (Blair 2010).

## Conclusion

The impacts of climate change will increasingly put internal stresses on countries that are least prepared to deal with them and external stresses on countries like the United States that will assuredly assist. The environment is being transformed and military leaders must be prepared for the inevitable changes and their consequences. There is cultural resistance to meeting this challenge while the Nation is engaged in war. Raindrops presently kill fewer people than bullets and the wars in Afghanistan, Iraq, and Libya remain a first order emphasis. Yet, if DOD does not define a better strategy aimed at shifting resources towards building the Nation's allies' and partners' capacities to adapt to, prepare for, and respond to climate change, it will continue to be caught up in responding to disasters and regional security crises after they occur. Enabling the Nation's allies and partners to deal with the impacts of climate change will ultimately allow our out of balance military to re-set and prepare for tomorrow's threats. In doing so, the United States will strengthen the security environment, be more prepared for an uncertain future, and assure its allies and partners with a strengthened image abroad.

"The people say this was an act of God. But what comes now, they say, is the act of man. If we don't deliver, they will not forgive us" (Gall 2010).

—Governor of Punjab Province following the 2010 floods in Pakistan

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# 7

# The Consequential Challenges of Climate Change

*Corry Juedeman*

"The danger from climate change is real, urgent, and severe," states President Barack Obama in his 2010 National Security Strategy (Obama 2010, 47). Drought, sea level rise, flooding and increased extreme weather events associated with climate change may lead to competition over scarce resources of fresh water, food and habitable land. The effects of climate change are already being seen in the Arctic where the Polar Cap is melting as temperatures increase at twice the rate seen elsewhere. Climate change acts as a "threat multiplier," exacerbating existing problems such as poverty and racial or religious tensions and overwhelms the governments of already fragile, developing countries (CNA 2007). Situations may become so dire that mass migrations away from an affected area occur, thereby worsening social, ethnic and religious tensions to the point of conflict. A government incapable of providing services to its people rapidly loses legitimacy, creating a power vacuum that may, unfortunately, be filled by radical extremists looking to take advantage of the situation.

Climate change has a threefold effect on the national security of the United States. First, regional instability and failed or failing states lend themselves to an environment that radical extremists can then influence to advance their causes as has been seen in Afghanistan. Climate change has already been shown to affect regional stability as evidenced by the situations in Darfur and Chad. In Darfur, scarcities in water and fertile land have been shown to contribute to internal violence and conflict (UN Environment Programme 2009). Furthermore, conflict in Darfur has forced over 285,000 refugees into neighboring Chad, where water and other natural resources are already limited (UNHCR 2011). Second, U.S. national security relies upon

unfettered access to strategic resources such as oil. As an example, Nigeria is consistently one of the top five oil exporters to the United States, yet is subject to the same regional perils of climate change as Darfur and Chad. Any type of destabilizing event there, to include repercussions from the effects of climate change, could limit access to strategic resources and prove perilous to the U.S. economy. Finally, the United States has been and will likely continue to be the preeminent first responder to humanitarian disasters worldwide. As the average global temperature continues to rise, multiplying the effects of climate change, and as the number of extreme weather events increases, the U.S. military, in particular, may find itself overextended in providing humanitarian relief in multiple settings.

The consensus within the scientific community is that the Earth's climate is changing and that the cause for the changes is anthropogenic (National Academies, 2005). This paper acknowledges that skepticism exists outside the scientific community, yet it is beyond this paper's scope to debate causation or to provide recommendations for mitigation of anthropogenic causes of climate change. Rather, the focus will be on exploring the observed effects of climate change, citing examples of past and present challenges, and then providing a projection of future challenges likely to affect U.S. national security. Broad ranging recommendations for a whole of government and international approach to combating climate change will be provided at the conclusion of the paper.

**Background**

So what, scientifically, is climate change doing to the world? In 2007, the Intergovernmental Panel on Climate Change (IPCC) released a 3,000 page report

that indicated climate change is an "unequivocal reality," and gave several examples of evidence to support that thesis (IPCC 2007a). Among other challenges, the report cited rising average global temperatures, rising sea levels and an increasing number of abnormal precipitation events. As measured by multiple methods, the global annual average temperature rose 0.13˚C per decade between 1955 and 2005, effectively doubling the rate experienced the five decades prior whereas the eleven years between 1995 and 2006 rank among the top twelve warmest years since thermometer readings were first recorded in 1850 (IPCC 2007a). Scientists have over ninety percent confidence that average Northern Hemisphere temperatures during the second half of the 20th century were higher than during any other 50-year period in the last 500 years, and almost seventy percent certainty the temperatures were the highest in at least the past 1300 years (IPCC 2007a).

According to the IPCC, the cause of these temperature increases is a dramatic rise in carbon dioxide ($CO_2$) levels in the atmosphere since the Industrial Revolution to a level not seen in over 650,000 years (NASA 2008). Furthermore, $CO_2$ levels continue to rise at an exponential rate (Figure 1). $CO_2$ lingers in the atmosphere, absorbs infrared radiation from the Earth and reradiates this thermal radiation back to the Earth having a net warming effect. A certain amount of atmospheric heating is necessary to sustain human life, but an overabundance of carbon dioxide will cause excessive warming – an effect scientists are seeing now.

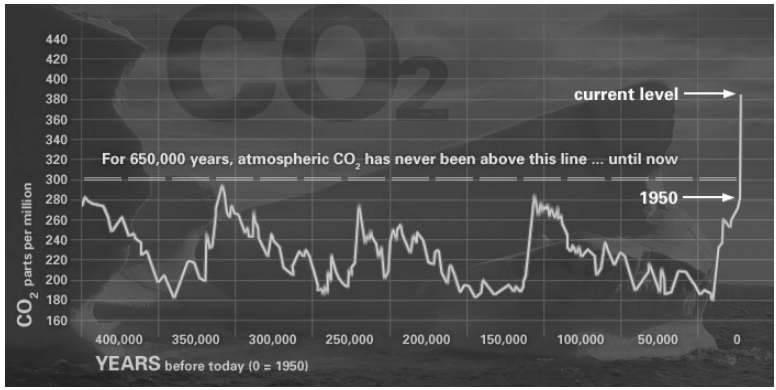


**Figure 1. $CO_2$ Level Increase over Time.**
Source: (NASA 2008)

One such effect of this warming is a rise in the global sea level. Since 1993, the global sea level rose 3mm per year— nearly doubling the previous rate of 1.7mm per year experienced during most of the 20th century. The rise in sea level has varied drastically around the globe, however, as sea levels along the U.S. Mid-Atlantic and Gulf Coasts rose 5-6 inches more than the global average due to subsiding of coastal lands (EPA 2011).

Temperature and precipitation changes vary across the planet, with some changes in ecosystems occurring at a vastly larger rate and magnitude than scientists previously anticipated. For example, the temperatures in the Arctic are rising at almost double the overall global rate, whereas in general, temperatures are rising faster over land masses than over open oceans (IPCC 2007b). Over the last hundred years, land masses north of 30 degrees latitude have experienced more precipitation while the tropics have experienced less since the 1970s (IPCC 2007b). Other evidence of climate change is demonstrated in the thawing of the northern latitude permafrost and an

increased frequency and intensity of heat waves and droughts (IPCC 2007b).

The IPCC projects global temperatures will rise by approximately 0.5 degrees Celsius in the next twenty years and 1.8° C to 4.0° C by the end of the century (IPCC 2007b). These projections are based on a range of greenhouse gas emission scenarios, but noteworthy is the assertion by the IPCC that even if emissions were capped at 2000 levels, a further warming of 0.1°C would still occur (IPCC 2007b). To put these temperature changes in perspective, consider the statement by the Director of the White House Office of Science and Technology Policy, Dr. John Holdren, that the "difference between an ice age and an interglacial period is only about 5˚C" (Holdren 2006).

Regarding global average sea level rise, conservative IPCC projections indicate an increase of up to 3 inches over the next two decades and 7 inches to 2 feet by the end of the century (IPCC 2007b). Rear Admiral David Titley, the current Oceanographer and Navigator of the Navy, has called these projections "gross underestimate(s)" and asserts that sea level rise by the end of the century will more likely be in the range of 3-6 feet (Titley 2011). Even the IPCC report itself acknowledges the conservative nature of the estimates as they are based on observed ice flow rates from the Greenland and Antarctic ice sheets between 1993 and 2003 (IPCC 2007b). More recent observations suggest warming could amplify the vulnerability of these ice sheets thereby drastically increasing projected sea rise levels (IPCC 2007b).

While a vast majority of the IPCC report was considered valid and well documented, two items in particular were refuted, and the integrity of the report was initially tarnished. Specifically, the IPCC "findings" on the melting of the Himalayan glaciers, indicated a

very high likelihood that the glaciers would disappear by 2035 or perhaps sooner if the Earth continued to warm at the current rate (IPCC 2007c). This claim was heavily scrutinized and was found to be based on a speculative 1999 news article, not actual research. Additionally, leaked e-mails between scholars at the University of East Anglia (UEA) in eastern England were interpreted as showing evidence of data manipulation (IISS 2010).

Subsequent independent inquiries and peer reviews of the IPCC report by organizations such as the InterAcademy Council (IAC), a multinational organization of science academies, showed no evidence of scientific malpractice (IISS 2010). The science was shown to be sound, with problems based primarily on procedural failures in publishing or editing. Ironically, the scrutiny imposed upon the IPCC 2007 report had the net effect of strengthening, not weakening, the scientific community's confidence in its conclusions (IISS 2010).

The report perhaps most relevant to a discussion of climate change, national security and the military is the 2007 Center for Naval Analyses (CNA) Corporation report entitled "National Security and the Threat of Climate Change" (CNA 2007). The report was generated by CNA's Military Advisory Board (MAB), composed of twelve retired admirals and generals who studied how climate change may affect U.S. national security over the next 30-40 years. A majority of these officers started the study as skeptics, yet were ultimately convinced of the reality of climate change when presented with the overwhelming scientific evidence. In particular, the MAB was tasked with addressing the following: conditions climate changes are likely to produce around the world that may be security risks to the United States, ways in which those

conditions may affect America's national security interests and finally, and actions the nation should take to address the national security consequences of climate change (CNA 2007, 6). The MAB found predicted effects of climate change to be in-line with those of the IPCC report, and asserted that conditions such as extreme weather events, drought, flooding and sea level rise would present a "serious" threat to national security (CNA 2007). Additionally, the report highlighted a key consequence of these conditions, namely that climate change acts as a "threat multiplier" for instability, worsening already poor living standards, increasing societal demands on a weak governments with insufficient capacities, thereby creating widespread political instability and increasing the chances of failed states (CNA 2007, 6).

The CNA panel's first recommendation was for national security and national defense strategies to fully integrate national security consequences of climate change (CNA 2007). An amendment to U.S. Code, Title 10, addressed this recommendation and implemented a requirement for national strategies to address the problem of climate change (U.S. Code §118 2001). Accordingly, President Obama's 2010 National Security Strategy (NSS) addresses climate change as a real danger and highlights U.S. confrontation of climate change as "based upon clear guidance from the science" and "in cooperation with all nations" (Obama 2010, 47). Additionally, the NSS gives some detail on carbon emission cuts for the near and long term, while ensuring an international effort has the necessary financing so that developing countries can successfully adapt to climate change while mitigating its impacts (Obama 2010). The current National Defense Strategy, not updated since 2008, briefly mentions climate change as one of several physical pressures to be con-

fronted over the next twenty years, and speaks to the need to "tackle climate change," yet does not provide much detail as to how that might be accomplished (Gates 2008, 5). The 2010 Quadrennial Defense Review contains perhaps the most detailed acknowledgment of climate change, stating that "climate change and energy will play significant roles in the future security environment" and acknowledging climate change as a trend which may "spark or exacerbate future conflicts" (Gates 2010, 7). The recently released 2010 National Military Strategy (NMS) is, unfortunately, critically lacking in language regarding climate change (Mullen 2011). While not specifically required by the Title 10 amendment, a more robust NMS would allow military planners to more proactively and accurately plan for future contingencies related to climate change based on higher guidance.

In June 2008, Dr. Thomas Fingar, as Chairman of the National Intelligence Council, testified to the House Permanent Select Committee on Intelligence and the House Select Committee on Energy Independence and Global Warming (Fingar 2008). In his testimony, Dr. Fingar gave a National Intelligence Assessment (NIA) on the National Security Implications of Global Climate Change to 2030. The NIA study leveraged outside climate research, working with modelers and experts from the U.S. Climate Change Science Program, the Department of Energy national laboratories, the National Oceanic and Atmospheric Agency (NOAA), the Joint Global Change Research Institute and the Naval Post Graduate School, among others (Fingar 2008). Using the United Nations IPCC Fourth Assessment Report as their primary source for climate science, the study group focused on the implications of climate change on U.S. national security and

gleaned several key observations. Specifically noted were "wide-ranging implications for U.S. national security interests" over the next 20 years (Fingar 2008, 4). Predictions indicate the United States will be less affected directly by climate change, but rather the most significant impact on U.S. national security will result from climate induced effects on other countries. Assessing that climate change alone is unlikely to trigger state failures, the NIA study did ascertain that the impacts of climate change will exacerbate existing problems such as poverty and ineffectual leadership, likely leading to conflicts over scarce water resources and environmental migration (Fingar 2008).

The U.S. Navy has led the way for the military in addressing climate change. On May 15, 2009 the Chief of Naval Operations directed the establishment of Task Force Climate Change (TFCC) and the development of an Arctic roadmap for the Navy. Since that time, the TFCC has published the Arctic Roadmap (dated November 10, 2009) and the Navy Climate Change Roadmap (dated April 2010) (Greenert 2010). Additionally, in 2010 the U.S. Navy conducted its first gaming exercise with a focus on climate-induced challenges. "Irregular Challenges 2010" brought together a diverse group of interagency experts to include military officers, climate scientists, health practitioners and water experts, all with the goal of exploring challenges and consequences of climate change, among other issues (U.S. Navy 2010). Climate-induced disasters were fed into each of the gaming scenarios and ultimately participants found climate change did in fact contribute to regional and even global instability (U.S. Navy 2010).

With the measurable effects of climate change and projected future climate changes as a background for analysis, this paper will now transition to an examination of climate change in the context of U.S. national

security. This will be accomplished by focusing on four particular challenges of climate change. The challenges to be studied are increased drought, desertification and water scarcity; extreme weather events; rising sea levels; and the melting Arctic polar cap.

**Challenge – Drought, Desertification and Water Scarcity**

Darfur is recognized by most as being the "First Modern Climate-Change Conflict" (Mazo 2010, 73). Sporadic conflicts began there in the 1980s over access to water and grazing lands, with violent fighting beginning in earnest in February 2003 (Mazo 2010). By 2007, over two million residents had been displaced to Chad, with the number of killed or wounded estimated to be between 200,000 and half a million (Mazo 2010). Assertions that this conflict began as a result of climate change have been made by Vice President Al Gore, UK Special Representative for Climate Change to the UN Mr. John Ashton, and UN Secretary-General Ban Ki-moon who stated publicly that the "Darfur conflict began as an ecological crisis, arising at least in part from climate change" (Mazo 2010, 73; Borger 2007). Drought in the northern part of Sudan drove Arab nomads southwards into a predominately agricultural area, igniting not only tribal, but also ethnic and religious tensions.

Drought has also been blamed as the root cause for the conflict in Somalia. Former Army Chief of Staff, General (Ret) Gordon R. Sullivan is on record as stating the drought in Somalia caused famine, which caused non-governmental organizations (NGOs) to arrive in an effort to provide food assistance. Local warlords started controlling the food on the black market, while letting the other side starve, which caused migration

to nearby countries, ultimately destabilizing the region (Kern et al. 2007).

An August 2009 National Intelligence Council Special Report on the Impact of Climate Change on North Africa through 2030 indicates that surface temperatures in North Africa will increase by up to 2° C by 2050, with precipitation decreasing by 10-30% across much of the desert areas of the region and larger precipitation decreases of up to 200% along the northern Africa coast (NIC 2009). Couple this with the projected population increase in Africa from 906 million to 1.9 billion by 2050, and the situation could very well be dire (Bankus and Delosua 2009). Migrations into Europe from Africa are ongoing and predicted to increase, creating significant challenges for our close European allies.

In Nigeria, the fourth largest exporter of oil to the United States, conflict between Nigerian gangs shut down nearly a quarter of the Organization of the Petroleum Exporting Countries member's oil output in 2006 (Mouawad 2007; USEIA 2011). The combination of increasing temperatures, decreasing available land for agriculture, increasing unemployment with a growing youth bulge compounded by existing social tensions and it is easy to see the "threat multiplier" effect climate change may have on this region. Particularly alarming is the likelihood of interference to U.S. access to strategic resources – in this case, Nigerian oil (Volman 2003).

Stability in the Middle East, of vital importance to U.S. national security, is being threatened by consequences of climate change and water-related issues. Already, water systems in the Middle East are incredibly stressed. Four consecutive years of drought in the Fertile Crescent area, which includes portions of Syria and Iraq, have created security concerns for national

governments who have grown more dependent upon other countries for food and water (Worth 2010). In Syria, this drought has pushed two to three million people into extreme poverty, with an estimated 50,000 families migrating from rural to urban areas in 2010 (Worth 2010). In Iraq, more than 70% of the underground aqueducts have dried up and been abandoned (Worth 2010). Challenges such as these can destabilize the moderate Muslim population in the Middle East, upon whom the United States depends for regional stability and access to strategic resources.

Another challenge to regional stability exists in the tenuous situation between India and Pakistan, two nuclear powers and eternal rivals, who have, until recently, peacefully shared the waters of the Indus River since signing a treaty in 1960 (Sharma and Wright 2010). A feud over water rights will likely upset prospective peace talks and produce yet another level of volatility. As evidence, Lashkar-e-Taiba, the belligerent group behind the 2008 bombings in Mumbai, has already begun to use the water dispute as an excuse for more anti-India rhetoric (Polgreen and Tavernise 2010). Here exists a direct intersection of U.S. national security with a challenge of climate change. It is extremely likely that future extremists will directly blame the United States and other western countries, as mass producers of greenhouse gases, for the climate change effects being felt in developing countries —just as Usama bin Laden did in a January 2010 tape (Fox News 2010). Misaligned blame such as this will fan the fires of radical extremism and may make the United States and its allies an even larger target for terrorism.

**Challenge – Extreme Weather Events**

2010 was a devastating year due in part to extreme weather events world-wide. Floods in Pakistan killed more than 1,600 people and left two million homeless, a heat wave in Russia killed as many as 15,000 or more while the grain harvest was reduced by at least a third due to drought, and nearly 1,500 people died in landslides due to months of torrential rain in China (Doyle 2010a). While scientists are reticent to directly link global warming with these weather phenomena, one study by the UN World Meteorological Organization concluded that global warming had "doubled the chances" of heat waves such as experienced in Russia (Doyle 2010a). Furthermore, scientists from the University of Reading and the Royal Netherlands Meteorological Institute believe the extreme weather events are caused by the same disruption to atmospheric circulation (Economist 2010). While no single event could be directly attributed to climate change, the exhibited pattern of increased extreme weather fits the scientific expectation of effects due to climate change (Economist 2010).

The IPCC 4th assessment asserts extreme weather events will be more common in the coming years due to climate change. Accompanying that assertion is an assumption that the U.S. military will be called upon for more humanitarian relief missions (IPCC 2007b). Dr. Joshua Busby asserted at the 2007 Strategic Studies Institute colloquium on Global Climate Change that extreme weather events are a more immediate, serious and direct threat to the U.S. homeland than rising sea levels or drought (Pumphrey 2008).

The recent earthquake in Haiti, while not obviously caused by climate change, is illustrative of the types of challenges associated with a developing

country's response to natural disaster. The United States deployed nearly 15,000 troops to the area and spent nearly $380 million between Department of Defense and USAID expenditures. Additionally, over 1,300 people died from an outbreak of cholera, with over 57,000 sickened by the epidemic, the situation compounded by Haiti's weak health and sanitation systems (Watson 2010).

Contrastingly, Chile's stronger 8.8 magnitude earthquake just a few weeks later was absorbed by the Chilean population without a requirement for a U.S. military response. The delta between the U.S. responses for disaster relief required in Chile vs. Haiti is instructive in highlighting the importance of proactive preparation, sound policy and solid governance. Hurricane Katrina proved that even a superpower such as the United States may not be able to adequately handle a natural disaster of significant scope. More likely problematic is an inadequate response to a natural disaster by a developing country's government that may be less prepared, less resourced and less credible than the U.S. government.

Certainly world opinion can have an effect on U.S. national security by fueling anti-Americanism and mobilizing would-be terrorists. A second or third order effect of U.S. participation in humanitarian assistance and disaster relief missions is the positive influence it has on the public opinions of those helped. Polls conducted by the Pew Research Center after the U.S. military's response to the 2005 tsunami in Indonesia found that the percentage of Indonesians with a favorable opinion of the United States increased from 15% in 2003 to 38% in 2005 (Pew Global 2005). A Terror-Free Tomorrow poll showed an increase in favorable opinion to 44% just a year later (Terror Free Tomorrow 2006). Similarly, favorability among

local Pakistani people following the U.S. response to the 2005 earthquake doubled from 23% pre-disaster to 46% post-disaster. Winning hearts and minds is never easy, but the successful response of the U.S. military in situations such as these has been shown to be noteworthy towards decreasing the leverage of those who would wish the United States harm, while at the same time opening the doors for greater cooperation.

**Challenge – Rising Sea Levels**

The costly combination of increased extreme weather events and rising sea levels will be particularly detrimental to coastal nations. In addition to reduced inhabitable land, decreased availability of freshwater for drinking and irrigation will cause obvious problems for the affected population and in crop production for food. Mass migrations to more prosperous areas are likely, and regardless of causation, will tend to swamp the social infrastructure of the receiving government and exceed the local capacity for sustainment.

As sea levels rise, island and coastal nations such as the Muslim nation of the Maldives, have been forced to make some difficult choices. As the Maldives is only 2.4 meters above sea level, the nation has begun saving a portion of its national income to purchase land for its nation in Australia (Ramesh 2008). Maldives has the benefit of being one of the richer island nations and can afford to be proactive and purchase a new homeland. Other nations will not be so lucky and environmental migrations for their populations will likely be more difficult and possibly deadly.

Bangladesh and India were recently listed by Maplecroft, a British global risk analysis company, as the nations most vulnerable to climate change (Doyle

2010b). Bangladesh, for example, is projected to be affected by the melting of the Himalayan glaciers, rising sea levels in the Bay of Bengal, and increased cyclonic activity (Agrawala et al 2003). The resulting migration of millions from rural to urban environments, including cross-border migrations into India, is very likely to cause social turmoil and ethnic tension. Furthermore, efforts to address climate change in this particular region are complicated by strained political relations between the governments of India, Pakistan, Nepal and Bangladesh.

While conflict in South Asia may pose an indirect threat to the national security of the United States, rising sea levels do also provide direct threats to the infrastructure of the United States. The Strategic Environmental Research and Development Program (SERDP) is pursuing a number of areas of investigation to help support the Department of Defense in addressing vulnerabilities and impacts of rising sea levels on multiple locations. SERDP determined that over thirty military installations in the United States will be affected in the coming years by rising sea levels (SERDP 2011). Additionally, coastal and island installations outside the continental United States will likely be affected as well. Specifically, flooding and the possible loss of Diego Garcia or Guam, strategic logistical bases, would be detrimental to operations in the Middle East and the Pacific Command Area of Responsibility.

**Challenge – Melting Arctic**

Perhaps the most visual example of climate change and the wide ranging implications is the melting of the Arctic Polar Ice Cap. According to the IPCC 4th Assessment, satellite data shows the annual average

Arctic sea ice coverage has shrunk by 2.7% per decade and up to 7.4% per decade during the summer months since measurement by satellites began in 1979 (IPCC 2007a). In 2007 Arctic sea ice reached its lowest levels of coverage in nearly thirty years, allowing for the complete opening of the Northwest Passage for the first time in recorded history (National Snow and Ice Data Center 2007). Scientists agree that an ice-free Arctic Ocean during the summer months could happen as early as 2030 (National Snow and Ice Data Center 2007). Surface temperatures in the Arctic have warmed almost two times as quickly as the global rate resulting in a rapid reduction in sea ice (IPCC 2007a). Dark arctic waters absorb more of the sun's energy than reflective white sea ice, and therefore, the water surface temperature is increased. The melting has decreased the surface area of reflective white ice, resulting in more dark arctic waters and creating a feedback loop that is self-perpetuating (NASA 2005).

Implications of an open Northwest Passage and increased access to the Arctic region offer opportunity and present interesting challenges. An obvious opportunity is the opening of a shorter, accessible trade and transit route between Asia and Europe. However, with this opportunity abide concerns.

The U.S. Geological Society claims that nearly a quarter of all undiscovered oil resources lay below the Arctic (USGS 2008). Arctic nations such as Russia, Canada and the United States are already making claims to these resources, as is the non-Arctic nation China (Homeland Security Newswire 2011). Accession to the United Nations Law of the Seas Convention would allow the United States, and other signatories, the legal right to claims on an extended economic exclusion zone based upon certification of an extended continental shelf. For the United States, this econom-

ic region would be similar in size to California, and would provide an enormous economic opportunity and access to significant strategic resources for the United States.

The Arctic is a largely ungoverned space and dispute exists on the international stage regarding ownership and responsibility for the region. That is to say, Canada regards much of the area as within its territorial waters while other nations, the United States included, regard the area as international waters. Additional challenges in the Arctic include the risks of terrorist activity in the vast ungoverned space, as well as the environmental disaster associated with an oil spill or the complications of a major search and rescue operation in the Arctic.

**Recommendations and Conclusion**

Climate change presents a variety of high probability/high consequence scenarios that are already affecting and will increasingly affect U.S. national security. General Paul Kern, former Commanding General of the U.S. Army Materiel Command, is on record as stating that the threat of climate change "… demands a military problem solving-like approach" (Kern 2007). The U.S. military and its senior leadership would be negligent to ignore, yet prudent to plan for these scenarios now. While much uncertainly still exists as to the specifics of climate change – how rapidly it will happen, where it will strike, how devastating the effects will be—military leaders "cannot wait for certainty," and must plan based on current predictions (CNA 2007, 7).

Six broad categories of recommendations, modeled closely around the Navy's Climate Change Roadmap framework, but modified to reflect a whole of gov-

ernment and international approach, are highlighted below to include: assessment and prediction; strategy, policy, plans; operations, training and partner engagement; investments; communications and outreach; and adaptive capability and capacity (Greenert 2010). All recommendations are intended to have the desired effect of improving U.S. and partner capabilities and capacities in order to decrease the likelihood of regional instability, allow unfettered access to strategic resources and proactively prepare for response to climate-induced disasters.

**Assessment and Prediction**

***Recommendation 1:*** U.S. government entities must have current environmental assessments in order to develop a clear understanding of the effects of climate change on the environment and to plan effectively and efficiently. Toward that end, the Navy's Arctic Roadmap recommends the establishment of a permanent interagency partnership to synchronize environmental assessment and prediction efforts in the Arctic environment (Greenert 2009). This paper recommends formalization of that partnership and expansion of its tasking to provide worldwide impact assessments.

***Recommendation 2:*** Leverage use of the State Department's Interagency Conflict Assessment Framework (ICAF) process to provide an on the ground assessment of where climate change stressors may already be affecting societies. This process involves face to face interviews with members of a given society and from that conflict drivers and opportunities for engagement can be derived. This assessment would be useful to assist in properly resourcing adaptation efforts and improving local and regional governance where needed.

**Strategy, Policy, Plans**

A holistic understanding of climate change based on current and future environmental assessments above would allow for more robust and accurate policy development and planning. Initial policy recommendations and planning cannot wait for certainty and must be started now.

***Recommendation 3:*** Recommend the U.S. Army, U.S. Air Force and U.S. Coast Guard follow Navy's lead in developing Climate Change Roadmaps for their respective services.

***Recommendation 4:*** Recommend military plans for combating climate change be synchronized at a centralized organization – namely, the Joint Staff J5 directorate. The J5 staff is already respected amongst Combatant Commander and Service staffs, and carries the functional responsibility for policy and plans.

***Recommendation 5:*** Recommend organization and stand-up of a Joint Interagency Coordination Group for Climate Change (JIACG-CC) at each Combatant Command. Conceivably each JIACG-CC would include interagency partners, military members and regional climate change specialists working towards the common goal of developing sound policies, strategies and plans for a specific region.

***Recommendation 6:*** Recommend the Chairman of the Joint Chiefs of Staff include climate change language and direction for strategic and operational planners in future versions of the National Military Strategy.

## Operations, Training and Partner Nation Engagement

***Recommendation 7:*** Include climate change science and strategic considerations in core curriculum of all Service Academies, Reserve Officer Training Corps (ROTC) units and Senior Service Schools.

***Recommendation 8:*** Recommend all U.S. military services incorporate climate-induced disasters and projected climate change impacts into wargames and table-top exercises.

***Recommendation 9:*** Recommend enhanced military to military engagements in order to help professionalize partner nation military forces while at the same time creating legitimacy, capacity and good governance for military and government. The benefits of prior U.S.—Egyptian military engagements were evident during the Egyptian crisis in February 2011.

***Recommendation 10:*** Recommend broadening of the Navy's Africa Partnership Station model to provide education on climate change and adaptation techniques.

Partnerships must be fostered and information shared in order to increase the capacity of response and resilience to climate change in nations around the globe. Combating climate change will require a multilateral, inter-agency, "all hands on deck" effort.

Furthermore, recommend the Partnership Station model and methodology be incorporated into Southern Command, European Command and Pacific Command Theater Security Cooperation Plans. While these commands differ slightly in capacity, capability and focus from the Africa Command, the concepts of education and training of partner nations from this platform, particularly in the climate change realm, would be extremely beneficial.

## Investments

***Recommendation 11:*** Recommend U.S. Army and U.S. Air Force initiate Capability Based Assessments focused on projected force structure and capabilities required to effectively accomplish future missions under a changing climate, and impacts to installations and infrastructure due to sea level rise and extreme weather events.

***Recommendation 12:*** Recommend Navy and Coast Guard formally initiate resource planning for ice-strengthened vessels and icebreaker vessel capability.

## Communications and Outreach

***Recommendation 13:*** The scientific reality of climate change, its causes and its effects, must be strategically communicated to as wide an audience as possible.

***Recommendation 14:*** Recommend outreach to environmental businesses, corporations and Non-Governmental Organizations to leverage work on adaptation techniques and enhance cooperation.

## Adaptive Capability and Capacity

***Recommendation 15:*** The U.S. military will be unable to act unilaterally in the future when faced with an overwhelming number of humanitarian situations as a result of climate change, while possibly dealing with the effects of climate change on the American home front. The United States is likely to, and should, continue to respond as able to humanitarian disasters around the world where the United States has national interests, not only because it is the humane thing to

do, but because of the marked difference it makes in international opinion.

In conclusion, climate change is real, it is happening right now and has already affected or exacerbated situations around the world. Scientists agree that the conditions of climate change are only going to worsen in the coming years. Therefore, it is a vital national interest for the U.S. government, and its military, to expend resources now to better model the projected effects of climate change. Furthermore, the United States must accept its role as a world leader and properly plan for worldwide operations based on these projections, while increasing the capacity and legitimacy of international partners.

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# 8

# Sustainability and States: Climate Change and Sovereignty

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## Introduction

> The impact of migration on conflict is a man-made problem; the way migration is managed (or not) can determine its potential for mitigating or escalating a conflict (Leuprecht 2008-2009, 38).

In one very particular way—migration—climate change will test the resilience of states. Unmitigated, the impact could weaken the international system, both inducing and leaving it more vulnerable to armed conflict (McKinley 2008). The test will come if climate change, already a main threat to maintaining progress in human development (United Nations Development Programme 2010), forces very large numbers of people to look for stable, secure, and sustainable conditions elsewhere. The test will become critical if migration crosses borders, such as will occur if island nations disappear beneath rising seas or if states or parts of states become uninhabitable and fracture or fail.

Uncontrolled movement of people across borders is anathema to sovereignty. International law makes little allowance for forced migration. The complexity of and slow pace for making international law compels us to ask whether a sustainable state system can be maintained if we do not start soon to make room for environmentally dispossessed peoples.

The international system was not designed for and cannot peaceably accommodate migration on the scale that climate change, combined with other factors, may produce. Under international law, states enjoy a near absolute sovereign right to control migration. History, both ancient and modern, amply illustrates the inclination of states to jealously guard the prerogatives of territorial integrity and inviolable borders.

Indeed, national security and the organized armed forces of states are premised on this cardinal orientation. A system that champions closed borders is not well-suited or easily adapted to more fluid movement of peoples.

Climate change, fast- and slow-moving, is underway in many regions, and is primed to accelerate. The pace, scale, and uncertainty surrounding climate change make the future look more variable, less predictable, more unstable, and less secure, and by those measures—and others—increasingly unsustainable. Nothing of this magnitude climatologically has occurred during we humans' relatively short time in being (National Science Foundation 2009).

Prognoses for climate change that were fanciful in 2010 may be modest in 2050 and obsolete by 2100. Climate change will bring us to new tipping points, causing or contributing to resource shortages, and sparking resource conflict, as 40 per cent of intrastate armed conflict over the last 60 years has been (United Nations Environment Programme 2011a). This would place an ever increasing large number of persons at risk and likely put many in motion, and on collision course with others. Dispossession is only one aspect of climate change, but may be the most significant.

High population density is a consistently strong predictor of armed conflict, higher, in fact, than resource scarcity (Raleigh and Urdal 2008-2009). Low Gross Domestic Product is the most reliable predictor (Raleigh and Urdal 2008-2009). Factors that cause population density to increase and wealth to decrease, as environmental dispossession may do, must therefore be regarded very carefully, especially when an ethnic majority's demographic dominance is challenged (Leuprecht 2008-2009).

Environmental dispossession has potential to reconfigure the geo-political landscape—its borders and perhaps sovereignty itself. Sustainability necessitates that the transformation be peaceful. Climate-related migration (or "ecomigration") (Reuveny 2007a) should be permitted to occur where it must. International law, must accommodate re-settlement from states that disappear or collapse, in whole or in part; the opening of once frozen frontiers to exploitation and settlement; and, migration within, from, and to those places, temporarily or permanently. Most acute is the need to address cross-border migration. The status and rights of environmentally dispossessed persons, and the corresponding authority and obligations of states, must be defined in law.

The challenge will be great. Ecomigration in large numbers over a lengthy period will be a much harder proposition on a planet of nine to ten billion people than anything that has gone before (Gillis and Dugger 2011). Unmanaged and clouded in legal ambiguity ecomigration, within the larger strategic context of risks, threats, and vulnerabilities, could trigger or aggravate armed conflict, albeit more likely of a non-international character (within a state) than of an international character (between or among states). The international community, comprised of states disposed and in many cases pledged to defend territorial integrity, is unready and inflexible. It will take much time to make necessary changes in law, policy, and attitude.

We will begin by looking at the right of states under international law to preserve territorial integrity. Next, we will look at the law governing migration, and finish by considering the scope of climate change and ecomigration, and what strains may arise.

## The Effect of Climate Change on the International System

Territorial integrity is an essential element of sovereignty, but impedes migration. A vital question climate change poses is whether ecomigration requires that this element of sovereignty be re-conceptualized.

## The Modern State System: Sovereignty in the 21st Century

In this section we will review the concept of sovereignty and begin to explore what climate change may mean for the state system.

Few terms in international law are more difficult to define than "state" and "sovereignty." In May 2009, the United Nations High Commissioner for Refugees stated:

> [T]here is no internationally agreed definition of what constitutes a state, [but] there is agreement…that there must be territory inhabited by a permanent population under the control of an effective government (United Nations High Commissioner for Refugees 2009a).

Sovereignty and the state are essentially one: a state is a polity established to exercise sovereign authority. Customarily and by treaty (Convention on the Rights and Duties of States 1933), a state must have defined borders, and within those borders a state possesses supreme authority and a monopoly on the use of force. In short, a state's borders are inviolable. International law, domestic law, and state practice all reflect this fundamental premise. A state, subject to few exceptions, decides who gets in, and may use force to maintain its integrity, character, and indepen-

dence. No surer route to armed conflict exists than by an assault on sovereignty through an invasion of territory; such would be an unlawful act of aggression Article 2 (4) of the United Nations Charter proscribes.

In sum, the modern (i.e., post-Westphalian) state system is composed of political, juridical entities possessing inherent right to exclude others. Centuries of state practice reveal that territorial integrity and border inviolability are jealously and sometimes dearly guarded prerogatives. From the Great Wall of China to the Berlin Wall and the U.S.-Mexico border, states have fortified themselves against outsiders who, or whose influence, they wish to exclude. Legalistic methods are also used, ranging from oppressive prohibitions of dictatorial regimes such as North Korea to more benign but sometimes discriminatory immigration laws and treaties of Western democracies.

Globalization and transnational security threats, among which climate change is counted, are trends with growing significance for national security and human security. But while these trends are undeniable and likely unstoppable, states remain at the heart of the international system. They, along with intergovernmental organizations such as the United Nations and myriad other treaty bodies, are the core constructs upon which international law is built, implemented, and enforced. It seems inconceivable that anytime soon that states will become irrelevant or abandon territorial integrity as a *modus vivendi*.

Inviolable state borders may hinder peaceful adaptation to climate change. Climate change has already put people in motion in modest numbers, voluntarily and involuntarily, temporarily and permanently. Looking ahead, in 2014, to what a Fifth Assessment Report of the Intergovernmental Panel on

Climate Change (IPCC) may predict, compared to its 2007 Fourth Report, the number of ecomigrants could reach a billion (International Organization for Migration 2011a; International Organization for Migration 2008a). It's not the numbers alone that are problematic.

Climate change will also likely mean fewer habitable places. Many regions will be affected—possibly irreversibly—by sea-level rise, desertification, and other adverse changes (International Organization for Migration 2008b). When coupled with resource depletion, environmental degradation (e.g., pollution and soil exhaustion), and other factors, climate change may cause vulnerable places to tip from marginal to unsustainable to collapse. As this happens, people will move.

Moderating conditions in resource rich Alaska, Canada, Greenland, and Russia, not to mention the Arctic Ocean itself, will become more attractive, perhaps irresistibly so. As this century becomes the next, a great migration may begin, born of the push and pull among climate change winners and losers. The difference between this and great migrations of the past is that sovereign states now stand in the way. Will the Kremlin allow vast numbers of Chinese to occupy and exploit eastern Siberia, or will it fight to preserve Mother Russia? Will Canada absorb ever growing numbers of Americans and Central Americans, or will it harden its border with the United States? The likelihood is that most states will try harder to seal their borders than to open them.

Peace, stability, and security depend on a state system that is able and willing to produce and maintain them. Climate change—the amalgamation of environmental risk and security risk (United Nations Environment Programme 2011b)—is a compelling reason to

re-examine what is required, what flexibility states and the state system must acquire or enhance. It's time to address how sovereignty, by impeding ecomigration, may add to the conflict-inducing pressures of climate change. No piecemeal solution will do; a fundamental paradigm shift is required. A planet of self-protective climate change winners and increasingly threatened climate change losers is ripe for conflict.

A new meaning of sovereignty must be devised, one that promotes stability, security, and sustainability—above territory—in a world in flux.

**Environmental Dispossession**

Environmental degradation, resource scarcity, and climate change could generate migration on a scale the international community is ill-equipped to prevent or manage (Morton et al. 2008). Climate change will produce complex impacts—direct, indirect, and cumulative—with first, second, and third order social, economic, and political consequences. The symbiotic interaction among climate change, resource scarcity, and environmental degradation will be pernicious. By further upsetting the equilibrium on which sustainability depends, it will complicate human security and national security in ways with which we're only beginning to come to grips, and mostly too slowly to mitigate in any appreciable way.

Emphasis has shifted to adaptation, where ecomigration may play a positive and a negative role (International Organization for Migration 2008b). Mishandled, ecomigration may cause or aggravate conflict by contributing to environmental degradation and resource scarcity, increasing vulnerability (Morton et al. 2008). Well managed, free of legal impediments,

ecomigration could be a useful adaptation mechanism. Climate change will challenge states and peoples to be resilient in the face of resource constraints and deteriorating conditions. Resource scarcity and environmental degradation, which climate change will amplify, led Indiana University professor Rafael Reuveny to coin the term ecomigration. Ecomigration, he observed, may generate conflict throughout the cycle (Reuveny 2007a).

Worse, the conflict is likely to be of high intensity (Reuveny 2007b). Indeed, the bigger and faster the migration, the greater the potential for conflict (Reuveny 2007b). Ecomigration will presumptively originate in underdeveloped, failing, and failed states, i.e., the ones most vulnerable to climate change in the first place (Reuveny 2007b). A compounding factor is that poor states, ones that depend disproportionately on the environment for sustainment (e.g., agriculture), are particularly conflict prone (Reuveny 2007a).

Climate change is a multi-causal, multi-dimensional phenomenon: extreme weather events (e.g., in the U.S. in 2005 and Pakistan in 2010); encroaching seas that over-wash entire island states or portions of land-based states, big and small, affecting major population centers or features on which maritime zones and seabed claims are measured; and, creeping desertification, especially that which, due to unsustainable irrigation, reduces the productivity of major food-growing regions. All of these conditions, and others, may precipitate or aggravate migration, temporary and permanent, within a state and across borders (Betts 2009). What is left behind may or may not be remediable, and if not, the flow cannot be reversed. This consideration—irreversibility—has not yet received much attention, but should.

## Security and Climate Change

Climate change and resource scarcity—their effects, in combination—are indirect causes of armed conflict (Evans 2010). Indirect does not mean insignificant, however. While climate change and resource scarcity are unlikely to cause international armed conflict (IAC), chances are improving that they will materially contribute to the risk of non-international armed conflict (NIAC), the most prevalent form of armed conflict anticipated this century. NIAC, despite its name and legal basis, may involve the militaries of many states and extend to multiple states. NIAC, which could look and feel very much like IAC, is heavily shaped and influenced by transnational threats (Harvard University 2011).

Climate change is a borderless threat (Reveron and Mahoney-Norris 2011). It is among those described, principally by human security theorists, as transnational and non-traditional. The security environment, these writers contend, has changed and is changing, requiring that more attention be paid to subnational and transnational threats than to peer-on-peer competition. Solutions to these problems, they assert, must operate within and across states, in an integrative approach focusing not only on threats to human security and national security but also on collaborative opportunities for peacebuilding (Khagram et al. 2003).

Sovereignty and traditional national security, inseparably wedded to border inviolability, were never designed for these circumstances. Borderless threats cannot be stopped at a border. Environmentally dispossessed persons can be stopped, but the conditions—the risks, threats, and vulnerabilities—that forced their migration will cross borders with impunity. Such conditions, exacerbated by the effects of eco-

migration (even if it remains internal), will undermine the stability and legitimacy of states on both sides of the border, increasing the risk of NIAC and IAC, the adverse effects from which will further confound the situation.

## State Sovereignty and Ecomigration in Volume: Between a Rock and a Hard Place

The fate of states may depend on how far and how fast ecomigration will go.

### The Authority of States to Control Migration

It is not only the law relating to states and persons on land that should be examined further. Although it is beyond the scope of this article, the law of the sea should also be considered because it, too, is grounded heavily in state sovereignty, as the 1982 United Nations Convention on the Law of the Sea amply illustrates. The health of the seas is vital to human survival and good reason to reconsider whether the seas should be divided and exploited according to sovereignty (Vidas 2011).

International law, domestic law, and state practice are legal barriers to migration, but states' prerogatives, though broad and powerful, are not unfettered. International human rights law is being interpreted, advocated, and in some cases applied in ways that reflect a developing consensus that human rights are slowly and selectively gaining ascendance over state rights. Climate change is reason to consider further, and possibly adjust, the balance between state prerogatives and individual rights.

In November 2010, U.N. High Commissioner for Human Rights, Navi Pillay, remarked:

> Although states have legitimate interests in securing their borders and exercising immigration controls, such concerns do not trump the obligations of the state to respect the internationally guaranteed rights of all persons (Pillay 2010).

The proposition that there are internationally guaranteed rights of all persons is easier to say than to apply. The guarantees that apply to any particular case depend greatly on the citizenship of the person concerned. The obligations of and constraints on a state (by treaty, customary international law, or domestic law) govern, which vary widely from state-to-state.

At present, there is no internationally guaranteed right to migrate from one state to another. Persons are not free to move and shift allegiance unilaterally. A strict and confining legal regime governs these things.

People cross borders and remain there—lawfully—only by sufferance. Even a partial list of recent treaties gives the impression that toleration for migration and respect for human rights are growing, which as to obligated states parties is true, but customary international law is less permissive. For example:

- International Convention on the Elimination of All Forms of Racial Discrimination (1969);
- International Covenant on Civil and Political Rights (1976);
- International Covenant on Economic, Social and Cultural Rights (1976);
- Convention on the Elimination of All Forms of Discrimination Against Women (1981);
- Convention against Torture and Other

Cruel, Inhuman or Degrading Treatment or Punishment (1987);
- Convention on the Rights of the Child (1990); and
- International Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families (2003).

The latter, to which the United States, Canada, Russia, India, Brazil, China, and most European countries are not states parties, purports to confirm a right to "leave any State," but conveys no right of entry (International Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families 2003).

Migrants are not a favored or much protected class (Commission on Human Security 2003). In many peoples' minds "migrant" conjures up the idea of disadvantaged persons who cross international borders, too often illegally, for primarily economic reasons. Witness the fear, anger, and recrimination generated by ongoing immigration pressures from Africa to Europe and Latin America to the United States. Other types of migrants, those who may be described as forced migrants, displaced persons, refugees, or stateless persons, are nominally better protected (International Organization for Migration 2011b). States, it seems, are more willing to accept humanitarian obligations towards persons whose presence is involuntary, on account of adverse conditions or compulsions beyond their control, especially if the obligations are temporary. But even refugees and stateless persons have no right to enter per se.

The Convention relating to the Status of Refugees (the Refugee Convention) entered into force in 1967 (Convention relating to the Status of Refugees and Protocol relating to the Status of Refugees 1967).

Canada, Russia, Brazil, China, and most European countries are states parties but the United States is not. The United States, however, along with 144 others is a state party to the Protocol that also took effect in 1967 (Convention relating to the Status of Refugees and Protocol relating to the Status of Refugees 1967). The Protocol expanded the convention beyond post-World War II Europe.

The Convention relating to the Status of Stateless Persons (the Stateless Persons Convention) entered into force in 1960 (Convention relating to the Status of Stateless Persons 1954). Brazil, China, and most European countries are among the 66 states parties but the United States is not. Both treaties provide a variety of protections but neither guarantees entry; the Refugee Convention prohibits expulsion of those entitled to its protections.

Environmentally dispossessed persons would be more akin to refugees or stateless persons than to economic migrants. It is therefore not inconceivable that environmentally displaced persons, in narrow circumstances, might qualify as refugees under the Refugee Convention (United Nations High Commissioner for Refugees 2009b). Indeed, as several island states already fear, environmentally dispossessed persons could soon become stateless. When statehood ceases, the population is rendered stateless (United Nations High Commissioner for Refugees 2009a). Stateless, environmentally dispossessed persons will have no legal right to migrate to any other state, no less another state of their choosing. Only if they are accepted will they receive the protections of human rights law and, if applicable, the Stateless Persons Convention.

If the scope of environmental dispossession is limited to a few island states, the international community should be able to absorb the relatively modest

numbers of migrants without difficulty. A number of complex legal issues would still require resolution, however. As a general rule, a population and government that move to another state would be entirely dependent on the status the receiving state accords (United Nations High Commissioner for Refugees 2009a). Would the migrating population and government retain some measure of sovereignty as a stateless state (viz., without territory)? Would the migrating state form a union with the host state, or would the host state cede territory? And what status would the migrants have, single or dual nationality?

The International Organization for Migration (IOM) proposes that environmentally dispossessed persons, both internally displaced persons and cross-border migrants, be labeled "environmental migrants" (The International Organization for Migration 2011c). IOM, among others, asserts that environmentally dispossessed persons should not be labeled refugees because they do not meet the requirements of the Refugee Convention (Morton et al. 2008). While true, it may be that refugee status, due to its association with forced relocation, is conceptually apt, especially if statelessness also occurs. One approach would be to expand the definition of refugee to include environmentally dispossessed persons.

IOM asserts that "[a]ll persons moving for environmental reasons are protected by human rights law" (The International Organization for Migration 2011c). This is also true, although the assertion is more a statement of aspiration than legal fact. Environmentally dispossessed persons are entitled to a variety of legal protections when they reach a new country, but a right to permanent residence is not among them, and admission to the new country may be denied without

recourse at the border. While denial of entry may also occur in the case of refugees, refugees are more likely to be admitted and retained.

What's different about climate change is that there may be no going back only going on, perhaps from country to country, in legal limbo—an ecological Diaspora. History instructs that the greater the legal ambiguity, the more at risk of exploitation such persons will be. A concern for receiving states is that the numbers of environmentally dispossessed persons desiring permanent residence may be unsustainable and if allowed would tip those states, or hasten the tipping of those states, into collapse. Much like survivors in a lifeboat, receiving states will not likely take on so many others that the ship of state is swamped and all go under.

One option is to add a protocol to the Refugee Convention that treats environmentally dispossessed persons substantially the same as refugees. Another option would be a treaty dedicated expressly to environmentally dispossessed persons. The key question is whether a new treaty or an additional protocol to the Refugee Convention would guarantee admittance. Today it would seem unlikely, if not absurd, that states, the United States among them, would agree to accept an unlimited number of environmentally dispossessed persons, however compelling their circumstances. Only if individual rights and state obligations are balanced and sustainable would bestowing a right to migrate be workable.

As mid-century approaches, the orientation of states may change dramatically. If states, the United States among them, begin to experience significant climate change pressures and substantial internal ecomigration, tensions will rise at home and relations with even peaceful neighbors may deteriorate. The push

and pull from climate change losers to climate change winners will grow in intensity. At that point the international community must make a fateful choice: will the state system, facing growing resource scarcity and worsening environmental degradation, fight to preserve itself in an every-state-for-itself fashion, or will it opt for a collaborative approach based on global sustainability?

Not until states perceive that the question is one of human survivability at sustainable levels, will the prerogative of territorial inviolability be surrendered. The question we must ask now is whether sufficient reason exists to act anticipatorily, to pave the way for the paradigm shift that must occur. The precautionary principle, on which so much of domestic and international environmental law and policy is predicated, offers ample reason.

Experience in the environmental movement beginning in the late 1960's and early 1970's cautions that only disaster overcomes inertia (reluctance to accept a new paradigm). Climate change has not yet produced the number and severity of disasters needed to galvanize the international community into action to mitigate climate change, no less enact an adaptation mechanism as novel as a right of environmentally dispossessed persons to migrate. Work on such a legal regime must nonetheless begin, so that implementable solutions are ready when states become ready—or are forced—to embrace them.

Sustainability must underlie the rights of persons and the obligations of states. A disproportionate burden may fall on climate change winners, the eight Arctic states, for example, but there may be no better humanitarian option. At all stages, effective controls will be essential, to ensure stability, security, and sustainability in transition. These will vary from the

simple and legalistic, such as a mechanism for renunciation and acquisition of nationality (*United Nations High Commissioner for Refugees 2009a*), to the complex and fundamental, such as whether to allow collapsed states to remain as legal fictions or whether to permit the return of ungoverned territories on a scale not seen since the early 19th century.

**More People, Fewer Places**

Ecomigration is no simple phenomenon. Its causes are several, interwoven, and complex (Hugo 2008). To date, environmental factors alone have not driven, and for the foreseeable future will not drive, ecomigration beyond temporary internal moves related to extreme weather events, Hurricane Katrina in 2005, and the floods in Pakistan in 2010, for instance. Soon, however, the growing world population and accelerating trajectory of climate change may cause environmental factors to play a greater role in stimulating ecomigration while concomitantly constraining the options to address it.

The Earth has more people than ever before, and its population will grow more than 32 per cent by 2050 (Evans 2010). Climate change, coupled with population density, resource scarcity, and environmental degradation, is likely to mean that fewer places will be habitable. And the fewer places there are to live, the more unbalanced and volatile various regions could become. Moderating conditions in the high Northern and low Southern Hemispheres may off-set the loss of habitable areas between the Tropics of Capricorn and Cancer, but continued population growth could largely negate the gain. Migration patterns, first internal and then external, often from rural settings to urban, and from underdeveloped states to developed

ones, can already be projected to run through some of the most populous regions, in Asia, for example, debilitating weak states and weakening strong ones.

In April 2009, the Inter-Agency Standing Committee, addressing itself to the Executive Secretary of the United Nations Framework Convention on Climate Change (UNFCCC), in anticipation of the 15th Conference of Parties in Copenhagen, wrote:

> The scale of the potential humanitarian challenge that climate change will present in the future is staggering: Almost two billion people now depend on the fragile ecosystems found in arid and semi-arid areas and which are expected to experience further increases in water stress; some 634 million people, one tenth of the global population, are living in low lying, at-risk coastal areas.
>
> …
>
> The effects of climate change are also expected to have an impact on the patterns of population movement and settlement. There are no reliable estimates of the magnitude of future population flows but it is believed that between 50 and 200 million people may move by the middle of the century, either within their countries or across borders, on a permanent or temporary basis. Numbers will be higher if the IPCC's worst-case scenarios materialize. Much of the movement will be to urban areas where local service capacity may be overloaded. While migration may be a form of adaptation for some, the many millions forcibly displaced by sudden and slow-onset disasters will be particularly vulnerable, requiring substantial humanitarian assistance and protection (Inter-Agency Standing Committee 2009).

Underlying this call to action on global warming is recognition that approximately a third of the world's current population is tied to fragile ecosystems and at-risk coastal areas, and that even slow-onset climate

change could wreak humanitarian disaster. As the global population increases from six to nine or ten billion (Gillis and Dugger 2011), the prospects for human calamity in these areas magnify. Consider the Asia-Pacific region where four billion persons—60 per cent of the world's population—already live. If large-scale ecomigration occurs here, and there are several places at high risk, the numbers of persons involved will truly be "unprecedented" (Asian Development Bank 2011).

The IOM, though acknowledging uncertainty, estimates that 25 million to one billion people will be displaced by climate change over the next 40 years (International Organization for Migration 2011d). Most of this, IOM believes, will be internal migration and much of that will be temporary; a great deal will be rural to urban, which creates special challenges to sustainability (International Organization for Migration 2011d). Even so, this does not strongly suggest that individual states or the international community would be much at risk, and there is a normative framework, the General Principles on Internal Displacement, that addresses it (Deng 1998). Will the second half of the century be the same or different? Globalization and climate change may actually combine synergistically to spur more cross-border migration (Hugo 2008).

There is obvious danger in predicting climate conditions beyond 2050, but that is where our focus must lie. If climate change does not abate, but rather accelerates, as it seems almost certain that it must, four decades will be little time to shift from a humanitarian/disaster relief orientation to a long-term adaptation approach, with all of the changes to international law, policy (domestic and international), and strategy (grand and military) that will be required to deal with "unprecedented" dispossession of peoples. Imagine

how additionally complicated the situation would be if major powers such as the United States and China were themselves heavily affected by climate change, a possibility that cannot be ruled out. A 2010 World Bank report concludes:

> At all levels, from local to global, climate change and scarcity issues will force decision-makers – and, ultimately, individual citizens – to make choices between intensifying zero-sum competition and increasing cooperation in rules-based orders (Evans 2010).

International consensus and cooperation will unquestionably be necessary. There is no precedent for loss of the entire territory of a state or the permanent exile of all or most of its population (United Nations High Commissioner for Refugees 2009a). New rules must be written for a problem whose scope will likely be much greater than the loss of a few small island states. Critically important is that the new arrangement be sustainable, make ecomigration easier, and meet the requirements of human security and national security. Climate change adaptation will compel the greatest reengineering project ever. As the locus of Western civilization was once the Mediterranean Sea, in little more than 100 years time it may be the Arctic Ocean.

## Conclusion and Recommendations

The effect of climate change on the international state system will be pronounced, and in one particular way—ecomigration—will directly challenge a bedrock tenet of state sovereignty and national security: territorial integrity. Changes to international law should therefore be made, starting soon, to permit ecomigration to occur when and where it must. A system that

champions inviolable borders against a borderless (or transnational) phenomenon like climate change is unsustainable. The likely effects of ecomigration suggest strongly that states must adopt a new paradigm, grounded in human security that will facilitate ecomigration as an effective adaptation mechanism in itself, and not react to it as a threat to national security. Uncontrolled, a mass exodus of peoples is both unsustainable and conflict-inducing.

The international state system is unprepared for, and has inadequate change mechanisms to respond to the movement of peoples climate change may induce. The effects of climate change, not alone but in combination with other factors, will impact three of the key components of state sovereignty: territory, permanent population, and effective government. Two related trends are significant: increasing population (and thus increasing population density) and decreasing habitable land (as will occur due to sea-level rise, desertification, environmental degradation, and resource scarcity). Taken together, these effects and trends will test the resilience of states. A sustainable solution will require greater flexibility toward territorial integrity, greater rights for environmentally dispossessed persons, or both.

An essential element of a sustainable solution is consensus on what status environmentally dispossessed persons should be given under international law, and whether that status should be accompanied by a right to migrate under enumerated circumstances. Environmentally dispossessed persons are likely to be sufficiently unique in circumstance that a separate convention addressing individual rights and state responsibilities should be preferred. Though environmentally dispossessed persons are similar in some

ways to refugees, there are marked differences, one of which would be the fact climate change may preclude a return to the place of origin, especially if exigent statelessness forces the migration. Unarguably, the rights of ecomigrants and the obligations of receiving states must be balanced; an unsustainable solution has no chance of gaining acceptance and every chance to fail even if accepted.

The prevailing view of climate change and ecomigration is that the risks, threats, and vulnerabilities associated with each are modest, and that ecomigration is and will be primarily a temporary, internal phenomenon associated primarily with extreme weather events and other short-lived conditions. While it is notoriously difficult to make predictions 40, 50, or more years out, careful attention must be paid to climate change's long-term trends. The time it takes to and the complexity associated with changing international law, policy, and attitudes are appreciable. Work on a sustainable solution must begin now, and states, embracing their responsibility to protect, must choose the solution. Survival—through mechanisms of climate change adaptation—is a human right to which state sovereignty and national security must be partly subordinated but not abandoned.

One dialog that must be expanded is that between security strategists and migration advocates, each of whose work in the cross-cutting arena of climate change must inform the others. Whereas environmentalists and sustainable development proponents have already begun to consider the security implications of climate change in depth, the efforts of those interested in migration should be encouraged. Ecomigration, more than any other form of displacement, is shaping up to be a leading issue of the 21st and 22nd centuries.

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# 9

## PURSUING THE DELTA
## Maximizing Opportunities to Integrate Sustainability in the Funding Process

*Kimberly A. O'Keefe*

## Part I. Establishing the Context

### *Recognizing Sustainability as an Operational Necessity*

The Chief of Staff of the Army, General Casey, described the evolving character of persistent conflict to have trends that include failing states, resource demand, climate change and globalization (Casey 2011). Further, he states that "[f]uture conflicts will be unpredictable and may arise suddenly, expand rapidly into unanticipated locations, and last for unexpected durations" (Casey 2009, 27). The common denominator in these threats is the need for quick response forces that are sustainable at a level beyond our current capability that is vulnerable due to dependence on liquid fossil fuel among other things. Sustainability has evolved in the Army vernacular. It was formally introduced in the 2004 Army Strategy for the Environment that used sustainability as its foundation paradigm with a systems approach for the Triple Bottom line: Mission, Environment and Community (Schoomaker and Brownlee 2004, 1). Over the past 7 years, leadership has come to the realization that the triple bottom line is a concept that extends well beyond environmental stewardship. In fact, it is applicable to every contingency scenario in the Army's deployment plans. Sustainability is a capabilities enabler by enhancing the lethality, agility, versatility, and interoperability of the force. In addition, it is now synonymous with survivability for both deployed soldiers and host nation populations due to the critical nature of natural resources and operational energy needs.

Reducing reliance on fossil fuels has been a national goal for several years for both environmental

and security reasons. However, the campaigns in Iraq and Afghanistan have demonstrated that this reliance is an even greater immediate and high consequence event for deployed military forces. Hundreds of casualties each year are being inflicted on our forces in Iraq and Afghanistan during resupply convoy missions (AEPI 2006, 3). The Feb 2010 Quadrennial Defense Review (QDR) recognizes the importance of sustainability with both climate change impacts that exacerbate global instability and threaten domestic infrastructure as well as the imperative need for operational energy security. The Feb 2010 report states:

> Energy efficiency can serve as a force multiplier, because it increases the range and endurance of forces in the field and can reduce the number of combat forces diverted to protect energy supply lines, which are vulnerable to both asymmetric and conventional attacks and disruptions (Gates 2010a, 87).

In May 2010 the Vice Chief of Staff of the Army (VCSA) and the Under Secretary of the Army approved the Army Sustainability Campaign Plan (ASCP) and directed that it be an "…organizing principle integrated across the Department's missions and functions to: Institutionalize sustainability in doctrine, policy, training, operations, and acquisitions" (Chiarelli 2010, i). The ASCP defines sustainability through the following 4 tenets:

1. Developing, producing, fielding, and sustaining materiel that is more energy efficient, is capable of using renewable energy resources, minimizes the use of hazardous materials, and generates less waste.
2. Ensuring the Army has sufficient access to training and testing resources and incorporat-

ing sustainability into operational planning and execution, so the Army can continue to effectively train today and in perpetuity.

3. Expanding our commitment to sustainability by instilling sustainable practices into all levels of our Soldier and Civilian education programs
4. Providing services and operating facilities in a manner that reduces consumption of energy, water, and other resources, promotes the use of renewable energy sources, enhances quality of life, and continues to protect the environment (Chiarelli 2010, 1).

In addition, a key point on the integration of sustainability in the operational environment lies in the implementation of the recently published Army Counterinsurgency Manual, FM 3-24. In austere locations every power source is a concern, not just petroleum. Basic services rely on some source of power and the more sustainable the fuel source, the more reliable the service. Equipment used by U.S. forces is frequently used to establish initial life support services for host nation populations whose infrastructure has been devastated. These services are vulnerable unless self reliant. The more resilient these services are, the more effective our operations are. FM 3-24 section 8-39 states:

> When U.S. forces restore and transition essential services to the HN [host-nation] government, they remove one of the principal causes insurgents exploit. This action greatly assists the HN government in its struggle for legitimacy. Competent leaders can expect insurgents to conduct attacks against restored services (FM 3-24 2006, 8-13).

Our units in theatre can bear witness to the need for sustainability better than any manual, policy or white paper can ever articulate. The need is real, it is immediate and it must be part of our funding decisions in order to deliver it.

### *Challenges of Fiscal Efficiencies and Process Transparency*

The challenge many see is how to incorporate a requirement for sustainability when the defense budget is facing drastic unprecedented cuts. Obviously there is no new funding to support a whole scale overhaul of equipment and facilities to make them suddenly sustainable. Indeed, there is not enough funding to even completely maintain the current Army inventory… and that is before Secretary of Defense Gates' efficiencies are implemented. In August 2010, Secretary Gates called for a comprehensive review of how all services operate with a goal of identifying $100 billion in efficiencies over the next 5 years from all the services (Gates 2010b). He provided a statement on 6 Jan 2011 that $29 billion of the $100 billion would come from the Army (Gates 2011). In addition to these cuts, the supplemental appropriation "Overseas Contingency Operations" (OCO) is projected to end by FY17 (Casey 2011). This creates an extremely tight budget for the Army. Any validated requirements that are not able to shift into the base budget will become completely unfunded.

This also means that scrutiny of funding decisions will be plentiful. Already the Department of the Army undergoes several external audits on an annual basis and nearly every program is subject to this examination. Important to realize is that the massive public

interest in sustainability progress will likely drive Congressional inquiries to focus on the degree to which sustainable options were considered in Army investment decisions. Auditors will want to see that the Senior Leader decisions were based on criteria that adequately reflected soldier resilience on the battlefield and environmental stewardship everywhere the Army operates.

In addition, in May 2009, President Obama signed Executive Order (EO) 13514, Federal Leadership in Environmental, Energy, and Economic Performance. This order outlines goals and responsibilities for each agency to include requiring a designated Agency Senior Sustainability Officer. Secretary of Defense designated Under Secretary of Defense for Acquisition, Technology and Logistics, USD (AT&L) for the Department of Defense (DOD). Secretary of the Army designated the Under Secretary of the Army for the Army. Each of these positions is tasked with several actions through the EO to implement sustainability within their agencies. Important to note is that they are also responsible for transparency of their efforts in achieving these actions. The EO states specifically: "Finally, it is also the policy of the United States that agencies' efforts and outcomes in implementing this order shall be transparent and that agencies shall therefore disclose results associated with the actions taken pursuant to this order on publicly available Federal Websites" (Obama 2009, 1).

The operational need coupled with a declining budget and demand for transparency will force staffs at all levels to make a conscious effort to ensure they have performed adequate due diligence of including sustainability considerations within their existing decision processes.

## Part II. Planning, Programming, Budget and Execution System (PPBES)

The development and vetting of the Program Objective Memorandum (POM) through the PPBES process is an institutional battle drill within the Army. The POM is the central document that assigns resources against specific requirements once all of the staff analysis is complete through the PPBES process (Army Force Management School 2006, 21). The PPBES process is complex, overlapping and integral to every program in the Pentagon. It starts with senior leader guidance and works its way through a labyrinth of staff analysis, briefings and finally fiscal recommendations. This chapter will not attempt to address the entire process, rather it will focus on three elements within the process that are integral to the transformation of guidance into staff recommendations: the Technical Guidance Memorandum (TGM), the Program Evaluation Groups (PEGs) and the Cost Benefit Analysis (CBA).

### *Guidance from The Army Plan (TAP) to the Technical Guidance Memorandum (TGM)*

The Army Plan (TAP) has 3 portions that directly impact the funding process: The Army Strategic Planning Guidance (ASPG), the Army Planning Priorities Guidance (APPG), and the Army Programming Guidance Memorandum (APGM). Collectively these parts provide Senior Leader guidance on planning and programming elements for the budget cycle. An initiative must be consistently captured in the TAP to demonstrate a top leadership priority for funding and indeed discussion of sustainability initiatives has

emerged in the 2011 version. Leadership has provided a clear foundation for the staff to actively pursue sustainability through their guidance in the ASPG and the APPG. Starting with the draft 2011 ASPG one can see that "Invest in Energy Security and Sustainability Programs" is one of 17 "Near Term Objectives for 2011-2012" (DA G3/5/7 2010a, 10). Further, the draft ASPG contains a strong message on the importance of investing in sustainability through the following implementation measures under this objective:

1. Focused investments on energy efficiency, renewable energy and assured access to reliable energy on installations, operations and weapon systems;
2. Reduction of energy consumption through improved management decisions; and
3. Reduction of dependence on fossil fuels and improving water management practices (DA G3/5/7 2010a, 10).

The next part of the TAP, the APPG, provides a priority for the key initiatives based on the four Army Imperatives: Sustain (Soldiers, Families and Civilians), Prepare, Reset, and Transform. Sustainability is addressed under the Transform imperative. The draft APPG contains the following verbiage:

> Consistent with Army Senior Leader Guidance, the Army must continue to transform its usage of power and energy for weapons systems and operations. Contingency operations over the past few years have amplified the vulnerability of reliance upon liquid fuel to support operations. Energy Security at home and in the theatre is an operational imperative that is a capabilities enabler. It is vital that the Army develop and deploy systems that make more efficient usage of fuel and energy, allow the incorporation of alternative

> sources of energy, and enhance or expand the capabilities of our operations (DA G3/5/7 2010b, 9).

The APGM is part III of the TAP and further defines the senior leader guidance for the programming activities of the senior staffs. The APGM is drafted by the Deputy Chief of Staff G-8 Program Analysis and Execution (PA&E). All justifications for requirements must align themselves with the APGM to be competitive for validation and then actual funding. This is the key document in the POM cycle for resource managers to focus their efforts as they analyze their data and translate their funding requests in terms of the priorities it highlights. If a requirement cannot be related to the guidance in the APGM, it stands little chance of getting recognized in the validation process. Annex A of the APGM is "Guidance to Program Evaluation Groups (PEGs) and Commands." Obviously this is a golden opportunity to insert language requiring sustainability considerations be a priority. The draft APGM 12-17 contained the following reference to sustainability in Annex A:

> Review and determine critical requirements for the Army Energy Security program ensuring the program provides the total cost of the proposal, the benefits that will result, and the proposed resource strategy (DA G8 2010a, A-4).

This language is not as strong as the verbiage in the ASPG and the APPG. Since it is the focus for the PEGs, it would be much more effective in the programming and budget process to have this verbiage in Annex A of the APGM clearly articulate the active role the PEGs should take in their reviews for ensuring sustainable

options were part of the analysis, particularly since it can impact multiple programs. The role of the PEGs is pivotal in the development of recommendations for Senior Leader budget decisions so it is paramount that the guidance they receive adequately reflects emphasis on sustainability.

Guidance to the PEGs is further defined in Appendix C of the APGM which is the "Technical Guidance Memorandum" (TGM). The TGM "outlines program intent and provides specific guidance to the Program Evaluation Groups with respect to resource allocation" (DA G8 2010a, C-1). The first draft of the POM 12-16 TGM addresses a 50% increase in Energy Security Resource Allocation from FY12 to FY16 of $60M (DA G-8 2010a, C-5). This is a positive step of course. However, in the "General Guidance" portion of the TGM the only reference to "Energy Initiatives" described the following two points:

1. Complete all metering required by the Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007 by 2012 within existing resources.
2. Any new utilities privatization requirement must have a favorable, DASA-CE certified, Cost-Benefit Analysis and gain approval of Three-Star BRP prior to incurring any commitments (DA G8 2010a, C-20).

Certainly these efforts are important, but unfortunately this verbiage was significantly diluted from the emphasis on the drive for renewable energy or sustainable alternatives that were voiced in both the ASPG and the APPG. This illustrates a very important and critical opportunity that exists with the drafting of the APGM and TGM to influence the work of the PEGs. Language consistent with the intent of the ASPG and

APPG needs to be inserted in the "General Guidance" portion of the TGM to emphasize the responsibility of the PEGs and commands to include sustainability options wherever possible in requirements that could potentially utilize them. Ensuring consistent emphasis on sustainability throughout these key documents is essential in the PPBES process.

Lastly, the APGM drafted for the 2012-2017 POM devotes an entire appendix to the CBA requirement (DA G8 2010a, E-1). In this appendix it would be appropriate to insert language to add sustainability and energy reduction to the CBA evaluation criteria. This will be discussed further in the CBA section below.

### *Program Evaluation Groups*

One of the biggest exercises in the PPBES process is the review process at the Department of the Army (DA) level of all requirements first by Management Decision Package (MDEP) and then by Program Evaluation Group (PEG). As discussed above, guidance for the PEG chairs comes from the APGM and the TGM. There are six PEGs and they correspond to the major functional areas (manning, equipping, training, organizing, sustaining and installations). All programs within those areas are broken down into smaller program packages called MDEPs. Resource managers prepare detailed data analysis to justify their funding requirements that undergo intense scrutiny at the MDEP level that then culminates at the PEG briefings. The PEG committees consist of co-chairs from the functional area and corresponding secretariat staff as well as a member from the G-3, PA-E, and ASA(FM & C) see figure 1 (DA G8 2010b).

| PEG Name | Co-Chair for Policy | Co-Chair for Requirements |
|---|---|---|
| Organizing | ASA(M&RA) | AASA |
| Manning | ASA(M&RA) | DCS, G-1 |
| Training | ASA(M&RA) | DCS, G-3/5/7 |
| Equipping | ASA(A&LT) | DCS, G-8 |
| Sustaining | ASA(A&LT) | DCS, G-4 |
| Installations | ASA(IE&E) | ACSIM |

**Figure 1. Program Evaluation Group (PEG) Leadership**

These committee members have the responsibility of conducting tedious reviews of volumes of data, to include the new CBA. The committee vets the material and determines which requirements to recommend to leadership for validation and funding. In order to provide leadership with a consistent evaluation of sustainability and energy security related considerations it would be most effective to add a staff member from the ASA(IE&E) office to the equipping, training, sustaining and installation PEGs. This member needs to be a subject matter expert in the sustainability area and would provide consistent evaluation of the objectives in the ASPG and APPG, (for the Installation PEG it would be in addition to the senior staff Co-Chair who comes from ASA(IE&E)).

This is particularly important in light of a recent change to the POM process that changes it from a biennial review to an annual review (Lynn 2010, 1). The intent is to have the most current review possible of the next year's budget requirements because the needs in theatre have been changing so rapidly. All requirements will undergo a thorough analysis on an annual basis with the realization that funding is decreasing. This change will likely result in the PEGs putting a lower priority on requirements that do not provide a return on investment (ROI) within the new annual budget review cycle. This could put sustainability initiatives, whose full ROI typically spans several years, at a significant disadvantage unless there is committee membership that has expertise in this area. In addition, many sustainability requirements are too new to be incorporated in the requirements generating models such as the installation base requirements generating model. These will need to be reflected as line items in the MDEP and PEG briefs. In order for such line items to compete for validation and funding their impacts need to not only be articulated well by the program manager, but also understood by the PEG committee.

Finally, this committee member would provide substantial support in the review of CBA to identify gaps in analysis where sustainable options could/should be inserted to provide full due diligence of the courses of action.

### *Cost Benefit Analysis*

In December 2009, the VCSA and the Army Under Secretary co-signed a memorandum to the Army staff mandating a standardized CBA be conducted on every new initiative or adjustment to an existing require-

ment that exceeds a threshold of $25M (DA G8 2010a, E-2). The CBA is now an integral step in the programming process as requirements are vetted through each stage of justification. The Deputy Assistant Secretary of the Army for Cost and Economics (DASA CE) has developed a Cost Benefit Analysis guide and provides blocks of instruction to teach resource and program managers how to build CBAs using a standardized format. The standardized format is a necessity to compare competing requirements against the same standard. In addition, with the fierce competition for funding, reviewers at all levels have begun to require a CBA. This makes it the ideal opportunity to insert sustainability considerations in the funding analysis. The basic goal of the CBA is balance as shown in the following diagram (DASA CE 2010, 7).

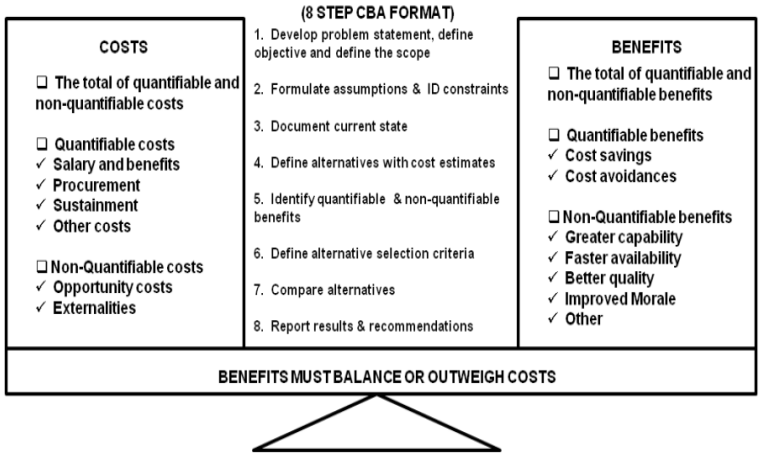


**Figure 2. Cost Benefit Analysis**

This diagram is taken directly from the DASA CE Cost Benefit Analysis Guide and demonstrates that total benefits must equal or outweigh total costs. In the center of the diagram are the 8 steps of the stan-

dardized format, listed in more detail below (DASA CE 2010, 12).

1) Develop the problem statement; define the objective and the scope
2) Formulate assumptions and identify constraints
3) Document the current state (the status quo)
4) Define alternatives with cost estimates
5) Indentify quantifiable benefits and non-quantifiable benefits
6) Define alternative selection criteria
7) Compare alternatives
    a) Compare costs and benefits
    b) Define trade-offs and billpayers
    c) Identify second and third order effects (cause and effect)
    d) Perform sensitivity analysis and risk assessment
8) Report results and recommendations

A simple example would be a request that had pure quantifiable costs and quantifiable benefits so that the equation was straightforward and purely numerical. As one might expect, such a simple analysis is rarely the norm. Much more common are the requirements with complex considerations that are both quantifiable and non-quantifiable. Sustainability requirements can be captured in the quantifiable benefit category when they result in cost reduction, cost avoidance and productivity improvements. However, they also tend to encompass non-quantifiable benefits because of their far reaching impacts to soldier survivability and ecosystem health that are not easily assigned a dollar figure.

### *Non-quantifiable Benefits and 2nd and 3rd Order Effects*

It is essential that resource managers and reviewers in the MDEP and PEG briefings have a solid understanding of the role of non-quantifiable benefits in the CBA so that they are adequately addressed. Minimizing or leaving out non-quantifiable benefits will result in unsatisfactory analysis on which to base leadership investment decisions. The DASA CE CBA guide lists examples of non-quantifiable benefits such as improved morale; compatibility; improved quality and security; and improved readiness (DASA CE 2010, 31). Non-quantifiable benefits of sustainable solutions certainly include soldier security and improved readiness, but they can also include numerous other benefits regarding health and resilience not only of the soldiers but of the ecosystem and surrounding community who share the same natural resources.

These impacts can also be considered second and third order effects. The CBA guide states: "In addition to the primary intended consequence of a decision, there can be second and third order effects. The concept of second and third order effects is based on a sequential cause and effect relationship" (DASA CE 2010, 47). Non-quantifiable benefits are closely linked to second and third order effects because of the impact an initiative may have on stakeholders, frequently the public. This can be true for domestic initiatives on bases with the surrounding community and for non-traditional base camps in host nation settings. Factors such as reduction or elimination of toxic waste in water or the preservation of air quality by methods that don't involve burning waste clearly have a positive impact on health risk for soldiers as well as local

populations. This impact to stakeholders is a second order effect that results in the non-quantifiable benefit of reinforcing supportive relationships with the population, which becomes a third order effect. These types of second and third order effects can potentially expand exponentially for larger initiatives and so will the corresponding non-quantifiable benefits.

Of note here is the emerging concept of Ecosystem services. The Army manages over 13 million acres of land in the United States. Ecosystem services can be described as "the benefits of nature to households, communities, and economics"(Boyd and Banzhaf 2006, 1). They include recreation, agricultural irrigation, wetlands banking, water purification and may soon include greenhouse gas credits for forested areas. Much work is being done in the public and private sector to identify numerical values for various ecosystem services. However, until those values are further developed, these services should be considered under the non-quantifiable benefit category as appropriate for CBAs which involve changes to Army real estate.

### *Fully Burdened Cost*

As mentioned at the onset of this paper, sustainability can often equate to survivability. Significant work has been done to quantify the key factors involved in delivering fuel and water to end users on the battlefield, including force protection. This is referred to as the "Fully Burdened Cost" typically of fuel (FBCF) or water. The concept of FBCF received strong attention from the Defense Science Board Task Force when they were tasked to study the Department's dependence on liquid fuel and its impact in an operational environment. The Task Force conducted

their first study in 2001 and strongly recommended that the FBCF be included in both the acquisition and PPBES processes (Defense Science Board 2008, 3). A memo signed by the Under Secretary of Defense for Acquisition, Technology and Logistics on 10 April 2007 directed that the Fully Burdened Cost of Energy be immediately included in the "trade off analysis conducted for all tactical systems with end items that create a demand for energy and to improve the energy efficiency of those systems, consistent with mission requirements and cost effectiveness" (Krieg 2007, 1). The memo further directed that the policy would begin via a pilot program to "develop the most effective business practices to incorporate the fully burdened cost of energy into acquisition decisions" (Krieg 2007, 1). The Defense Science Board Task Force produced a follow-up report in Feb 2008 that reinforced its earlier recommendations that the FBCF still needed to be fully implemented in both the acquisition and the PPBES processes (Defense Science Board 2008, 63).

To date, many tools for the FBCF algorithm have been developed to include a "Sustain the Mission Project (SMP)" sponsored by the Army Environmental Policy Institute (AEPI) and developed in conjunction with DA G4. A sample case study for the SMP for the FBCF is a Tactical Hybrid Electric Power Station (THEPS) based on supporting a Sustainment Brigade in Iraq. The THEPS example consists of power from a solar array, wind turbine, diesel generator and a battery. The study results indicate a potential fuel savings of over 138K gallons per year by utilizing the THEPS (AEPI 2008, 2). This would directly result in a reduction of convoy missions. Deputy Assistant Secretary of the Army for Cost and Economics (DASA CE) is working to establish annual guidance for FBCF cost

figures for use in analysis of alternatives and is using the framework developed by the SMP project as a key source of its annual guidance. It is abundantly clear, that an analysis without the FBCF is incomplete for any initiatives that depend on liquid fuel. The DASA CE approved tools and annual FBCF figures need to be added to their CBA Guide under the Appendix D "Cost Estimating Models and Tools" so that they are recognized by and available to the entire resource management community.

The SMP project has also studied factors to fully capture the cost of water. Similar to the FBCF analysis, the SMP model for Fully Burdened Cost of Water (FBCW) includes factors for the cost of force protection (AEPI 2008, 3). The FBCW SMP tool and methodology enables the user to compare attributes of emerging technological solutions in contingency scenarios. This decision support tool would also be an effective addition to the DASA CE CBA guide.

Another effort to quantify sustainability costs has been underway in the subject of waste management in contingency operations, also sponsored by AEPI. Building upon the concepts in the SMP project, the waste management decision support tool provides a close look at the fully burdened cost of managing solid and hazardous waste as part of life support services (AEPI 2010a). This is a considerable challenge for our deployed soldiers when the most common options consist of either burning solid waste or paying host nation contractors to pick it up and often dispose of it in close proximity to drinking water sources. This would be another useful tool to contribute to the DASA CE CBA Guide.

So integral is the concept of Fully Burdened Cost, particularly that of liquid fuel, that it should be in-

cluded in all operational planning models as these ultimately feed requirements discussions. In November 2010, a study on the comprehensive deployment planning and analysis of alternatives process was conducted. This study is entitled the Methodology and Analysis for Energy Security in Military Operations (MAESMO) and one of its focuses was the FBCF within key operational models. The study was conducted by the Office of the Assistant Secretary of the Army for Installations, Energy and Environment in conjunction with DA G4 and in coordination with CASCOM, CAA, AMSAA, TRADOC-TRAC and of course, DASA CE. The results of the study showed that these organizations already have the capability to integrate FBCF in their models but until it is fully standardized this integration will be on hold. An example of MAESMOs findings was that by simply adding allocation rules and planning factors for alternative/renewable energy to CASCOM's data sets this would in turn enable the studies conducted by CAA to incorporate sustainability factors in their models (AEPI 2010b, 37). The finding of the MAESMO study points out how relatively minor updates to the Army's basic models can result in a significantly more comprehensive look at the FBCF. These agencies already understand the importance of such updates and are ready to execute once the FBCF factors are formally certified.

**Part III. The Acquisition Process**

The Army Acquisition system is governed by several documents but its central direction comes from the Federal Acquisition Regulation (FAR), the Defense Federal Acquisition Regulation (DFAR) and DODI 5000.02. It is a very complicated process which this

chapter will in no way attempt to address in its entirety. However, there are numerous aspects of this vast process that could better incorporate sustainability considerations. This chapter will focus on a few key opportunities, starting with the basic ESOH documentation.

There exists within the Acquisition system framework already a well known and executed requirement for a Programmatic Environment, Safety, and Occupational Health Evaluation (PESHE) that is required of all programs regardless of their Acquisition Category (ACAT). The purpose of the PESHE is to incorporate ESOH management early in the acquisition process not only to ensure that legal responsibilities are fulfilled but also to enhance performance, sustainability, deployability and reduce total ownership cost (DAU 2010). It seems the obvious location to insert emphasis on goals from the ASCP, particularly tenet 1: "Developing, producing, fielding, and sustaining materiel that is more energy efficient, is capable of using renewable energy resources, minimizes the use of hazardous materials and generates less waste." Indeed, this meshes well with the content of most PESHE documents already. The PESHE must be integrated into the systems engineering process and per DODI 5000.02 it is required at Milestone B, C and the Full Rate Production (FRP) Decision Review (DAU 2010). A diagram of those milestones (figure 3) follows (DOD USD AT&L 2008, 12).

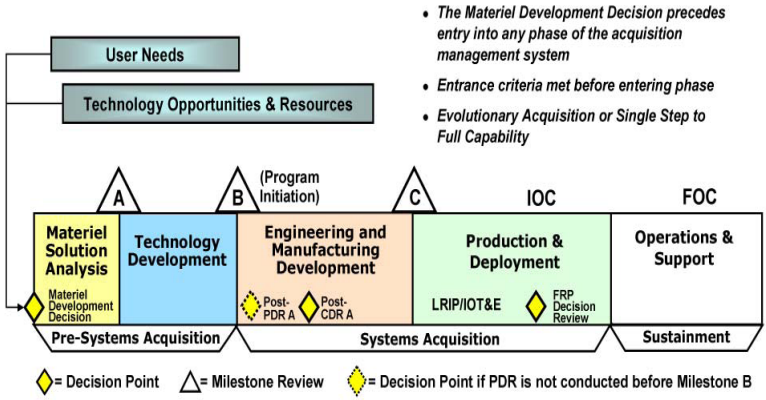


**Figure 3. Acquisition Milestones**

However, there are opportunities to increase the focus on sustainability in the acquisition process much earlier in the life cycle. Once again it starts with leadership emphasis from the highest levels.

### *Joint Capability Integration and Development System (JCIDS)*

All of the opportunities thus far are a systematic progression of integrating sustainability into the institutional processes starting with senior leader guidance. However, a truly dynamic opportunity to move sustainability forward in large steps exists through the JCIDS process because of its direct link to major acquisitions (DAU 2010). CJCSI 3170.01G describes the objective of the JCIDS process is "to ensure the capabilities required by the joint warfighter are identified with their associated operational performance criteria in order to successfully execute the missions assigned" (OCJS 2009, A-2). Capability gaps are defined as requiring either a materiel or a non-materiel solution.

Materiel solutions of course require an acquisition effort and must go through a series of steps to identify all the characteristics needed by the solution to fulfill the operational capability gap. Key Performance Parameters (KPPs) are integral to the JCIDS process as they are the most significant characteristics of the material solution system. A formal recommendation by the Defense Science Board in their 2001 study, and re-emphasized in their 2008 report, was the need to establish and implement an Energy Efficiency KPP. Progress has been made in the form of a pilot effort as directed by the 2007 memo from Undersecretary of the Army (AT&L), but full implementation has yet to be instituted as results of the pilot continue to be reviewed (Defense Science Board 2008, 24).

Instituting an Energy Efficiency KPP would have far reaching impacts. There is tremendous potential for increased combat effectiveness if energy efficiency and interoperability were reinforcing factors in the Functional Area Analysis (FAA). The FAA is the first step of the JCIDS process and defines the tasks needed to achieve operational success when building the capabilities package (Defense Science Board 2008, 40). If weapons, equipment and life support systems were designed so that energy source parts were multifunctional, interoperable and adaptable to renewable energy sources then the versatility of batteries, microgrids and powerpacks (to name a few) would be enormously increased. This capacity would be a new era for joint operations, joint logistics and interagency country development. These items could be produced with economy of scale and their simplicity would ensure long term relevance, reduction in training and overall vastly improved efficiency across the complete spectrum of deployment phases.

This requires consistent emphasis of the Energy Efficiency KPP at each stage of the JCIDs process until the capability package is through the Joint Readiness Oversight Council (JROC) and finally results in the Initial Capabilities Document (ICD) to start the acquisition cycle. The ICD then becomes a foundation document in the acquisition process for the government and the contractor as the system progresses through the acquisition milestones. It also influences the language used in the procurement contracts.

### *Sustainability Considerations in Contract Language Request for Proposal*

Leveraging the research and technology assets from private industry is an absolute must in this era where the demand for sustainable products is being driven from several sectors besides defense. The Army needs to capitalize on this trend by insisting that contracting efforts incorporate language that makes sustainability part of the deliverable, whether it be a product or service. Dr. Ashton Carter, Under Secretary of Defense for Acquisition, Technology and Logistics, published a memo in September 2010 to the Service Secretaries mandating increased focus on executing efficient acquisition contracts. His memo states: "Real competition is the single most powerful tool available to the Department to drive productivity….Competition is not always available, but evidence suggests that the government is not availing itself of all possible competitive situations" (Carter 2010a, 9).

The first opportunity to energize contractor interest in sustainability goals is in the Request for Proposal (RFP) that provides information to prospective bidders on the scope of the contract and the criteria

for selection among other things. Army RFPs follow a standardized format called the Uniform Contract Format (UCF) (CFR 2010 Section 15.204-1).

Section M of this format pertains to the selection criteria or evaluation factors for the contract. Inserting language in the selection criteria that pertains to the ASCP sustainability goals will activate the competitive bid process to motivate contractors to address and commit their resources to pursuing those sustainability goals as part of their contractual responsibility should they be selected.

An example can be taken from the recent Ground Combat Vehicle (GCV) RFP dated 23 Dec 2010. Section M of this RFP describes 5 common evaluation factors: Technical; Schedule; Price; Past Performance; and Small Business Participation. Under the Technical factor is a subfactor of "Integrated Design" that will be assessed according to 5 risks. The fifth risk states:

> The proposed Mobility architecture has power consumption estimates that accurately account for the applicable subsystems in its Product Structure (U.S. Army Contracting Command 2010, 40).

Another option to address this evaluation factor and emphasize the fuel efficiency goals would be to use language in the next RFP, before the Engineering Manufacturing and Development (EMD) phase such as:

> The Department will evaluate the offerer's approach to maximizing fuel efficiency in the mobility architecture while optimizing performance for the applicable subsystems in its Product Structure.

Further, a sustainability expert (energy or environmental) should be part of the transdisciplinary team

that reviews the bid packets and makes recommendations to the Selection Committee or Board. If emphasis on sustainability goals were applied at the point of source selection and this criteria was specifically articulated in section M of the RFP, then the responsibility would be placed on the contractors in the initial stages of competition to ensure their product design addressed the goals.

### *Contract Clauses*

Sustainability requirements should be clearly incorporated in the actual contract once the selection process is completed. Pre-vetted contract clauses already exist for several ESOH considerations consistent with FAR Part 23. These are readily available in PESHE Handbooks and even the ASA(ALT) website which contains a library of ESOH information for use in contracting (USAEC 2004, B1). There is room to develop additional contract clauses consistent with the FAR that focus on sustainability goals. Templated language developed by subject matter experts with contract expertise is a tremendous tool especially when made available as part of the standard acquisition toolbox. Once the verbiage is inserted in the contract then the responsibility lies with the contractor to fulfill the sustainable criteria.

A related opportunity is the contract templates in expeditionary environments for base support requirements, particularly LOGCAP. LOGCAP contracting and subcontracting have come under heightened scrutiny for several reasons, one of which is their lack of energy efficient support. Their mission inherently provides support in areas where fuel and energy efficiency should be a prerequisite. This is a problem

when it is precisely in the area where supplying energy puts personnel at risk. Army Materiel Command has been developing an automated web-based tool called "Contingency Acquisition Support Module" or cASM. The Commission on Wartime Contracting (COWC) in Iraq and Afghanistan specifically noted the potential of the "cASM" tool to facilitate improvements with life support contracts. They note that, "this tool will assist with translating a combatant commander's requirement into a procurement package that includes all the required documents and approvals, a responsive contract statement of work, and any ancillary data or information for acquisition approval and contract action" (DOD Task Force 2009, C-1). This is precisely where sustainability considerations need to be integrated to ensure that energy efficiency, sustainable waste management and other life support measures are appropriately addressed in the contracts. Naturally, the options for host nation support will be limited as far as being able to provide advanced technological support. But U.S. companies that are involved in the LOGCAP subcontracts should be able to adhere to such sustainable considerations by using their capacity to reach back to the U.S. industrial base for innovative solutions in order to win a contract. This is an excellent driver for private industry to aggressively pursue sustainable life support products. Further, if the life support products are simple, interoperable and interchangeable they then become transferable to host nation personnel – thus making them a very competitive product for the military to invest in.

In Oct 2009, USD(AT&L) Dr. Carter signed a memo designating cASM as a Special Interest program (Carter 2010b). The cASM system is currently in the "Limited User Evaluation and Initial Deployment phase."

This is prime opportunity to integrate sustainability in the contingency contracting arena for life support services.

### *Technology Insertion*

Many large acquisition endeavors become an investment not only for the government but also for the contracting company in terms of expansion of their portfolio through successful product development. Companies want their products to be their calling cards and indeed, past performance is often a criteria in the selection process of future contracts. As the global market for renewable energy systems and other sustainability efforts increases, industry will focus their R&D at an increasing rate to meet this demand and will want to showcase their success. All of those factors make insertion of technological advancements into defense procurement a powerful tool to achieve sustainability goals. The report on the 2010 QDR by Hadley and Perry, "QDR in Perspective," recommends inserting technological advances in the acquisition process in no more than 5 to 7 years due to the pace of technology maturation (Hadley and Perry 2010, 92). However, due to the overwhelming global demand for renewable energy, the advancements are likely to appear more rapidly. In order to utilize these advancements, the FAR provides a mechanism called the Value Engineering Change Proposal (VECP). Language can be inserted in the contract that can encourage VECPs. Then, during the development of the system if the contractor identifies and develops a proposal to update an existing design such as a more resilient materiel, simplification of a component design or switch to a multifunctional component then the

contractor follows the VECP procedures to introduce the change for consideration. The incentive to the contractor is that they receive a percentage of the savings that the government would experience due to the insertion of the technology if the proposal is accepted (DAU 2010). The benefit to the government is a more relevant, efficient and sustainable piece of equipment.

This is in keeping with the November 2010 memo from Dr. Carter further emphasizing contractor incentives, "Implementation Directive for Better Buying Power - Obtaining Greater Efficiency and Productivity in Defense Spending." The intent of this memo is to provide guidance on achieving efficiencies in contracting using various measures such as incentivizing contractor productivity and innovation in industry. The message is clear – contracting will be under intense scrutiny by several stakeholders to include the Army Audit Agency, Congress and the Government Accountability Office, Office of Management and Budget, as well as a plethora of private sector think tanks to ensure investments yield the highest productivity possible. The opportunity here is the enormous leverage that can be achieved with deliberate partnership with industry to insert proactive technology which is the essence of sustainability development.

Technology insertion can also be accomplished by governmental research and development discoveries. The mechanism in the acquisition process that covers this is through Engineering Change Proposals (ECP) and of course results in savings to the government, not shared with the contractor. In addition, there is research being done in the Army in the lane of "Environmental Quality Technology"(EQT). This effort is currently divided among numerous offices right now. The EQT program provides great opportunity for in-

creased focus to include updating its strategy to more fully integrate energy initiatives.

Key to this internal department Research & Development (R&D) effort is the fact that all services are aggressively pursuing solutions to sustainability of soldier and mission requirements in contingency environments. It would be most efficient and effective to have a strong coordinated effort across services to maximize the advancements in research and lessons learned in testing and fielding. As stated earlier, interoperability provides the most benefits to our forces to be sustainable at every phase of an operation. The Strategic Environmental Research and Development program (SERDP) is an OSD level organization that was specifically mentioned in the February 2010 QDR to be the lead for climate change impact analysis (Gates 2010a, 86). SERDP partners with DOE and EPA as well as other Federal Agencies. This is a powerful partnership that could provide great unity of effort between the DOD services as well as adding interagency expertise in sustainability R&D. Part of the Army EQT strategy should be greater functional lines of communication with SERDP in order to better utilize its collaborative framework.

In addition, a key venue to advance the Army's sustainable technology efforts in the EQT strategy is the capacity of the newly established Center for the Advancement of Sustainability Innovations (CASI) within the Engineering, Research and Development Center (ERDC) of the Corps of Engineers at Champaign, Illinois. CASI has already initiated interservice coordination projects so there is great opportunity for CASI to expand collaboration with the Navy Research Lab in Washington DC, and the Air Force Research Lab at Wright Patterson. Both of those services are in-

vesting in efforts for power generation and fuel alternatives as well as tech transfer efforts that the Army could team with, particularly for rapid fielding options.

The Hadley QDR Report places specific emphasis on the success of the Rapid Equipping Force (REF) Initiative which inserted emerging technologies into contingency environments to meet an immediate operational need. The report recommends that this type of special process remain in place to continue to address urgent needs (Hadley and Perry 2010 88). Using processes such as the REF for emerging energy and sustainability technology should be a key avenue for tech transfer. As Douglas Macgregor comments in his book *Transformation under Fire*,

> …the numbers of technologies and systems that may be worthy of consideration for rapid prototyping are still endless, and choices will have to be made. For the moment, many technologies are not yet mature enough for widespread fielding. These include directed-energy weapons and non-fossil fuel energy sources such as fuel cell technology, but some of these can be selectively employed within the existing equipment mix to determine their proper use when they do mature (Macgregor 2003, 278).

A coordinated effort between the service labs seems the ideal synchronization point for such an effort.

The key to any pursuing any technology advancements is interest from the leadership. Status of potential technological developments should be briefed to leadership to provide visibility on the progress. An ideal forum for this information is the Capability Portfolio Reviews conducted by the VCSA on the major acquisition efforts.

### *Capability Portfolio Reviews (CPR) and Net Zero Vision*

The VCSA initiated CPRs in December 2009 with the aim of "holistically examining, validating, modifying or recommending termination of requirements driving capability development, acquisition and sustainment across a series of portfolios defined by the Army but aligned to those defined by the Department of Defense (DOD) (AUSA 2010, 2). This has been a significantly effective approach in forcing coordination, identifying redundancy, and putting increased attention on senior leader priorities within the major acquisition programs. The CPR effort was originally intended to be a one year cycle but based on the success of these reviews, Senior Army Leadership has recognized the need to continue the process. Moving forward, the configuration of the CPRs is under review with a potential to restructure the process from the systems listed above into additional portfolios that are organized into two categories: Operating Force Portfolios and Generating Force Portfolios. Under this proposal, energy concerns are captured under installation services portfolios in the Generating Force (G3/5/7 2011). While this is certainly important, it will be critical to have operational energy be a consideration in the Operating Force portfolios should the process be reconfigured in that manner. Additionally, wherever ASA(ALT) engages in the CPR process, so too, should ASA(IE&E) in order to maintain consistent input on operational energy issues in the major acquisition efforts, particularly in the discussions of technology maturation and insertion.

As discussed earlier in the JCIDS portion, the formal implementation of an Energy Efficiency KPP will

be of enormous benefit to all of the review processes, to include the CPRs. One of the primary goals of the CPR is to "Revalidate portfolios through an examination of combatant command operational needs, wartime lessons learned, Army Force Generation, emerging technologies, affordability, interest and opportunity" (AUSA 2010, 3). This is in complete alignment with the goals of the Net Zero vision of the ASA(IE&E) which includes the following theme:

> In an era of persistent conflict, with a mission of stabilizing war-torn nations, a true stabilizing factor can be that of appropriate resource management. The Net Zero vision ensures that sustainable practices will be instilled and managed throughout the appropriate levels of the Army, while also maximizing operational capability, resource availability and well being (OASA(IE&E) 2010, 2).

## Part IV. Recommendations

- Insert language in the Army Programming Guidance (APGM) Annex A "Guidance to PEGs and Commands" consistent with the intent of the ASPG and APPG to clearly articulate the responsibility of the PEGs to actively ensure sustainability options are incorporated in the requirements justifications including CBA.
- Insert language in the TGM in the portion of "General Guidance" that is consistent with the added verbiage to the APGM (recommendation above) so that all PEGs understand their role in ensuring sustainable options are included in the development of analysis that come under their review.
- Ideally, add a subject matter expert from the ASA(IE&E) office to the PEG committees for

Equipping, Training, Sustaining and Installations. At a minimum include the SME in the staffing of all CBA to ensure sustainable options were included in the course of action analysis.

- Add a scenario to the DASA CE Cost Benefit Analysis Training Course that demonstrates an example of non-quantifiable benefits of sustainability to promote greater awareness of the impacts.
- Add the Fully Burdened Cost of Fuel and Water tools as well as the FBC of Waste management tool to DASA CE Cost Benefit Analysis Guide under Appendix D "Cost Estimating Models and Tools"
- Incorporate FBCF in operational models throughout the Army in accordance with the MAESMO study recommendations.
- Expand the traditional Programmatic Environment, Safety, and Occupational Health (PESHE) templates used in the Acquisition process to increase emphasis on sustainability considerations.
- Fully implement the Energy Efficiency Key Performance Parameter within the JCIDS and the Defense Acquisition System.
- Include language in Section M "Selection Criteria" of the Uniform Contract Format (UCF) for RFPs so that contractors make a deliberate effort to demonstrate progress toward sustainability goals as part of being selected in the bid process.
- Include a sustainability expert, for example a staff member with expertise on environmental and energy issues, on the transdisciplinary team that reviews contract packets and makes

recommendations to the Selection Board or Selecting Official.

- Develop standardized templated language that PMs and contracting support agencies could readily access and insert in their contracts that address sustainability efforts consistent with both the EO 13514 and the FAR section 23.
- Insert sustainability language in the cASM tool to address contingency life support services and thus impact LOGCAP contracts and subcontracts.
- Leverage contractor R&D efforts to advance alternative energy, fuel efficiency and other sustainability initiatives by increasing the use of VECP options in their contracts.
- Refocus the Army EQT strategy to include increased emphasis on energy and interservice collaboration.
- Include review of technology maturation in the context of the Energy Efficiency KPP in the Capability Portfolio Reviews for all acquisition systems.
- Ensure the ASA(IE&E) is included in all the CPR decision making efforts alongside ASA(ALT).

## Part V. Conclusion

The need for sustainable weapons, equipment and life support services is unequivocal. Similarly, the desire from the field is undeniable. It is incumbent upon the staffs at every level but in particular those within the Headquarters, Department of the Army who are responsible for synthesizing and reviewing requirements to make sustainability a part of their consideration. This can be done in numerous ways within the

existing framework of both PPBES and Acquisition. Further, it must be done within the existing funding lines, not pushed to the side until additional funding becomes available because that is an unrealistic timeframe and therefore an unacceptable approach. Our soldiers and counterparts in the field need this now and leadership needs to look at them with confidence and say their survivability is part of every equation and every decision. When the fiscal decisions are fully vetted, let it show that the most valuable return on investment is a sustainable security for our nation, our soldiers and the populations we deploy to assist.

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# 10

## U.S. Nuclear Energy: National Security and Sustainability

*James J. Raftery, Jr.*

*Through the release of atomic energy, our generation has brought into the world the most revolutionary force since prehistoric man's discovery of fire. This basic power of the universe cannot be fitted into the outmoded concept of narrow nationalisms. For there is no secret and there is no defense; there is no possibility of control except through the aroused understanding and insistence of the peoples of the world.*

—Albert Einstein 1946

The words above appeared in a form letter authored by the Nobel Laureate near the end of 1946. Written under the letterhead of the Emergency Committee of Atomic Scientists (ECAS), an organization which he co-founded, Professor Einstein made an appeal to raise money to fund a "great educational task" to "carry to our fellow citizens an understanding of the simple facts of atomic energy and its implications for society" (Einstein 1946). The aims of ECAS were "to educate the public about the dangers of atomic warfare, to promote the benign use of atomic energy, and to work for the abolition of war as the only answer to weapons of mass destruction" (Peace Pledge Union 2010).

In the more than half century since this letter was authored, the number of nations possessing nuclear weapons has risen from one to perhaps nine (Nobelprize.org 2011). In 1946, no nations possessed nuclear reactors for the generation of electricity. Reported by the World Nuclear Association (WNA), as of April 1, 2011, there are 440 commercial nuclear reactors across 30 countries operated for this purpose (WNA 2011a). Additionally, 56 countries operate approximately 250 research reactors and some 180 nuclear reactors power roughly 140 ships and submarines (WNA 2011b). While the abolition of war has not been realized, no

nuclear weapons have been used in a hostile act since 1945.

A July 2010 Center for Naval Analysis (CNA) report, titled *Powering America's Economy: Energy Innovation at the Crossroads of National Security Challenges,* found that "America's energy choices are inextricably linked to national and economic security" (CNA 2010, vii). As "the most revolutionary force since prehistoric man's discovery of fire" (Einstein 1946), nuclear energy is one of these energy choices. Its sustainability affects the degree of its future impact on U.S. national security.

The motivation for this chapter is to continue the "great educational task" by examining U.S. national security and sustainability considerations of nuclear energy. As the source of 20 percent of U.S. electric energy generation, and 14 percent of worldwide electric energy generation, nuclear energy is a strategic resource on both the national and international levels (WNA 2011a). Nuclear energy is herein defined as energy produced from land-based nuclear reactors. The principal application for terrestrial nuclear reactors is the generation of electricity. Maritime or space-vehicle propulsion reactors are excluded from this definition, as are nuclear weapons. This chapter explores considerations relevant to formulating national priorities related to the future of this resource. National security interest areas of energy independence, energy security, climate change, economics, public health and safety, and nuclear terrorism and proliferation are considered. Aspects of sustainability are considered within each area. This work primarily examines domestic nuclear energy, but considers facets of foreign nuclear energy as well.

## Background

On January 25, 2011, during his State of the Union Address to the nation, President Barack Obama stated:

> I challenge you to join me in setting a new goal: By 2035, 80 percent of America's electricity will come from clean energy sources. Some folks want wind and solar. Others want nuclear, clean coal and natural gas. To meet this goal, we will need them all – and I urge Democrats and Republicans to work together to make it happen (Obama 2011a).

To help meet this goal, the administration is proposing a Federal Clean Energy Standard (CES) for electricity, which is generally described in the *Economic Report of the President* transmitted to Congress in February 2011 (Obama 2011b). This CES would require the nation's electric power utilities to generate an increasing share of electricity from clean energy sources. The CES is a portion of a broader *Blueprint for a Secure Energy Future* (Obama 2011c). On March 30, 2011, the President announced the release of this *Blueprint,* which "outlines a comprehensive national energy policy, one that we've been pursuing since the day I took office" (Obama 2011d). Two tenets of the plan are cutting the nation's oil dependence by a third by 2025, and generating 80 percent of the nation's electricity from a diverse set of clean energy sources by 2035 (Obama 2011d). Nuclear energy can directly contribute to the latter, and by way of electric vehicles and plug-in hybrid electric vehicles, indirectly contribute to the former. As indicated by the degree of Presidential attention, the significance of energy to U.S. economic prosperity and national security is widely accepted. Less accepted is the path that the na-

tion should follow to address its energy policy, as indicated by the President's urging for bipartisan support. However, there is likely no scenario that achieves the President's goal which does not include a significant role for nuclear energy.

The first commercial nuclear plant came online at Shippingport, Pennsylvania in 1957 (EIA 2011a). Today the United States has 104 nuclear reactors in operation for electrical power generation, the largest number of any country, with approximately 100 gigawatts of total generating capacity (EIA 2011a). As of 2009, these commercial reactors met 20 percent of U.S. electrical energy demand (EIA 2011a). In 2008 this represented approximately 31 percent of the worldwide nuclear generation capacity (EIA 2011a). As of April 2011, the countries with the next highest number of commercial nuclear reactors are France and Japan with 58 and 51, respectively (WNA 2011a). The countries with the highest percentage of their electricity needs supplied by nuclear energy are Lithuania with 76 percent, France with 75 percent, and Slovakia with 54 percent (WNA 2011a). At 20 percent, the United States ranks 17th (out of 30), while China, at 2 percent, ranks 30th (WNA 2011a). By one estimate, by 2035 the U.S. electricity demand is projected to increase from 2008 levels by 30 percent (EIA 2010a), and worldwide electricity generation capacity is projected to increase by 87 percent (EIA 2010b).

Before 2009, ground hadn't been broken for construction of a new nuclear power plant in the United Statesin more than three decades (Obama 2010a). The last commercial reactor added in the United States was in 1996 (TVA 2010), following 20-plus years of schedule delays and cost overruns. As of April 2011, there are 27 nuclear reactors under construction in

China, with an additional 50 planned and an additional 110 proposed (WNA 2011a). Before March 11, 2011, critics derided nuclear energy as dangerous and polluting, pointing to the Three Mile Island and Chernobyl incidents, and to radioactive waste (Greenpeace International 2010). The March 2011 earthquake and tsunami natural disasters in Japan, and the subsequent crisis at the Fukushima Daiichi power plant, have returned these concerns to the forefront of public attention. Some advocates exalt nuclear energy as a "green" solution necessary to combat global warming (Kristhof 2005). Energy is important globally, as national wealth and Gross Domestic Product (GDP) can be linked to energy use (Muller 2008, 63). With the help of Russia, Iran is in the last stages of bringing its first nuclear power plant online (Pomeroy 2010). Proliferation of nuclear materials and weapons, along with the potential for their destructive use, represent perhaps the gravest existential threat to the security of the United States (Obama 2010b, 23). Interdependencies, both supporting and conflicting, between energy, environmental, economic, security, and foreign policies are the reality.

## The Nuclear Energy Strategic Environment

During a January 26, 2009, White House address, given at a time of "deepening economic crisis" (Obama 2009), with the United States engaged in open hostilities in Iraq and Afghanistan, President Obama stated: "At a time of such great challenge for America, no single issue is as fundamental to our future as energy" (Obama 2009). In his January 17, 2010, State of the Union Address, the President called for "a new generation of safe, clean nuclear power plants in this country" (Obama 2010c). Twelve days later he issued

a memorandum to the Secretary of Energy, establishing a Blue Ribbon Commission on America's nuclear future. The opening paragraph of that memorandum stated:

> Expanding our Nation's capacity to generate clean nuclear energy is crucial to our ability to combat climate change, enhance energy security, and increase economic prosperity. My Administration is undertaking substantial steps to expand the safe, secure, and responsible use of nuclear energy. These efforts are critical to accomplishing many of my Administration's most significant goals (Obama 2010d).

This statement qualitatively expresses the President's desired objective for domestic nuclear energy. In his May 2010 *National Security Strategy*, the President stated "we must develop the clean energy that can power new industry, unbind us from foreign oil, and preserve our planet" (Obama 2010b, Introduction).

For more than a decade, Gallup has been querying Americans to answer the following question: "Overall do you strongly favor, somewhat favor, somewhat oppose, or strongly oppose the use of nuclear energy as one of the ways to provide electricity for the U.S.?" (Jones 2010). In each year, except 2001, favorable responses outnumbered opposing ones (Jones 2010). In an article dated March 22, 2010, Gallup reported that:

> Support has edged up in the last two years, eclipsing 60 percent this year for the first time. In addition, 28 percent of Americans now say they "strongly favor" nuclear power, also the highest Gallup has measured since the question was first asked in 1994 (Jones 2010).

In its October 2010 report, titled *The Geopolitics of Energy: Emerging Trends, Changing Landscapes, Uncertain Times*, the Center for Strategic & International Studies (CSIS) offered: "In recent years, the notion of a nuclear 'renaissance' has become fashionable as countries around the world have sought to meet burgeoning energy demand with stable, base-load, and low-carbon sources of energy" (Verrastro et al. 2010). As of April 1, 2011, there are 61 commercial nuclear reactors in construction worldwide, though only the Iranian reactor would be the first for any country (WNA 2011a).

The recent natural disasters in Japan and subsequent nuclear crisis at the Fukushima Daiichi nuclear facility have renewed fears and rallied naysayers to speak out against nuclear energy. In his March 30, 2011, *Blueprint for a Secure Energy Future* address, President Obama offered the following:

> Now, in light of the ongoing events in Japan, I want to just take a minute to talk about nuclear power. Right now, America gets about one-fifth of our electricity from nuclear energy. And it's important to recognize that nuclear energy doesn't emit carbon dioxide in the atmosphere. So those of us who are concerned about climate change, we've got to recognize that nuclear power, if it's safe, can make a significant contribution to the climate change question … we can't simply take it off the table (Obama 2011d).

Despite this showing of support by the President, the Japanese crisis will undoubtedly impact public and political support, as well as, economic considerations for nuclear power in the United States and around the world.

It is within this background and strategic environment that nuclear energy is examined. The national security interest areas of energy independence, energy security, climate change, economics, public health and safety, and nuclear terrorism and proliferation are considered. Aspects of sustainability are considered within each area.

**Energy Independence**

During the January 26, 2009, White House address, President Obama stated: "Today, I'm announcing the first steps on our journey toward energy independence, as we develop new energy, set new fuel efficiency standards, and address greenhouse gas (GHG) emissions" (Obama 2009). The concept of energy independence can be expressed in terms of absolute or strategic energy independence. Absolute energy independence means a country produces all of its own energy, which was largely the case in the United States prior to 1950, as reported by the American Energy Independence (AEI) website (AEI 2010). Strategic energy independence means a country allows imported energy, but only if the imported energy does not create vulnerability, such as economic, political, or military vulnerability (AEI 2010). For example, strategic energy independence might be achieved by the United States while importing petroleum from Canada and Mexico, whereas it would not be achieved when dependent on imports from the Middle East. It has been argued that U.S. energy policies under Presidents Nixon, Ford, and Carter, which were influenced by the Arab oil embargo of 1973, eventually lead to strategic energy independence for the United States during the period from 1982–1985 (AEI 2010).

Unites States oil imports declined sharply from 1980 through 1985, reaching pre-1974 levels in 1983 (EIA 2010c). While partially attributable to the opening of Alaskan oil fields, this reduction was also due to reduced oil consumption by the combination of alternative fuels, increased fuel efficiency, and conservation (AEI 2010). One such contribution came from the U.S. electrical energy sector. Electrical utilities responded to the economic and regulatory environment by replacing petroleum fuel oil with domestic coal, nuclear energy, and natural gas (AEI 2010). As a result, the United States no longer depends on petroleum to generate electricity for the power grid and since the mid-1980s has effectively achieved absolute energy independence with regard to electricity generation (AEI 2010).

Attributed largely to shifts in energy policy beginning with President Reagan (Hakes 2008, 71), the U.S. net petroleum import percentage, as a share of product supplied, increased from 27 percent in 1985 to 52 percent in 2009 (EIA 2011b). This situation was likely a factor contributing to President Obama's 2009 announcement:

> America's dependence on oil is one of the most serious threats that our nation has faced. It bankrolls dictators, pays for nuclear proliferation, and funds both sides of our struggle against terrorism. It puts the American people at the mercy of shifting gas prices, stifles innovation and sets back our ability to compete (Obama 2009).

The July 2010 CNA report summarizes:

> Economically, the nation's heavy oil dependence diverts hundreds of billions of dollars out of the econ-

> omy each year and leaves American businesses and governmental agencies vulnerable to unpredictable price volatility (CNA 2010, vii).

As previously related, the electrical energy sector within the United States has effectively achieved absolute energy independence. In 2009 this sector represented 38.3 percent of U.S. energy demand (EIA 2010d). Because nuclear energy supplies this sector, and the U.S. demand for foreign petroleum is predominantly in the transportation sector, there is not a direct path for increasing overall U.S. energy independence by way of nuclear energy. In 2009 the transportation sector represented 27.0 percent of U.S. energy demand, supplied by 94 percent petroleum, 3 percent natural gas, and 3 percent renewables (EIA 2010d). There are, however, at least two plausible indirect methods by which an expanded role for nuclear energy could make a positive impact on energy independence in the transportation sector.

The first of these methods involves a greatly expanded role for vehicles that are either partially or fully energized by electricity, as is the case for plug-in hybrid electric vehicles (PHEV) and electric vehicles (EV), respectively. The Chevrolet Volt (a PHEV) and the Nissan Leaf (an EV) are but two examples of consumer automobiles that can be powered from the electric grid. The performance of PHEV or EV vehicles is not currently adequate for replacing gasoline or diesel powered vehicles in all applications, but it is completely capable of doing so in certain applications. To reinforce this assertion, each is being offered in the U.S. market in the 2011 model year. A Chinese PHEV-60 vehicle (implying it is capable of 60 miles of electric only travel), the Build Your Dreams Auto F3DM, was the world's first production PHEV, first offered

for sale to business and government buyers in China on December 15, 2008 (Balfour 2008). Like the hybrid electric vehicles (HEV) that preceded them, PHEV and EV have the potential to reduce the demand for petroleum in the transportation sector. Unlike HEV which did so solely through increased fuel economy, PHEV and EV also displace energy from petroleum with energy from the electric power grid. In the case of the U.S., this contributes to energy independence. In his 2011 State of the Union Address, President Obama called for the U.S. to "become the first country to have a million electric vehicles on the road by 2015" (Obama 2011a).

The second method involves the use of nuclear energy to produce hydrogen. Hydrogen could be used to cleanly power transportation, either by direct combustion or as a fuel for fuel cells. The term "hydrogen economy" has been widely used with regard to this concept (Rahman and Andrews 2006). There are established methods for producing hydrogen using electricity or heat to energize the processes. A clean and abundant energy source is required for such an "economy" to be viable, as the energy required to produce hydrogen is greater than the energy that is later available from it (Muller 2008, 70). Nuclear reactors could be the source of the required electricity or heat. The Department of Energy (DOE) has funded research investigating this concept (DOE 2011). In addition to the need for economically viable large-scale sources of hydrogen, there are many other practical limitations impeding a hydrogen economy, such as the physics of energy density (Muller 2008, 302) and a viable nationwide hydrogen infrastructure (Borgese 2004).

The largest contribution made by nuclear energy in terms of energy independence was its contribu-

tion to absolute energy independence in the electrical energy sector which has lasted since the mid-1980s. The significance of nuclear energy within this sector will be examined further in the section on the Climate Change. The potential for nuclear energy to impact the transportation sector, and subsequently overall U.S. energy independence, is currently marginal, though the outlook with respect to PHEV and EV is promising, especially in light of the President's recent call for one million electric vehicles on U.S. roads by 2015. The potential for a much larger impact exists should breakthroughs in complementary technology areas occur.

**Sustainability Considerations**

Maintaining a U.S. electric energy sector that enjoys absolute energy independence is sustainable in that the U.S. possesses ample domestic fuel reserves needed to do so and is unlikely to add additional capacity that requires foreign fuels to operate. Increasing the percentage of clean energy sources will likely add risk from the Energy Independence perspective, as reliance on considerable U.S. coal reserves will abate. Nuclear energy is the proven U.S. technology capable of reducing this risk. The United States must ensure that other forms of clean energy technology, such as solar and wind, are also available from U.S. sources, such that their increasing mix in this sector does not threaten U.S. energy independence.

Increasing U.S. energy independence in the transportation sector likely requires a paradigm shift away from petroleum. Nuclear energy indirectly offers approaches for doing so. Second order sustainability considerations, such as rare earth elements for per-

manent magnets in the motors of electric vehicles (or wind turbines) must be considered, along with research into electric vehicle technologies without such dependencies. Increasing U.S. energy independence is itself inherently desirable from the perspective that it reduces the many negatives mentioned: bankrolling dictators, paying for nuclear proliferation, funding terrorism, stifling innovation, setting back our ability to compete, diverting hundreds of billions of dollars out of the economy each year, and creating vulnerability to unpredictable price volatility.

The same post-1973 energy policies and statutes that resulted in sustained absolute energy independence in the electric energy sector, succeeded in reachieving strategic energy independence in the early 1980s in the transportation sector. However this result proved temporary, as the resulting low worldwide petroleum prices rewetted the public appetite for oil and lowered the political will to stay the course. Sustainability considerations related to energy independence have proven as dependent on such public and political attitudes as on natural resources or technology alternatives. This will likely continue to be the case with regard to the future roll of nuclear energy and its ability to impact U.S. energy independence.

**Energy Security**

Energy security in its basest definition means having assured access to the energy resources necessary to meet demands. Energy security and independence are sometimes used interchangeably, and though interrelated, are not strictly the same. Energy security can be greatly enhanced when a nation enjoys absolute or strategic energy independence, though these situations are generally uncommon. A more recent

definition of energy security is provided by the International Energy Agency (IEA) as: "the uninterrupted physical availability at a price which is affordable, while respecting environment concerns" (IEA 2011). On its webpage entitled "Energy Security," the DOE Energy Information Administration (EIA) simply lists the main headings of Oil, Natural Gas, and Electricity, with subordinate headings like: Disruptions and Vulnerabilities; Shipping, Chokepoints, and Spills; Infrastructure and Nuclear Energy (EIA 2011c). A more comprehensive definition is proposed in a United Nations (UN) Department of Economic and Social Affairs (DESA) publication as:

> A nation-state is energy secure to the degree that fuel and energy services are available to ensure: a) survival of the nation, b) protection of national welfare, and c) minimization of risks associated with supply and use of fuel and energy services. The five dimensions of energy security include energy supply, economic, technological, environmental, social and cultural, and military/security dimensions (UN DESA 2006, 151).

Nations often weight heavily their other national interests with energy security considerations in mind and employ the elements of their national power commensurately. Former Marine Corps Commandant and U.S. National Security Advisor, retired General James Jones explains:

> Our entire economy depends on the expectation that energy will be plentiful, available, and affordable. Nations like Venezuela and Iran can use oil and gas as political and economic weapons by manipulating the marketplace. Half of our trade deficit goes toward buying oil from abroad, and some of that money ends up in the hands of terrorists (AEI 2010).

With regard to nuclear energy, there are three primary energy security considerations. The first has to do with the physical security of the nuclear facilities themselves. A Brookings policy report states:

> In recent years there have been a number of terrorist plots against nuclear facilities, including the "alleged" plot by a group of Pakistani Americans to attack the Karachi nuclear reactor, initial plans by Al Qaeda to crash an aircraft into a U.S. nuclear facility, and the 2006 "Toronto 18" plot by an Islamic fundamentalist group to use a truck bomb to attack a nuclear power facility in Ontario, Canada (Banks et al. 2010, 2).

This threat is shared not only by the nuclear reactors, but also by the locations where spent nuclear fuel is maintained. The second consideration is the potential vulnerability of the power grid and the nuclear facilities to possible cyber attack. The third consideration is related to the previously mentioned concept of a worldwide nuclear "renaissance." The Brookings report cites this renaissance as posing challenges and opportunities for corporations, governments, and international organizations with regard to the nuclear fuel cycle. While noting that these issues are not new, the renewed interest by nations to acquire domestic uranium enrichment and/or reprocessing capabilities, together with a projected construction rate for nuclear reactors not seen in decades, makes these challenges significant. The Brookings report proposes that these actions might be motivated "either by perceived commercial opportunities or energy security concerns about relying on other nations for the provision of these services" (Banks et al. 2010, 2). The impact is more nuclear facilities worldwide, facing the physical and cyber security threats mentioned. With

increased worldwide use of nuclear energy, especially new nuclear fuel processing/reprocessing, comes increased potential for proliferation of nuclear materials and weapons.

## Sustainability Considerations

In terms of energy security there are two primary sustainability considerations. The first is related to the current costs incurred by the nation in its attempt to maintain energy security in the context of its current dependence on foreign oil and the worldwide dependence on oil from the Middle East. These costs are debatable, but are certainly considerable. Reducing these costs largely equates to reducing the dependence on foreign oil. As described, nuclear energy can indirectly contribute to that end.

Second, energy security more directly related to domestic nuclear energy involves the physical and cyber security of nuclear facilities and spent fuel storage locations. This includes susceptibility to both man-made and natural threats. The sustainability implication is not just the physical loss of nuclear capacity, as is now the case in Japan, where 4 reactors have been lost, but also the impact of such an event on public and political will, which in itself can deny the nation's optimum use of a valuable resource, as has largely been the case in the United States since the 1979 Three Mile Island incident.

## Climate Change

*The JOE 2010: Joint Operating Environment,* produced by U.S. Joint Forces Command, states: "Climate change is included as one of the ten trends most likely to impact the Joint Force" (Mattis 2010, 32). In a 2007

CNA report, titled *National Security and the Threat of Climate Change*, the following statement is made: "Climate change can act as a threat multiplier for instability in some of the most volatile regions of the world, and it presents significant national security challenges for the United States" (CNA 2007, 1). This concept of climate change as a "threat multiplier" is echoed by the October 2010 CSIS report (Verrastro et al. 2010, 20). The CNA report further offers: "The consequences of climate change can affect the organization, training, equipping, and planning of the military services" (CNA 2007, 1). As indicated by these statements and those made by the President, climate change is certainly a pressing global matter with national security and sustainability implications.

Nuclear energy presents a contemporary paradox when it comes to environmental considerations. In the past, nuclear energy was nearly universally vilified by environmentalists due to the radioactive waste produced primarily by the fission of its nuclear fuel. In U.S. reactors this fuel is a particular isotope of uranium, called uranium-235 (U-235). When reactor grade uranium is consumed, highly radioactive byproducts, including plutonium, result. In 2005, "liberal" (Muller 2008, 154) columnist Nicholas Kristhof wrote in his New York Times opinion-editorial piece: "If there was one thing that used to be crystal clear to any environmentalist, it was that nuclear energy was the deadliest threat this planet faced" (Kristhof 2005). Kristhof went on to offer:

> But it's time for … us to drop that hostility to nuclear power. It's increasingly clear that the biggest environmental threat we face is actually global warming, and that leads to a corollary: nuclear energy is green. Nu-

clear power, in contrast with other sources, produces no greenhouse gases (Kristhof 2005).

As mentioned, nuclear energy satisfies 20 percent of the U.S. electrical energy demand. In 2009, approximately 69 percent of that demand is met by fossil fuel fired power plants, with coal being the greatest single fuel source, used to meet approximately 45 percent of the electrical energy demand (EIA 2009). While the deleterious effects of acid rain have been largely curtailed in the United States in the last 30 years (EPA 2009), the polluting byproduct of fossil fuel combustion now receiving great attention is the GHG carbon dioxide ($CO_2$). Burning fossil fuels releases carbon into the atmosphere that had been naturally sequestered underground. Coal combustion is the second largest source of $CO_2$ emitted in the United States and the single largest source on the planet (EIA 2010e).

It is with respect to combating climate change that nuclear energy could perhaps make the greatest direct impact. As previously stated, the President seeks to expand the use of nuclear energy. Since this is not quantified, the following two cases are examined. Option 1 is herein defined as substantially expanding nuclear energy capacity within the next 25 years to meet 50 percent of the U.S. electrical energy demand. Based on the EIA projected 30 percent increase in U.S. electrical energy demand, this would necessitate a fleet of 340 reactors by 2035.* Even without an expected increase in capacity from renewable sources, this option would reduce the absolute electrical energy needed from fos-

*The U.S. 2008 electrical energy requirement was 3873 billion kilowatt-hours. In the year 2035 U.S. electrical energy demand is estimated at 5021 billion kilowatt-hours. Knowing that 104 reactors provided 20% of the 2008 demand allows for a straightforward calculation of total reactors needed by 2035 for Option 1 and Option 2.

sil fuels, and subsequent $CO_2$ emissions, by nearly 10 percent from 2008 levels. Option 2 is herein defined as expanding the nuclear capacity only to compensate for growing demand over the next 25 years, maintaining the status quo of 20 percent of the demand met by nuclear energy. Based on projections, this would necessitate a fleet of 135 reactors. This option would not contribute to a reduction in fossil fuel use as a percentage of demand, so an absolute increase in terms of fossil fuel use and $CO_2$ emission would likely result. With Option 2, substantial increases in other clean energy sources would be required to slow the growth of $CO_2$ emission related to electrical power.

In the section on Energy Independence, the potential for nuclear reactors to energize PHEV and EV by way of the electrical power grid was discussed. Based on a report prepared at Oak Ridge National Laboratory, titled *Potential Impacts of Plug-in Hybrid Electric Vehicles on Regional Power Generation* (Hadley and Tsvetkova 2008), one may deduce that the greatly expanded use of PHEV and EV in the U.S. automobile fleet is also extremely attractive with regard to climate change considerations, but only if the energy used to power them comes predominantly from sources cleaner than today's coal. The 2009 U.S. national mixture of energy sources for electrical power is approximately 45 percent coal, 23 percent natural gas, 20 percent nuclear, 7 percent hydro, and 5 percent other renewables (EIA 2009). Drawing from the Oak Ridge report, a July 2010 article, titled "The Dirty Truth About Plug-In Hybrids" (Moyer 2010), makes a comparison between EV and PHEV relative to HEV. In a regional scenario, where the regional power grid is supplied by 84 percent natural gas and 16 percent nuclear, the notional EV carbon emission is 37 percent better than a notional HEV, while the PHEV is 20 percent better than the

HEV (gasoline consumption for the EV is reduced 100 percent relative to HEV, while the PHEV is reduced 47 percent) (Moyer 2010). In another regional scenario, where the regional power grid is supplied by 75 percent coal and 25 percent natural gas, the EV carbon emission is 36 percent worse than the HEV, while the PHEV is 12 percent worse (relative gasoline consumption same as previous case) (Moyer 2010).

By reducing the demand for petroleum, both scenarios offer significant improvements with regard to energy independence. However, only the first scenario offers an improvement with regard to GHG emissions, while GHG emissions in the second scenario are considerably worsened by adding EV and PHEV vehicles. Given this data, it is understandable that the President consistently couples climate change with energy independence, so that the latter is not optimized without consideration for the former, consistent with the two tenets of the *Blueprint for a Secure Energy Future* previously described. Given the current mix of energy sources supplying the U.S. power grid, it makes sense to replace as many non-hybrid vehicles as possible with PHEV or EV. It is also clear that to obtain the greatest reduction of GHG, reducing the percentage of coal and increasing the percentage of clean sources, such as nuclear and renewable energy sources, is necessary; though this may change if a practical clean coal technology is developed.

Despite the potential positive impact to the environment of replacing fossil fuel generated electricity with nuclear produced electricity, there are several more points to consider. Depending on the design of a nuclear plant's cooling system, large amounts of water can be required; hence nuclear plants are normally located near large readily available bodies of water.

This can be a limiting factor for certain locations, but in general is not a large impediment in the United States. Large clouds of non-polluting white steam rising from a nuclear cooling tower are an iconic image of nuclear energy to many, dramatically displaying the portion of the water cycle where liquid is returned to vapor. This design is employed where many factors dictate it to be optimal, generally meaning water is not scarce. There are other cooling designs used among the nation's 104 reactors which do not evaporate fresh water, but merely circulate it back into the large body from which it was drawn, consistent with necessary ecological considerations. Additionally, approximately 71 percent of the world's surface is covered by oceans and seas. Nuclear cooling systems are not dependent on fresh water only, and those located in coastal areas can use sea water for cooling. Given that nearly half of the world's population lives within 100 miles of the coast (Stewart 2011), nuclear reactors can often be placed where water for cooling is not in competition with water for other needs. When nuclear plants must be located farther from population centers, electricity can still be supplied, albeit with an associated cost of greater transmission line losses. The need for cooling is more a function of the heat cycle used to generate electricity, than the fuel source, meaning plants of like energy capacity will have similar water requirements whether they are nuclear or coal powered, though in the case of coal a portion of the waste heat is carried away in the polluting smoke. Unique to nuclear plants is the need to provide cooling for the fuel assembly even when the plant is not generating electricity, as residual heat from fissile fragments must be removed for safety reasons.

While nuclear energy is considered to be a clean source of energy, it is not considered to be a renewable energy source, such as hydro, solar, wind, or biomass. Nuclear energy is considered clean, because in its intended usage GHGs are not emitted into the environment (nor are other pollutants emitted). It is not considered to be a renewable energy source, because its nuclear fuel is created from a finite raw material supply, U-235 in the case of current U.S. reactors. Perhaps overlooked by Kristhof due to their relatively small contributions at the time, solar and wind are also non-$CO_2$ producing energy technologies. Bio-mass is generally accepted as clean in that the $CO_2$ released by burning bio-mass fuel is largely gas that was relatively recently removed from the atmosphere by photosynthesis. It is therefore said to be carbon neutral with no net annual increase in atmospheric $CO_2$ concentration. However, its combustion does release other pollutants into the atmosphere. These renewable technologies do not share the radioactive risks of nuclear energy. Despite these points, Dr. Stephen Chu, U.S. Secretary of Energy and Nobel Laureate, offers: "As a zero-carbon energy source, nuclear power must be part of our energy mix as we work toward energy independence and meeting the challenge of global warming" (Chu 2009).

**Sustainability Considerations**

The sustainability of burning fossil fuels has been questioned by many, not only due to the nature of the finite supply, energy independence and security considerations, but increasingly due to the emission of GHG and subsequent contribution to climate change. Nuclear energy is thus inherently sustainable with

regard to physical climate change considerations. Expanding the nation's nuclear capacity to meet more than 20% of the demand in the electric energy sector could help further reduce GHG emissions.

This section also shows that while a paradigm shift to power a portion of the transportation sector with electricity via EVs or PHEVs would benefit energy independence, it could actually worsen GHG emissions in a region, unless a significant percentage of the electricity in that region is generated with fuel sources cleaner than today's coal plants. Since nuclear plant design may take advantage of a number of cooling system alternatives, the usage of large amounts of fresh water for cooling might only be chosen where this resource is not scarce. However, when nuclear plants are located in coastal areas, considerations for natural disaster events, such as tsunami, must be taken into account and mitigated. If this is not properly considered, then the public and political good will to add nuclear capacity, motivated by its benefit to combating climate change, can be negated by an incident like that currently unfolding in Japan.

**Economics**

When it comes to national security considerations and economics, it is generally accepted that the healthier a nation's economy, the more robust its capacity to address national security issues. Chairman of the Joint Chiefs of Staff, Admiral Mike Mullen, is credited with stating: "Our national debt is our biggest national security threat" (CNN 2010a). Relating energy, economics, and security, The *JOE* states:

> Another potential effect of an energy crunch could be a prolonged U.S. recession which could lead to

> deep cuts in defense spending (as happened during the Great Depression). Joint Force commanders could then find their capabilities diminished at the moment they may have to undertake increasingly dangerous missions (Mattis 2010, 26).

The President has identified energy as the single most fundamental issue affecting our future (Obama 2009). The President has been consistent in expressing the need for clean and sustainable energy.

The nuclear power plants making up the current U.S. fleet have been described as "cash machines" (WNA 2011c), in that they are able to produce large amounts of electricity at operating and maintenance (O&M) costs lower than fossil fuel fired plants, including coal plants. This is an attractive economic prospect, especially in light of 20-year operating license extensions which have been regularly granted by the Nuclear Regulatory Commission, beyond the initial 40 year operating license (Deutch et al. 2009, 5). These extensions have proven warranted based on the current physical condition of the nuclear plants, which exceeded the conservative estimates used in the original licensing. This same degree of quality and purposeful over-engineering have also allowed the output of the reactors to be increased during the lifetime of the plants, allowing the amount of energy supplied to U.S. consumers to increase without increasing the number of reactors (Deutch et al. 2009, 5).

Despite this situation, the economic barrier to construct additional nuclear capacity has been high, largely attributable to initial capital costs and the financing of these costs. While China is significantly expanding its nuclear energy capacity, U.S. expansion is much more modest. A major difference between nuclear energy in the United States and China is that

U.S. nuclear power plants are not nationally owned or operated, though they are very heavily regulated. Due to the fragmented nature of the U.S. electrical power generation industry, the capital cost of a new reactor can represent an unacceptable risk to an entity proposing to add new capacity. Economic risks are often too high for individual companies considering adding new nuclear capacity without mitigation assistance from the government, often in terms of loan guarantees. Historically in the 1970s and 1980s default rates on these loans were as high as 50 percent (Indiviglio 2010). Other anticipated economic risks include liability concerns, licensing delays, regulatory or statutory changes, mid-stream government mandated design changes, construction delays, and the resulting increased finance costs and delayed return on investment.

Capital costs are often estimated in terms of "overnight cost." Overnight cost "is an estimate of the cost at which a plant could be constructed assuming that the entire process from planning through completion could be accomplished in a single day" (EIA 2010f, 2). This concept allows financing to be treated separately and is useful for making more meaningful comparisons across technologies. In a 2009 update to an oft-cited 2003 Massachusetts Institute of Technology (MIT) study, titled *Update of the MIT 2003 Future of Nuclear Power*, the authors estimate that major U.S. construction projects, like nuclear plants, have increased 15 percent annually from 2003 through 2009 (Deutch et al. 2009, 6). Their estimate of overnight costs for additional generating capacity (2007 constant dollars) is: nuclear $4000/kW, coal $2300/kW, and natural gas $850/kW (Deutch et al. 2009, 6). For a notional 1 GW reactor the overnight capital cost would be $4 billion.

Overall competitiveness of various generating technologies is often expressed in terms of "levelized cost." Levelized cost "represents the present value of the total cost of building and operating a generating plant over an assumed economic life, converted to equal annual payments and expressed in terms of real dollars to remove the impact of inflation" (EIA 2010f, 5). Levelized costs include overnight capital cost, fuel cost, and fixed and variable O&M costs. The 2009 MIT study estimate of levelized costs for additional generating capacity (2007 constant dollars) is: nuclear $0.084/kWh, coal $0.062/kWh, and natural gas $0.065/kWh (Deutch et al. 2009, 6). This study assumed a 40 year operating lifetime for the nuclear plant, not the 60 year lifetime that is becoming the U.S. norm, meaning the levelized costs for nuclear energy are likely overestimated relative to coal and natural gas.

The study also included a risk-premium in terms of a higher weighted cost of capital for the nuclear case, which was not included in the coal or natural gas case. This is due to a poor industry track record in the 1980s and 1990s, in terms of construction cost overruns, schedule delays, and loan defaults. While indications are that this premium may not be merited today, it is the opinion of the MIT authors that it should only be removed once demonstrated plausible by actual construction. As a result, many are closely watching the progress of the Vogtle nuclear project underway near Augusta, Georgia. With this risk premium removed (and still only considering a 40 year operating lifetime), nuclear levelized costs would be reduced to $0.066/kWh, which is competitive with both coal and natural gas (Deutch et al. 2009, 6). The study also includes another estimate which includes a notional $25/ton charge on the $CO_2$ emitted into the atmosphere. This charge does not impact the level-

ized cost of additional nuclear capacity, but raises the levelized cost of coal to $0.083/kWh and natural gas to $0.074/kWh (Deutch et al. 2009, 6). If one or more of these three considerations is realized (40+20 year nuclear operating license; no capital risk premium; $25/ton $CO_2$ emission charge), then the levelized cost for new nuclear capacity could equal or be less than that for coal or gas fired plants. The 2009 MIT study summarizes its economic analysis as:

> The 2003 report found that "In deregulated markets, nuclear power is not now cost competitive with coal and natural gas. However, plausible reductions by industry in capital cost, operation and maintenance costs and construction time could reduce the gap. Carbon emission credits, if enacted by government, can give nuclear power a cost advantage." The situation remains the same today. While the U.S. nuclear industry has continued to demonstrate improved operating performance, there remains significant uncertainty about the capital costs, and the cost of its financing, which are the main components of the cost of electricity from new nuclear plants (Deutch et al. 2009, 6).

Nuclear energy is currently the leading source of U.S. clean energy, providing more than twice the energy supplied by hydroelectric power, solar power, and wind power combined (Newell 2010). The MIT analysis is a clear indicator of the significance the inclusion of consideration for $CO_2$ emission can have on the economic analysis. Whether instituted in terms of a carbon tax or as a cap-and-trade program, such an initiative will change the market forces at work. The CES addresses a fundamental tenet of the *Blueprint for a Secure Energy Future*, greatly increasing the percentages of clean energy sources in the United States. The CES would essentially establish a cap-and-trade

program with regard to carbon emissions for electrical power generation. The *Economic Report of the President* states:

> Electricity generators would receive credits for each megawatt-hour of clean energy generated; utilities with more credits than needed to meet the standard could sell the credits to other utilities or bank them for future use. By ensuring flexibility through a broad definition of clean energy and by allowing trading among utilities, the program is designed to meet the overall target cost-effectively. The Administration's proposal emphasizes the importance of protecting consumers and accounting for regional differences (Obama 2011b).

An analogous type of cap-and-trade system was put in place by the 1990 Clean Air Act for sulfur dioxide and nitrous oxides, which successfully achieved national goals with regard to curtailing acid rain in the United States (EPA 2009). Such a system can enable meeting the President's 2035 goal by allowing market forces to have a greater impact in picking the optimum combination of technologies and processes, as they did in the case of acid rain. However, without the Federal CES for electricity, market forces would arrive at solution that is very like the status quo or inefficiently react to a patchwork of uncoordinated state laws, hence federal government action is likely needed. To further this point, the *Economic Report of the President* offers:

> The benefits of transitioning to clean energy – energy security, cleaner air, fewer risks from climate change, and enhanced economic competitiveness – are enjoyed by everybody, not just the producers or consumers of the clean energy.…These spillovers mean that market

> rewards for switching to clean energy production are lower than the societywide benefits, market costs of switching to clean energy consumption are higher than the societywide costs, and markets alone provide less clean energy than is optimal (Obama 2011b, 127).

Arguments against a CES are generally either motivated by self-interests that would see their market share or profitability lessened by such an initiative, or by fears of unintended impacts to the U.S. economy resulting from higher U.S. energy prices. The latter is especially relevant in light of a global economy where competitors in other nations may not have to comply with similar standards. Not passing a CES, but continuing to keep it an active possibility is already having a negative impact. In an October 2010 *Fortune* online article, titled "Uncertain of Future Regulation, Businesses are Paralyzed," Dick Kelly, CEO of Xcel Energy and chairman of the Edison Electric Institute, states: "If we had a national policy and knew what the rules were, we could take action" (Colvin 2010). The article's author points out that "Kelly's industry knows only that momentous changes in the federal laws governing it are probably on the way; what those changes might be, and when they might happen, managers have no idea" (Colvin 2010). The *Blueprint for a Secure Energy Future* acknowledges this reality and offers:

> A CES will provide the signal investors need to move billions of dollars of capital off of the sidelines and into the clean energy economy, creating jobs across the country and reducing air pollution and greenhouse gas emissions (Obama 2011c, 7).

The Energy Policy Act of 2005 addressed many of the economic risks associated with the nuclear industry and provided incentives that are directly relevant to adding nuclear energy capacity. These include loan guarantees, extension of the Price-Anderson Act nuclear liability system, insurance against regulatory delays, and production tax credits. An October 2010 Congressional Research Service (CRS) report, titled *Nuclear Energy Policy*, states: "Together with higher fossil fuel prices and the possibility of greenhouse gas controls, the federal incentives for nuclear power have helped spur renewed interest by utilities and other potential reactor developers" (Holt 2010, 6). The United States has one reactor site under construction, nine additional reactors planned, and as many as 23 more proposed (WNA 2011a). An $8.5 billion loan guarantee was approved by the Department of Energy for one of these projects, and others are in progress (WNA 2011a). The CRS report also advises: "Relatively low prices for natural gas—nuclear power's chief competitor—and rising estimated nuclear plant construction costs have decreased the likelihood that new reactors would be built without federal support" (Holt 2010, 6).

Timelines and scale are important considerations as well. Putting a new nuclear reactor online in the United States has historically taken more than a decade, though Asian projects have recently been completed in less than five years (WNA 2011c). The two options discussed in the section on Climate Change projected a need for a fleet of 340 and 135 reactors by 2035 for Option 1 and Option 2, respectively. Assuming the current fleet of 104 reactors will be extended to remain operational at that time (EIA 2010a), 236 additional reactors would be needed to meet 50 percent of

the projected 2035 U.S. electricity demand, and 31 additional reactors would be needed to continue to meet 20 percent. This could potentially require $985 billion in loan guarantees for Option 1 and $130 billion in loan guarantees for Option 2.** The engineering and specialized human capital needed to undertake an effort like Option 2 would likely stress the capacity of the nation, and that needed for Option 1 likely does not currently exist within the United States.

As indicated by the "cash machines" description for current nuclear capacity, and unlike fossil fueled power plants, relatively little of the cost of nuclear energy comes from the cost of the nuclear fuel itself (WNA 2011c). Once initial capital costs are met, and a nuclear reactor comes online, it produces electricity less costly than fossil fuel plants (EIA 2011d). Though a finite natural resource, uranium is abundant on the Earth, approximately as common as tin or zinc, and it is a constituent of most rocks and even of the sea water (WNA 2010). Its availability should not be a limiting consideration for nuclear energy this century (Deutch et al. 2009, 12). Unlike other fuel sources such as petroleum, nuclear energy in the United States is not subject to volatile world markets (WNA 2011c). Coal, likewise, enjoys this benefit in the United States. The United States has very large coal reserves, as do China and India (Muller 2008, 89). In 2008, China averaged adding one large (1 gigawatt sized; same output as a nuclear reactor) coal fired power plant weekly (Muller 2008, 300). In 2009, China's consump-

**A simple calculation was used to arrive at these estimates based on the February 2010 DOE loan guarantee precedent. From this precedent a new reactor requires a $4.17 billion loan guarantee ($8.33B divided by 2; FY2010 constant dollars). $4.17B x 236 reactors ≈ $985B. $4.17B x 31 reactors ≈ $130B. The amount would be distributed over the first 15-20 years of the 25 year period. Same process used for Option 2.

tion of coal exceeded three times that of the United States and is trending strongly upward (EIA 2010g). To reduce the economic motivation for the use of coal as an energy source, carbon tax and/or cap and trade programs are a possibility. Implementation of either by governments on a world-wide scale is clearly problematic. A bottom line near term result wherever either is implemented will be a higher cost of energy for consumers, commercial and private. An impact to the economies asked to absorb this will be real, but this does not mean it is not justified.

Adding new U.S. nuclear capacity will add new jobs, many of them specialized and requiring extensive education and training. Addressing this national human capital need, as part of the Energy Policy Act of 2005, in 2009 the Nuclear Regulatory Commission (NRC) "awarded nearly $20 million to 70 institutions to boost nuclear education and expand the workforce in nuclear and nuclear-related disciplines" (NRC 2009). For example, Augusta Technical College, located in Georgia near the only U.S. nuclear reactor site under construction, was awarded a $121,500 grant from the NRC "to help train the next generation of workers in the nuclear industry" (Kyzer 2010). In addition to addressing clean energy, President Obama's 2011 State of the Union Address reinforced the importance of investing in such education.

Increasing the nation's nuclear capacity could be viewed as threatening to the current U.S. coal industry. Generations of Americans have depended on the coal industry for their livelihood, with nearly 90,000 employed domestically in coal mining operations in 2009 (EIA 2010h). President Obama's 2011 State of the Union Address included the possibility of "clean coal" as part of the 80 percent clean energy source mix. Per-

haps an expansion of clean energy capacity to offset growing electricity demand until such "clean coal" technologies can be developed is a possibility.

As is often the case, the direct cost of a course of action will likely determine whether it is implemented and to what degree. The costs of constructing additional nuclear energy capacity will be high. In addition to supply and demand, the economics of fossil fuel usage is dependent on what form and degree of carbon penalty that might be implemented. The true costs of climate change are extremely controversial and at best difficult to forecast. Whether the President's objective to expand nuclear energy within the United States is even capable of maintaining the 20 percent status quo remains to be seen. Based on a 2010 outlook, the DOE estimates that only six to fifteen additional nuclear reactors will come online within the United States by 2035 (EIA 2010a). If a more ambitious expansion, like that of the Option 1 scenario, is realized, then nuclear energy may make a direct impact on national security by positively impacting climate change. However, the environmental argument to incur the costs to do this is weakened if GHG reductions made by the United States are rendered moot by increases in carbon emissions from other countries. As a world leader, perhaps it is time for the United States to lead.

**Sustainability Considerations**

Perhaps the most pressing considerations with regard to the sustainability of nuclear energy as a strategic resource are the economics involved. While this can be said for nearly any resource, in the case of nuclear energy neither raw materials nor technology advancements are the limiting factors. Capital costs and their inherent risks of adding more capacity, driv-

en by the size, complexity, and duration of the construction, is the principal economic driver. The largest U.S. generator of nuclear energy, Exelon (owner of Three Mile Island), did not construct any nuclear plants. They instead purchased them after they were in operation, at which point the risks associated with unknowns related to capital costs and financing were retired. The *Nuclear Energy Policy* CRS report noted the decreased likelihood that additional nuclear capacity would be built in the United States without federal support (Holt 2010, 6). Also as noted, an excerpt from the *Economic Report of the President* justifies such support for clean energy sources, which is restated here for emphasis:

> Market rewards for switching to clean energy production are lower than the societywide benefits, market costs of switching to clean energy consumption are higher than the societywide costs, and markets alone provide less clean energy than is optimal (Obama 2011b, 127).

The Energy Policy Act of 2005 addresses many of the associated economic issues, and its provisions should be sustained, both in authorities and appropriations. The scale of potential loan guarantees far surpasses those currently provided for by legislation. Sustainability of a larger scale loan guarantee program is greatly dependent on reversing the causes of loan defaults as seen previously in the United States. The CES addresses the remaining key economic consideration: a weighted economic disincentive for energy production that increases GHG levels in the environment.

## Public Health and Safety

The 2010 *National Security Strategy* states: "This Administration has no greater responsibility than the safety and security of the American people" (Obama 2010b, 4). It is within this context that factors related to public health and safety implications of nuclear energy are considered.

The fear of nuclear power has been pervasive in the United States (PBS 2010), though attitudes have improved (Jones 2010). In his book *Physics for Future Presidents*, Professor Richard Muller states:

> There is great confusion not only in the minds of the public but in those of our leaders. Many people on both sides of this divisive issue think that their point of view is obvious, and that makes them suspicious of those who disagree. Nuclear power is a problem that future presidents will have to contend with, not only in making decisions, but in convincing the public that their decisions are correct (Muller 2008, 154).

The physics of a nuclear reactor are inherently similar to those of a nuclear bomb, but the engineering of a power plant and a nuclear weapon are necessarily and fundamentally different. Nuclear power plants like those used in the United States are not physically capable of exploding like a nuclear weapon. The physics of their design makes this impossible, period (Muller 2008, 159). More advanced reactor designs, such as next generation light-water reactors and pebble bed reactors, are even safer than those in use today (Muller 2008, 168). A proposed type of future reactor, called a fast breeder reactor, is fueled by plutonium and has efficiencies that make it an attractive option to some. The spent fuel from a fast breeder reactor ac-

tually contains more plutonium than the initial fuel, meaning it can be reprocessed to provide an even greater amount of future fuel. However, the physics of a fast breeder reactor design do not eliminate the possibility of a run-away reaction which could lead to a nuclear explosion (Muller 2008, 163).

Physics also shows that the radiation hazard from nuclear energy is real. The danger generally results from unintended distribution of radioactive material, as in the case of Three Mile Island or Chernobyl. The UN International Atomic Energy Agency (IAEA) estimated that there would be 4000 cancer deaths attributed to Chernobyl (UN IAEA 2005, 4), though Professor Muller believes this calculation more accurately predicts 36,000 cancer deaths (Muller 2011). Using this same calculation method, it is estimated that one cancer death may result from the Three Mile Island accident (Muller 2008, 166). Radon gas from naturally occurring uranium in the region around Three Mile Island is typically 30 percent above national average. For the 50,000 people who live in that immediate area, such natural radioactivity would lead to 60 excess cancer deaths above national averages (Muller 2008, 166). As a counterpoint, Greenpeace has estimated that the cancer deaths due to Chernobyl are closer to 100,000 (Greenpeace International 2006). Any deaths due to a preventable accident are tragic, but perhaps more tragic are deaths that result from intended usage. It has been reported that an estimated 25,000 Americans die annually due to pollutants resulting from the combustion of coal (Kristhof 2005). Additionally, today it is common for coal burning plants to bury their ash byproduct in the ground, even though these ashes are high in carcinogens (Muller 2008, 177).

Development and operation of a more suitable storage solution for spent nuclear fuel must be addressed. Today spent fuel is maintained locally at each nuclear energy facility. From a safety and security perspective, it is difficult to justify this situation. To address this issue, billions of dollars have been spent developing a centralized long term storage location at Yucca Mountain in Nevada. This project is not supported by President Obama and has seen its 2011 federal funding nearly zeroed (Tetreault 2010). Direct instructions related to this "back-end" of the nuclear fuel cycle were provided by the President to the Blue Ribbon Commission (Obama 2010d).

**Sustainability Considerations**

The WNA reports that as of May 29, 2011, there have been 14498 reactor-years of worldwide experience in producing civil nuclear power (WNA 2011d), and during this 50-plus year history there have been three major reactor accidents: Three Mile Island, Chernobyl, and Fukushima. The WNA summarizes: "One was contained without harm to anyone, the next involved an intense fire without provision for containment, and the third severely tested the containment, allowing minor release of radioactivity" (WNA 2011e). Based on these data, one might assert that nuclear energy has demonstrated a track record of sustainability with regard to public health and safety at appropriate risk levels, especially relative to risks associated with other means of energy production and usage. Once again public and political will are greatly, and rightly, swayed by health and safety considerations. An education and communications effort to rightly inform each is needed. An expansion of the U.S. fleet of nuclear re-

actors offers the ability to add safer and more efficient designs, allowing for retirement of older units and the reducing the source of harmful effects from fossil fuel combustion. A long-term, safe, secure storage solution of spent nuclear fuel seems to be a major sustainability issue that requires resolution. This will likely be a lesson learned from Fukushima.

**Nuclear Terrorism and Proliferation**

In his seminal 1993 paper, titled "The Clash of Civilizations?," Professor Samuel Huntington relates the response from the defense minister of India when asked what lesson he had learned from the 1991 Gulf War. The defense minister's response was: "Don't fight the United States unless you have nuclear weapons" (Huntington 1993). Professor Huntington offers that non-Western nations "have absorbed, to the full, the truth" (Huntington 1993) of this lesson.

In his opening statement within the 2010 U.S. *Nuclear Posture Review* (NPR), Defense Secretary Robert Gates states: "This NPR places the prevention of nuclear terrorism and proliferation at the top of the U.S. policy agenda" (Gates 2010, i). The NPR goes on to state:

> The most immediate and extreme threat today is nuclear terrorism. Al Qaeda and their extremist allies are seeking nuclear weapons. We must assume they would use such weapons if they managed to obtain them (Gates 2010, 3).

Preventing terrorist organizations from obtaining, creating, or employing weapons of mass destruction (WMD) has been a central theme in the on-going U.S. war against terrorism and al Qaeda. *The National Mili-*

*tary Strategy of the United States of America 2011*states: "The intersection between states, state-sponsored, and non-state adversaries is most dangerous in the area of WMD proliferation and nuclear terrorism" (Mullen 2011, 3). Additionally, preventing terrorist acts against nuclear energy infrastructure, as discussed in the section on Energy Security, are important both to directly ensure the availability of the resource and to prevent an erosion of public support for nuclear energy which could indirectly deny the resource. The NPR lists nuclear proliferation as today's next pressing threat, specifically calling out actions by North Korea and Iran:

> In pursuit of their nuclear ambitions, North Korea and Iran have violated nonproliferation obligations, defied directives of the United Nations Security Council, pursued missile delivery capabilities, and resisted international efforts to resolve through diplomatic means the crises they have created (Gates 2010, 3).

There are three key elements listed in the NPR for preventing nuclear terrorism and proliferation. The first element is most applicable to nuclear energy, while the latter two relate specifically to current nuclear weapons. The nuclear energy related element has multiple initiatives, the first of which is to "bolster the nuclear non-proliferation regime and its centerpiece, the Nuclear Non-Proliferation Treaty (NPT), by reversing the nuclear ambitions of North Korea and Iran" (Gates 2010, vi). Also identified is the need to strengthen UN IAEA safeguards and their enforcement, and to curb the illicit trade of nuclear materials and technologies. Finally, the NPR calls for "promoting the peaceful uses of nuclear energy without increasing proliferation risks" (Gates 2010, vii).

The previously cited Brookings report summarizes the proliferation risks that are currently inherent in expanded peaceful uses of nuclear energy:

> An expansion of the civilian nuclear sector to include new actors will bring with it a wider diffusion of nuclear materials, technologies, and knowledge at a time when the international regulatory regime is struggling to cope with existing security and safety concerns. The Treaty on the Non-Proliferation of Nuclear Weapons (NPT), the foundation of international efforts to ensure nuclear non-proliferation, is facing both institutional and operational challenges with respect to current nuclear activities. Any expansion of nuclear commerce involving the spread of sensitive technologies such as uranium enrichment and spent fuel reprocessing will put additional pressure on a fragile non-proliferation regime leading to increased risks (Banks et al. 2010, vi).

Two aspects of the NPT are essentially, though perhaps unintentionally, at odds with each other. The basic intent of the NPT is to reduce the risk of nuclear war by preventing the proliferation of nuclear weapons. It also openly allows for the peaceful use of nuclear energy. The conundrum is that a nation which possesses a self-sufficient nuclear energy program, subsequently also possesses the capability to conduct a nuclear weapons program.

The two areas specifically called out in the Brookings report are uranium enrichment and spent fuel processing. Addressing the latter first, "plutonium is created in most nuclear reactors, including those built to produce electric power" (Muller 2008, 136). Professor Muller explains: "It (plutonium) comes out mixed with other nuclear waste, but it can be separated using relatively straightforward chemistry" (Muller

2008, 138). Spent fuel processing or reprocessing are terms used to describe this process. Reprocessing can be used to remove fissile waste materials from spent reactor grade uranium, so that the fuel may be used again. In this case the plutonium is a waste product. Reprocessing could also be used to recover the plutonium. In this case the plutonium recovered by reprocessing can be used as fuel for commercial nuclear reactors like those used in France. Reprocessing could be considered desirable, because in practical terms it ensures a "near-infinite" supply of nuclear fuel and it can reduce the total volume of nuclear waste produced. However, this plutonium could also be a source of nuclear material for a thermonuclear bomb. Because of this inherent risk, provisions were placed in the NPT addressing reprocessing and "developing nations that signed the NPT have agreed that they will not reprocess spent fuel" (Muller 2008, 137).

Under President G. W. Bush, the United States reversed a long-standing policy to abstain from nuclear fuel reprocessing, funding a program described as nuclear fuel "recycling" (Squassoni et al. 2008). President Obama has reversed this decision by withdrawing funding for this program before any reprocessing activity occurred. At President Obama's direction, the Blue Ribbon Commission is specifically addressing issues related to U.S. nuclear fuel reprocessing. Dr. James Acton, from the Carnegie Endowment for International Peace, addressed the Commission and spoke against domestic spent fuel reprocessing, stating: "The real value of American restraint is not that it encourages existing reprocessers to stop; it is that it doesn't encourage new ones to start" (Acton 2010). Linked to the issues of reprocessing is the need for the United States to decide on a path forward for long term storage of nuclear waste.

Uranium enrichment is not prohibited by the NPT and is a fundamental step necessary to produce reactor grade fuel like that used in U.S. commercial reactors. However, a program that is capable of enriching uranium to reactor grade is also capable of producing uranium that is weapons grade. Professor Muller explains:

> The hard part of enriching uranium is handling the large amounts you have to process to convert the uranium from 0.7 percent U-235 to reactor grade 3 percent U-235. By the time you've done that, the amount of material you have to handle has been reduced by a factor of four, and further enrichment to 80 percent or 99 percent U-235 purity is relatively straightforward (Muller 2008, 189).

As such, the NPT can too easily be used as cover for an illicit nuclear weapons program, as is potentially the case in Iran, an NPT signatory nation. The inspection authorities the treaty gives the IAEA are intended to prevent this from occurring, though this is clearly problematic as the statements from the NPR and the Brookings report have indicated.

Consistent with this line of reasoning, the supply of nuclear fuel from Russia to the Iranian nuclear reactor at Bushehr (Pomeroy 2010) could be considered a stabilizing action with regard to nuclear weapons non-proliferation. Given this supply of nuclear fuel, the on-going Iranian activities to enrich their own nuclear fuel could be considered a de-stabilizing act. The website CNN.com quoted White House Spokesman Robert Gibbs as saying:

> Russia is providing the fuel and taking the fuel back out. It, quite clearly, I think, underscores that Iran does

> not need its own enrichment capability if its intentions, as it states, are for a peaceful nuclear program (CNN 2010b).

From a physics perspective, Professor Muller offers: "No matter what the intentions of Iran are, the capability to make weapons is being developed in that country" (Muller 2008, 189).

**Sustainability Considerations**

The 2010 U.S. NPR effectively captures and addresses the sustainability considerations of a nuclear renaissance in terms of the potential for an increased threat of nuclear terrorism and proliferation by championing a series of initiatives: bolstering the nuclear non-proliferation regime and its centerpiece, the NPT; strengthening UN IAEA safeguards and their enforcement; and curbing the illicit trade of nuclear materials and technologies. This approach helps ensure the sustainability of commercial nuclear energy by recognizing the needs to promote the "peaceful uses of nuclear energy without increasing proliferation risks" (Gates 2010, vii). While the raw resources needed to produce nuclear fuel are not a worldwide limitation, an increasing number of nations with the capacity to turn the raw material into fuel is itself potentially threatening. A world nuclear fuel bank could alleviate the need for nuclear fuel production in additional nations (Banks et al. 2010, viii).

**Recommendations**

Motivated by the underpinning concept that America's energy choices are inextricably linked to national security (CNA 2010, vii), this examination has

focused on one of those energy choices: nuclear energy. From the analysis herein, I believe that all six of the national security interest areas would be advanced by: 1) substantially expanding capacity for nuclear power generation within the United States, along with 2) providing worldwide leadership to ensure that the positive contributions of "benign" nuclear energy are enjoyed and the negative aspects are mitigated. To accomplish these, the sustainability considerations discussed must be addressed. This position is consistent with the vision espoused by President Obama, though the execution of this vision must be long-term and is by no means certain. To this end, the following three recommendations are offered.

First, quantify the goal for nuclear power generation. A vision without a plan can be a difficult thing around which to create policy, commit resources, and execute a decentralized nation-wide program. President Obama's *Blueprint for a Secure Energy Future*, containing his goal of 80 percent of America's electricity coming from clean energy sources by 2035, is a good start. Given the 2009 U.S. percentage for non-fossil fuel electrical energy sources was roughly 32 percent (EIA 2009), a considerable advancement is required. An annual roadmap, by percentage and type of energy source needed to reach this 2035 goal, must be created.

A notional scenario, called Option 1 in the Climate Change and Economics sections, called for meeting 50 percent of the U.S. electricity demand with nuclear energy by 2035. This would require that other clean energy sources supply the remaining 30 percent needed to meet the President's goal. Option 1 required 236 additional nuclear reactors to be built by 2035. Today in the United States, there is new construction underway

at one nuclear site. A 2010 DOE outlook, conducted prior to the *Blueprint's* release, estimated that only between six and fifteen new reactors will be built by 2035 (EIA 2010a). While these figures are estimates, and relative percentages need not be has defined in the Option 1 or 2 scenarios developed herein, clearly action must be taken very soon to address the magnitude of this disparity. Quantifying the nuclear power generation goal will allow for progress to be tracked, such that policy, resources, and execution can be adjusted accordingly, helping ensure the vision is achieved.

Second, set the stage economically to achieve the goal. Once a roadmap is in place, it must be resourced in order to be executed. Author Thomas Friedman has been quoted as using an oft-repeated Pentagon saying: "vision without resources is a hallucination" (Kotin 2008). Offering loan guarantees commensurate with the levels projected by the roadmap is a start. Addressing the causes which lead to high default rates in the past would be critical to ensuring this program succeeds. Tax incentives, to offset the large capital costs that discourage entry into the market, could later be offset by the taxes generated on revenue from the additional capacity and increased economic activity spurred by additional energy. Consistent with the 2011 State of the Union Address, a continued investment by the federal government in the human capital is needed to support the roadmap. The authorities of the 2005 Clean Energy Act address many of the relevant concerns and should be sustained and resourced.

The federal government has other means to influence resourcing beyond simply spending money from its treasury. Further streamlining the federal licensing and oversight process could pay immediate dividends in terms of time and cost savings. An example of such could be the standardizing of reactor designs

to no more than two or three for a period of time, say ten years. This would allow for simplified licensing and oversight, while allowing for competition in the marketplace, and ensuring that only the safest designs are used to increase the U.S. commercial nuclear fleet. Lastly, the current stagnation on formulating energy policy regarding carbon taxes or cap-and-trade programs increases uncertainty and discourages private sector investment. The President has put forth his intent as defined in the *Blueprint for a Secure Energy Future*. Around this intent, legislation must be proposed so that the details can be debated and worked out. Perhaps an essential role of government in a capitalist society is to address areas where societal costs and benefits are not adequately reflected by market forces, but to do so to establish a balance and then allow market forces to work. Ultimately, legislation, law, and an actionable roadmap should be a priority for our nation. The roadmap will be viable only if the economics of the program are viable.

Third, with an increasing emphasis on a nuclear renaissance, the United States must remain vigilant on the world stage to ensure that existential threats to the United States and its allies are not realized through actions such as nuclear terrorism. The United States should work to gain international support for an addition to the NPT to disallow nuclear fuel enrichment by non-nuclear weapons states or by states with a nascent nuclear program, similar to how the treaty addresses nuclear fuel reprocessing. To make this feasible, another provision could create a world nuclear fuel bank (Banks et al. 2010, viii) to give those nations not producing their own fuel the energy security they require with regard to access to nuclear fuel. An economic incentive for compliance, such as subsidized lease rates

for the use of the fuel, might be in the interest of the United States. Nation's with only peaceful intentions for nuclear energy would likely benefit by such provisions. Nations which refuse to accept or comply with these provisions could lose the cover to pursue an illicit nuclear weapons program that the NPT currently provides. Finally, to further address the viability of a world nuclear fuel bank and to improve upon the current public safety and energy security situations, the United States must decide and act upon a long-term storage solution for spent nuclear fuel.

**Summary**

This paper has endeavored to continue Professor Einstein's work to "carry to our fellow citizens an understanding of the simple facts of atomic energy and its implications to society" (Einstein 1946). In examining the relevance that nuclear energy has with regard to U.S. national security, a broad exploration of the national security interest areas of energy independence, energy security, climate change, economics, public safety, and nuclear terrorism and proliferation was conducted, along with sustainability considerations for each. From a systems perspective, it was evident that these six areas were often interrelated. Both direct and indirect ties where presented relating nuclear energy to national security. I believe that all six of the national security interest areas would be advanced by: 1) substantially expanding capacity for nuclear power generation within the United States, along with 2) providing worldwide leadership to ensure that the positive contributions of "benign" nuclear energy are enjoyed and the negative aspects are mitigated. Three recommendations for actions beneficial to implementing this position were offered.

In conclusion, the insights of a third Nobel Laureate are presented for consideration. In 2004, Professor Richard Smalley testified before the U.S. Senate Committee on Energy and Natural Resources, saying: "Energy is the single most important challenge facing humanity today.…Electricity will be the key" (Smalley 2004).

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# 11

# Sustainability National Security Military Lands Management: The Ecological Foundation of Sustainability

*William W. Doe III*

## Introduction

Since the early 1990's, the U.S. Armed Services have developed and implemented a wide range of initiatives and programs to comply with federal and state environmental protection laws on the lands they manage for military training and testing. Beyond mere compliance, many of these efforts have been aimed at instilling the foundations of environmental stewardship and sustainability practices within the military. This reality is often counter-intuitive to those groups who view the military as the federal government's largest polluter and agent of environmental destruction.

More recently the U.S. military has embraced "sustainability" as an overarching concept for managing its installations, focusing primarily on the built and operational environments from the perspectives of energy use, efficiency and security. However, the military's management of its landscapes and natural resources – currently representing over 30 million acres of federal lands within the fifty states – represents the historical, geographical and ecological foundation of its environmental and sustainability ethos. The "ecology of place" is the underlying and organizing principle of sustainability. Thus, recognizing and understanding the relationships between military activities and their physical/ecological contexts cannot be ignored in the path to sustainability.

As the U.S. military's largest land-based component, the U.S. Army has arguably led the evolution of land environmental stewardship and sustainability. There is a synergistic relationship between the Army's training to fight in varied operating environments in the United States, and its success once it is deployed

to a particular region of the world. Thus, the Army needs diverse landscapes in which to train units and test equipment as "operational analogs" to places they may be deployed. The diversity and extent of lands managed by the Army requires them to exercise proactive environmental stewardship practices to sustain these resources as an essential component of its readiness posture.

Military lands in the United States have become increasingly valuable, not only in support of national defense, but for their unique ecological value as well. These landscapes and ecosystems contain significant biodiversity of flora and fauna. As much of the United States has developed and commercialized, these military lands now have become, in many cases, "islands of diversity," supporting a wide range of threatened and endangered species, and their associated natural habitat. This reality has increased the complexity of managing these lands sustainably, while meeting mission requirements. Thus, increasing conflicts, both within the military and with outside neighbors, have become part and parcel of the military's land management paradigm.

This chapter will provide an historical, geographic and ecological overview of U.S. military lands, illustrate the approaches to land management, and address some of the emerging trends and conflicts in land sustainability.

## Introduction to Military Lands and Mission Perspective

Today there are over 3,700 locations where the military manages land in the fifty states. Figure 1 depicts the distribution of 200 of the largest military installa-

tion locations, totaling approximately 18 million acres, or some 60%, of the 30 million acres in the existing military land inventory. Land management responsibilities lie with all four Armed Services (Army, Air Force, Navy and Marine Corps). The Army manages the largest percentage of lands, with approximately 51% of the 30 million acres (12.1 mill ha), while the Air Force manages about 38% of the inventory and the Navy/Marine Corps the remaining 11% (Doe and Palka 2011).

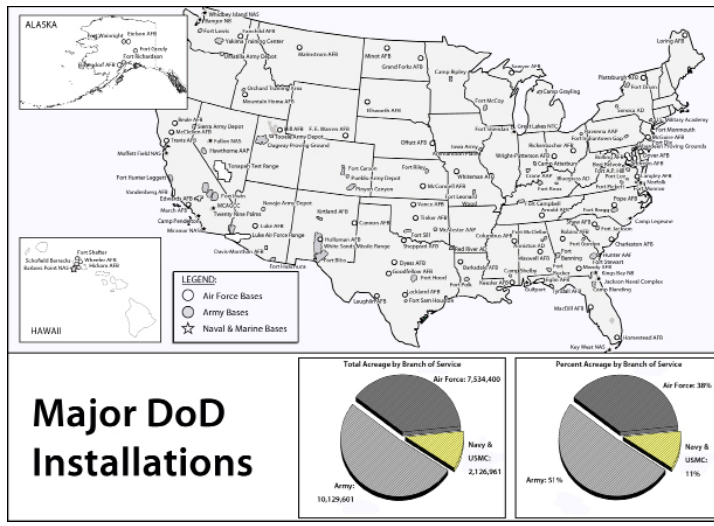


**Figure 1. Map of major U.S. military installations (Doe 2011).**

Today's military lands represent the Department of Defense's (DOD) places for training, testing and power projection of forces from the United States to theaters of operation abroad, be it to fight global terrorism, conduct security and stability operations, or support humanitarian missions, such as disaster

response to hurricanes, tsunamis and earthquakes (Doe et al. 2006). While the total footprint remains approximately the same as it did during the Cold War era, several large installations have been closed or realigned under the congressionally mandated Base Realignment and Closure process (BRAC). The projected redeployment of many forces from abroad in Germany, Iraq and other countries back to the United States will require additional space on current installations in the United States. For example, Fort Bliss, TX and Fort Carson, CO are increasing by over 10,000 soldiers (in addition to their family members) each in the next two years.

Of all the Armed Services, the Army has the largest requirement for land to provide the maneuver space, ranges and munitions impact areas necessary for the conduct of training and testing. Army installations are geographically distributed throughout the continental U.S., Hawaii and Alaska, representing a variety of landscapes and environmental conditions that are found throughout the rest of the world. There are more than one hundred major (50,000 acres or larger) Army installations currently managed by the Active Army, Reserves and Army National Guard.

The sizes of today's major Army installations vary considerably, ranging from approximately 25,000 contiguous acres (10,118 ha or 100 $km^2$) to as many as 2 million contiguous acres (809,000 ha or 8,500 $km^2$) (Doe and Palka 2011). The largest Army installations with land available for training and testing are found in the southwest and far western regions of the country. These include Fort Bliss, TX, and White Sands Missile Range, NM (separate installations joined by a common boundary), comprising approximately 3.2 million acres (1.30 mill ha), and Yuma Proving

Ground, AZ, a weapons, equipment and vehicle test site in the desert, comprising approximately one million acres (404,700 ha). The Army's largest installation dedicated to large-scale, mechanized, force-on-force exercises is Fort Irwin, CA, covering approximately 755,000 acres (305,548 ha) in the Mojave Desert (Doe and Palka 2011). Other notable concentrations of major active Army installations exist in the Southeast (Fort Benning, GA; Fort Bragg, NC; Fort Gordon, GA; Fort Jackson, SC; Fort Polk, LA; Fort Rucker, AL; and Fort Stewart, GA), and the Rocky Mountain region (Fort Carson, CO; and Pinon Canyon Maneuver Site, CO). Additionally, the Army has three major installations (Fort Greely, Fort Richardson, and Fort Wainwright) in Alaska and two major installations (Schofield Barracks and Pohakuloa Training Area) in Hawaii.

From a readiness perspective, these training and testing lands, and their associated physical attributes (e.g., terrain, vegetation and climate), can be viewed as "operational analogs" for potential areas of conflict where the Army may be deployed to fight a major theater war or participate in security, stability and support operations (Doe and Bailey 2007). There is a synergistic relationship between the Army's training to fight in varied operating environments in the United States, and its success once it is deployed to a particular region of the world. In Table 1, the Army's U.S. land inventory depicts analogs to potential areas of conflict where the Army may be deployed to conduct real-world missions (Doe 2011). Figure 2 illustrates the locations of 31 major Army installations superimposed upon a map of ecoregions in the United States, as described by Robert Bailey's World Ecoregional Classification System (Bailey 1998; Doe and Bailey 2001). Bailey's system delineates and describes contiguous areal extents with common climate and

vegetation characteristics across continents, which also exhibit similar landforms, soil, flora, fauna, and ecological succession. Thus, it enables geographical and environmental comparison of Army training and testing lands throughout the United States with regional areas abroad where Army forces may be deployed operationally (Doe and Bailey 2007).

| Conflict-Operational Area | Ecoregion (Bailey's Classification) | Army Installation Analogs |
|---|---|---|
| Iraq, Kuwait, Saudi Arabia, Afghanistan | Tropical/Subtropical Desert | Fort Irwin, CA; Fort Bliss, TX; Yuma Proving Ground, AZ; White Sands Missile Range, NM; Fort Huachuca, AZ |
| Iran, Somalia | Tropical/Subtropical Steppe | Fort Hood, TX; Fort Sill, OK |
| Korea | Hot Continental | Fort Campbell, KY; Fort Knox, KY; Fort Drum, NY; Fort Leonard Wood, MO |
| Haiti | Savanna, Rainforest | None |
| Panama, Nicaragua | Savanna, Rainforest | None |
| Rwanda | Savanna, Rainforest | None |
| Philippines, Indonesia | Savanna, Rainforest | None |
| Bosnia, Kosovo | Mediterranean | None |

**Table 1. Analogs of U.S. Army installations (Doe 2011).**

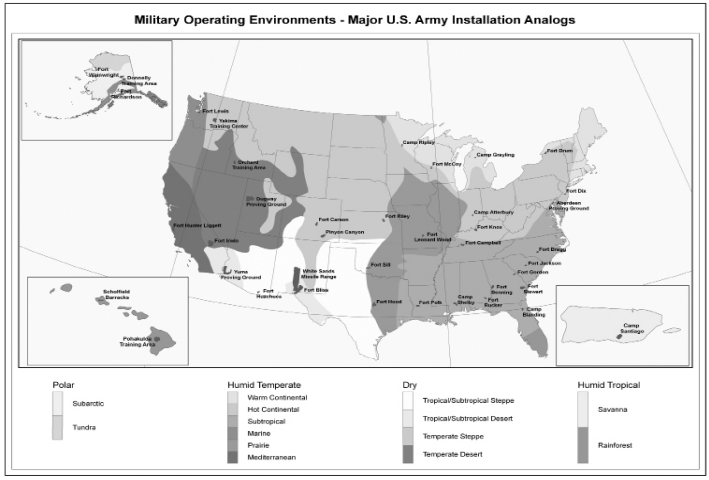


**Figure 2. Map of 31 U.S. Army installations by ecoregion (Doe and Palka 2011).**

## Historical Roots and Evolution of Environmental Stewardship in the Army

The Army's engagement with land stewardship and natural resources management has extensive historical roots that long preceded current perspectives on sustainability. The evolution of these historical and organizational perspectives is important to consider as a foundation for embracing and implementing sustainability. Historically, in its relationship to the founding of the American nation and its early continental expansion in North America, the U.S. Army represents a unique military organization.

The Army possessed a strong environmental ethic during its organizational roots in the late 18th and early 19th centuries. From the beginning of nationhood, the Army's environmental character was innately linked to its relationships with the American landscape (Doe 2008). This began with President Thomas Jefferson's declaration in 1802 to develop a military engineering school at West Point, New York. In addition to mathematics and engineering, the early curriculum at West Point included such subjects as geography, geology, meteorology, and landscape sketching. West Point graduates could prepare detailed topographical maps, identify and sketch flora and fauna and write about the natural environment with scientific clarity and precision (Meyerson 2001). This education was perhaps most evident in the landscape paintings of Captain Seth Eastman, an early faculty member at West Point, who became famous for his sketches of landscapes along the Mississippi River while stationed on frontier posts during the 1820's. Subsequent expeditions to the West by Academy graduates, such as Major Stephen Long to the Great Plains and the Front

Range of the Rocky Mountains in the 1830's, included geologists, botanists, zoologists, artists, surveyors, astronomers and meteorologists who documented and mapped the territories and their flora and fauna (Meyerson 2001).

The academic foundations and training which West Point officers received in these early years extended further into the 19th century as the westward movement ensued. Many West Point officers were commissioned in the Cavalry (horse cavalry) and led mounted troop units westward into the Great Plains and Desert Southwest to control and fight Native American tribes residing in these territories. These officers and their soldiers established forts throughout the West, along wagon trails and major waterways, to protect citizens, trappers, fur traders and commercial investors as they moved westward. While their primary role was to provide security and protection, the U.S. Cavalry, which later became known as the "Old Army," developed a unique sense of public service and citizenship that has been described as "ecological nationalism."(Meyerson 2001). This ecological nationalism evolved from the Cavalry's close association to the western landscape as it traversed its vast and inspiring terrain and weathered the harshness of its climate and natural phenomena. Additionally, the Army Cavalry was given a mission of public service to "protect and defend" this western landscape from those who were more bent on malicious use and consumption of its resources. In the early 1900's as President Teddy Roosevelt sought to protect national treasures in the emerging National Parks, the U.S. cavalry was assigned this mission, with several West Point officers holding the distinction of being the first National Park Superintendents at Yellowstone, Sequoia and Yosemite parks (Meyerson 2001).

The Army emerged from the frontier era at the beginning of the 20th century as an international power beginning with World War I. In the mid-1940's, as the Army expanded to meet the U.S. entrance into World War II, it significantly expanded its territorial needs for training and testing lands in the continental U.S. Army maneuvers were conducted on vast expanses of land in the desert Southwest (Mojave Desert) by General Patton and his armored forces, and in the Southeast during the so-called Louisiana Maneuvers (Bischoff 2008). During later conflicts abroad (Korea and Vietnam), the Army became focused on the technological advances in warfare, becoming one arm of what President Dwight Eisenhower coined the "military-industrial complex." Much of its awareness of environmental stewardship waxed and waned, with the exception of small civilian conservation staffs on military installations dedicated to forest management and other related activities. However, the emergence of the national environmental movement in the late 1960's and early 1970's caused the Army to adapt to increasing environmental laws and regulations. This slowly led to a reawakening of its responsibilities towards environmentally sustainable land management practices (Wilcox 2007).

During the 1990's the Army took several steps to integrate environmental awareness training and education into its leadership courses for commissioned and non-commissioned officers. For example, short courses in environmental training were developed and imbedded into the curriculums at the various Army Officer Basic Courses (OBC) and Advanced Officer Courses (AOC) which every junior officer was required to attend as part of their professional development. During this same period, the Army began to

publish a variety of professional service manuals (referred to as Training Circulars and Field Manuals) to codify and address the responsibilities of unit leaders for environmental stewardship. As stated in the "Unit Leader's Handbook for Environmental Stewardship,"

> All leaders are expected to serve as the Army's basic environmental stewards. They have a professional and personal responsibility to understand and support the Army's environmental program… which will enable leaders to complete an assigned mission and conserve the fighting strength, while protecting the environment and conserving our natural resources (U.S. Army, 1994).

Also included in this Handbook are statements of policy from then-Army Chief of Staff General Gordon Sullivan:

> The Army will be a national leader in environmental and natural resources stewardship for present and future generations as an integral part of our mission. Among the many challenges we in the United States Army face today, none is more crucial than the balancing of realistic training, dwindling resources, and the preservation of our vital natural resources. We must remain trained and ready; we must protect the environment today and in the future. Just as we preserve and defend the freedom of this great country of ours, so must we also protect its finite and precious resources (U.S. Army, 1994).

This educational component of Army officer and non-commissioned officer training continues today and has been broadened to incorporate larger contexts of sustainability. Additional educational initiatives in military sustainability have emerged beyond the in-service training to include graduate level courses at

public universities, such as Colorado State University and the University of Virginia (Doe 2010; Zeidler 2010).

**Integrated Natural Resources Management**

Within this broader historical context of military sustainability, the management of natural resources management on military lands began in earnest in the middle of the 20th century as the Services acquired and retained extensive tracts of lands for training and testing before and after World War II. In particular, the early focus of these efforts centered on forest management and wildlife management. In the post-WW II era, weapons technology and tactics led to bigger, more powerful, and more destructive vehicles and weapons systems. Consequently, the environmental disturbances and impacts of military activities on these lands became a concern. The need to rehabilitate this land damage, both to sustain it for long-term use and to comply with emerging federal environmental laws in the 1970's, increased the importance of comprehensive land management approaches. Furthermore, multi-purpose uses of military lands beyond military activities also necessitated these efforts. These management requirements resulted in the establishment and growth of professional land management staffs on military installations, representing such disciplines as forestry, wildlife management, watershed management, vegetation and invasive species management, and ecology.

Several Congressional initiatives, including the Sikes Act of 1960 spurred early efforts in land management. The Sikes Act, named after Rep. Robert L.F. Sikes, a Democrat representing Northwest Florida,

home to Eglin AFB and other major DOD installations, was enacted in 1960 "to promote effectual planning, development, maintenance, and coordination of wildlife, fish, and game conservation and rehabilitation in military reservations." Over the last several decades the Act has been significantly strengthened, and its scope expanded, to the point that it now represents a comprehensive law mandating the conservation of all aspects of natural resources on military lands (Benton, et al., 2008).

The amendments provided in the Sikes Act Improvement Act of 1997 significantly strengthened DOD natural resources programs by mandating the development and implementation of Integrated Natural Resources Management Plans (INRMP) for all installations with natural resources. INRMPs are required to be prepared in cooperation with the appropriate state fish and game agency and the U.S. Fish and Wildlife Service, and are subject to public review and comment. Additionally, the services must fund and implement their INRMPs, review them annually, and update them as necessary at least every five years (Benton, et al., 2008).

In addition to their primary use for military activities, military lands provide other uses including: 1) forestry management, 2) hunting, fishing and outdoor recreational activities, and 3) agriculture and grazing. In some rare instances, mining and mineral extraction activities may also occur. While multiple-purpose uses on these federal lands are not directly related to the military mission, they may complement the overall natural resources management approach. These multiple uses may also generate revenue for the military installation. Many of these multiple purposes provide opportunities for military personnel and their families

and community members to enjoy the outdoors and local environments associated with military installations.

In order to accomplish this multidimensional land management stewardship, military installations employ numerous research and support organizations and programs, staffed by federal environmental professionals at all levels of the organization (Doe et al. 2005). Although each installation's staffs may vary depending upon the scale and scope of its lands, larger installations are composed of natural resources staff organized under the installation or garrison commander. These land management efforts are often supported by a wide range of environmental consultants, academic researchers and non-profit organizations, who work under federal contracts or other collaborative agreements to provide these services. As the demands for land management have increased and the size of the federal workforce has declined, these other groups represent a much larger component of the day-to-day natural resources management capacity. As one example, the author worked for ten years as an academic contractor and scientist with the Center for Environmental Management of Military Lands (CEMML) at Colorado State University, which provided over 300 natural resources management personnel to military installations nation-wide under a variety of federal contracts.

One example of these land management programs is the U.S. Army's Integrated Training Area Management (ITAM) program, conceived in the mid-1980s by the U.S. Army Corps of Engineers, under the auspices of the Corps' Construction Engineering Research Laboratory (CERL) in Champaign, Illinois. The ITAM program provides land management professionals to manage training land resources, including

inventorying and monitoring of vegetation and soils, rehabilitation and repair of damaged lands, and GIS mapping and modeling (Balbach et al. 2008). Additionally, through ITAM and other educational awareness programs, the Army has formulated broad and encompassing educational and operational directives and programs to provide soldiers and unit leaders – those who actually conduct military operations – with an understanding of environmental stewardship principles and applications, and their relationship to military readiness.

**Ecosystem Management and Conserving Biodiversity**

Significant proportions of military lands in the United States remain minimally undisturbed from their pre-military occupation state, and often represent the most undisturbed ecosystems in a region, particularly in areas where residential, commercial and industrial development have largely altered the landscape. This reality is somewhat counter-intuitive to the general public, who generally envision these lands as "wastelands of destruction," impacted by maneuvers, unexploded ordnance, munitions waste and other fragments of military activities. Indeed, some portions of these military lands, particularly the live-fire impact areas for ranges, are heavily impacted and contain dangerous and toxic constituents from munitions. However, these designated "sacrifice areas" represent only a small fragment of the overall military land inventory.

Consequently, many military lands have become, through somewhat unintended consequences, sanctuaries for hundreds of threatened and endangered

species of flora and fauna and become increasingly valuable for their ecological value and ecosystem services. The DOD has over 220 federally listed species on their lands. In comparison to other large federal land management agencies with much larger acreages, including the Bureau of Land Management (BLM), U.S. Forest Service (USFS), U.S. Fish & Wildlife Service (USFWS), and the National Park Service (NPS), the Department of Defense lands contain a much larger population and proportion of threatened and endangered species which are regulated under federal environmental laws (Stein 2008). Figure 3 illustrates this point, showing that of all the federal agencies that manage land, the DOD has by a large margin, the greatest biodiversity per acre as compared with any other federal agency, including the BLM, USFWS, the NPS, and the USFS (Benton et al. 2008).

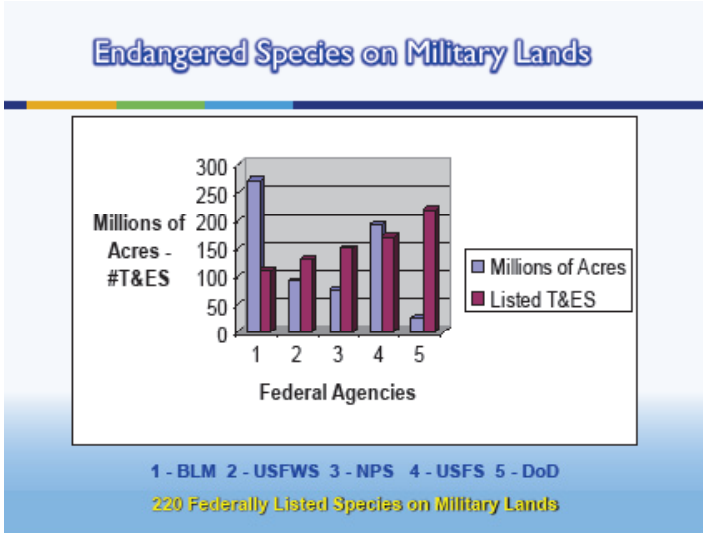


**Figure 3. Threatened and Endangered Species on U.S. federal lands.**

Military lands are required to comply with the provisions of the Endangered Species Act (ESA) and other environmental laws. The management of threatened and endangered species and their habitats on military lands has become a focal point of natural resources management at such installations as Fort Bragg, NC; Fort Benning, GA and Fort Polk, LA (for the endangered red-cockaded woodpecker), Fort Irwin, CA (for the desert tortoise) and in Hawaii for several endangered plants (Shaw et al. 2005).

The DOD formally established a policy for an ecosystem approach to natural resources management and for the conservation of biological diversity in its 1996 Conservation Instruction 4715.3 (Benton et al. 2008). The stated goal of ecosystem management is to ensure that military lands support present and future training and testing requirements while preserving, improving, and enhancing ecosystem integrity. Over the long-term, this approach is intended to maintain and improve the sustainability and biological diversity of terrestrial and aquatic (including marine) ecosystems while supporting sustainable economies, human use, and the environment required for realistic military training operations. This directive establishes the following goals for the conservation of biological diversity on military lands (Benton et al. 2008):

- Maintain or restore remaining native ecosystem types across their natural range of variation.
- Maintain or reestablish viable populations of all native species in an installation's areas of natural habitat, when practical.
- Maintain evolutionary and ecological processes, such as disturbance regimes, hydrological processes, and nutrient cycles.
- Manage over sufficiently long-time periods for changing system dynamics.
- Accommodate human use in those guidelines.

Each of the services has incorporated policies regarding ecosystem management and biodiversity conservation into their natural resources directives. Land managers are beginning to incorporate the ideas and financial incentives of "ecosystem services" into their approaches in order to capitalize on the value of habitats and natural resources under their management (USAEPI 2007a).

**Integrated Cultural Resources Management**

A related aspect of ecosystem and natural resources management on military lands has been the implementation of programs to manage cultural resources, including pre-historic, historic and cultural artifacts, sites and buildings. In parallel to the rise of federal environmental laws, the past several decades have seen wide ranging legislation related to cultural resources, including the National Historic Preservation Act, the Archeological Resources Protection Act, the American Indian Religious Freedom Act, and the Native American Graves Protection and Repatriation Act.

Contained within U.S. installations and their associated military lands are more than 160,000 known archaeological sites, 19,000 historic properties, 73 national historic landmarks, and the largest inventory of historic buildings in the federal government (Zeidler 2010). As with natural resources, cultural resources are managed by professional government staffs, often augmented by contractors and universities. The development of Integrated Cultural Resources Plans (ICRMPs) for each installation provides the goals and protocols for ensuring protection of these resources in concert with federal laws and the military mission.

## Encroachment Issues and Conflicts

Despite the many successes and strides noted by the military in moving towards a sustainable land and installation management concept, the military's management of its land is not without controversy. The management of species and other resources mandated by law has often come into conflict with military training needs. Examples of these conflicts abound, sometimes resulting in the closure of critical training ranges and assets or producing legal actions against the military. One of the more noteworthy cases was the closing of a critical multi-purpose firing range at Fort Bragg, NC in the late 1980s when the USFWS successfully stopped Army use due to violations of the Endangered Species Act with regards to the red-cockaded woodpecker. The policy and legal aspects of this case are well documented (Rubenson et al. 1993). In Hawaii, a newly constructed firing range was never opened when an endangered plant was discovered during a biological survey (Shaw et al. 2005).

Many military lands were initially established in very rural areas but are now surrounded by development – both residential and commercial. This has created additional land use conflicts with surrounding communities. In the late 1990's the term "encroachment" was defined by the DOD as "the cumulative result of any and all outside influences that inhibit normal military training and testing" (USGAO 2003). These influences included noise complaints, zoning regulations, safety concerns for landing aircraft and munitions firing, and other issues. Encroachment issues initially resulted in a "we versus they" mentality that put the military and its surrounding neighbors at odds.

However, in the past five years an era of some co-operation has emerged on "both sides of the fence" with the recognition that encroachment is a two-way street. The military, other federal agencies, non-profit organizations and local landowners have begun to creatively address and resolve encroachment issues through land use partnerships and collaborative conservation (Benton et al. 2008). These strategies employ many different approaches such as alignments, easements, buffer zones, and zoning regulations. For example, the Army Compatible Use Buffer (ACUB) program, allows the military to expend funds through non-profit organizations to support non-development of lands from private land owners surrounding an installation, thus reducing the potential for noise, dust and other impacts on the installation's neighbors. Many of these strategies have emerged as communities grow and military land use becomes more constrained, and as some communities are threatened by base closure and realignment (BRAC). Buffer areas have recently been established adjacent to Fort Carson, CO and Fort Riley, KS through collaborative conservation. The successful implementation of these strategies is paramount if military lands and communities are to coexist for the future.

**The Future of Military Lands Sustainability**

As the nation's military enters the second decade of the 21st century, a new era of military land management is emerging. Our armed forces have been at war for the past decade, with virtually all forces preparing for, engaged in, or returning from deployments to Iraq and Afghanistan (Doe 2011). These wars have required intensive, short-term use of training and testing areas in the United States, but overall, because of

these protracted forward deployments, there has been a decrease in overall land use and associated environmental impacts. That situation is about to change. Many of these deployed forces are now returning permanently to U.S. installations. Concurrently, units are being consolidated at several major installations – for example, Fort Carson, CO and Fort Bliss, TX. This will place increased pressure on some of these installations and their neighboring communities. The trans-boundary effects of encroachment between the military and its neighboring communities will require new ways of looking at the military installation in the context of local and regional space, communities and ecosystems.

Another factor which will have major influences on military lands and their sustainability in the 21st century are the effects of climate change. The regional effects of prolonged flood and drought, insect infestations, rising sea levels and other greenhouse gas induced outcomes will directly impact the quality and diversity of military lands (USAEPI 2007). Military land managers will have to be adaptable and flexible in their management approaches to responding to these changes.

These new trajectories in military lands management further emphasize that the physical ecosystems existing on military installations represent a national asset for training and testing of our military forces. They provide the ecological foundation of sustainability. These critical federal lands do not exist in isolation within their administrative boundaries. Rather, they are imbedded into local and regional contexts and ecosystems that are characterized by trans-boundary processes, flows, effects and changes. Efforts to sustain these resources, both within and outside the installations' boundaries, will require an increased

understanding of how these complex ecosystems operate. Furthermore, it will require the military's sustained organizational will and financial resources to seek collaborative solutions with its neighbors. These challenges characterize the three intersecting circles of sustainability – environment, economy (mission) and community.

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# 12

# Promoting a Sustainability Ethic in Future Army Leaders at West Point

*Marie C. Johnson and Mark A. Smith*

## Introduction

Sustainability is a key concern of our current Army (Office of the Deputy Assistant Secretary of the Army, 2004). In the past, the Army judged its success mainly on mission accomplishment standards. Now the Army is moving towards an accounting process that includes a triple bottom line: mission, community, and environment (Fig. 1). This evolutionary change reflects growing recognition that terrorism, violence and conflict have their roots in unstable environments and that quick, decisive military action must be leavened with long-standing nation building activities (U.S. Department of Defense, 2005). It is no longer sufficient to deploy lethal force and achieve a narrowly defined military goal. Many of today's conflicts stem from degraded environments, environments that promote high incidents of infectious diseases and food insecurity and provide few resources for economic growth.

**Figure 1. The Army embraces a triple bottom line equally valuing the mission, the environment and the community. Figure from the Army Strategy for the Environment**
Source: www.asaie.army.mil/Public/ESOH/doc/ArmyEnvStrategy.pdf

Communities decimated by poverty, hunger, and corruption provide little hope for a child's education, a young person's employment, or any of its citizens' futures. At best, these communities may allow terrorism to flourish unimpeded; at worst, they become terrorism strongholds. If the degraded environment and devastated community issues are not resolved at their root levels, the Army may find itself repeatedly engaged in the same conflict, a discouraging strategy which is costly in lives and dollars. The triple bottom line emphasizes that to fight and win the nation's wars requires lethal force as it always has, but now also includes creating environmental and community conditions which lead to lasting peace. An Army that can succeed on the three fronts of mission, environment and community is an Army dedicated to long term sustainability as well as offensive and defensive operations.

In some ways, the Army is the perfect institution to embrace sustainability as an organizational ethos. The Army can serve as a test bed, innovator and early adopter of technologies which will make the United States more energy secure and ultimately unleash our nation from the tether of oil (Center for Naval Analysis, 2009). The Army has a global footprint and thus can test new technologies under a nearly infinite variety of field conditions. The Army can also exploit its chain of command structure to implement and enforce environmentally friendly regulations and policies which may take longer to work through civilian organizations. Finally, the Army can lead by example and challenge domestic users to reduce water and energy demands.

The Army is deeply immersed in sustainability as improving our energy security may do more to im-

prove our overall national security than any other single action. An energy policy which frees us from imported oil and increases our reliance on secure, homegrown, renewable clean energy sources would untangle us from hostile, unstable regimes. It would reduce our national debt and balance of trade inequities. It would render countries in the mid-east that currently exert tremendous influence on world markets to be less powerful than they are now. It would free our field Army from supply chain logistics which hinder missions and cost lives as soldiers protect long exposed supply chains whose sole purpose is to ensure that fuel for generators and vehicles gets to forward operating bases.

West Point is a training ground for future Army officers and the Army is a potent arm of our national security. Since national security is directly related to energy security and sustainability, it is appropriate for our future Army officers to study these relationships while in school at West Point. If we can promote a deep sustainability ethic in these young leaders, they will take this mindset with them as they interact with others in the Army and will view each mission they encounter through the holistic lens of the triple bottom line: mission, community and environment.

**Academy level sustainability actions**

As an institution, West Point is working towards developing post-wide sustainability strategies. One of the first endeavors in this direction was implementing a greening initiative, a direct result of the West Point Strategic Planning Guidance for 2010. This document specifically stated that creation of a greening initiative was a priority "…after evaluating the significant threat of the impacts of shortfalls in energy, prices of

energy coupled with an anticipated budgetary shortfall in the Army's budget, and the increasing use of electricity" (USMA, 2009). The greening initiative was developed "to take advantage of the intellectual capital in our academic departments and engineering fields to save scarce fiscal and energy resources, and develop the concepts to become the Army/Federal installation 'laboratory' for energy efficiency" (USMA, 2009). The Superintendent of West Point assigned the Commander, U.S. Army Garrison as the lead for the greening initiative.

One of the first tasks accomplished was forming the West Point Energy Council. The West Point Energy Council consists of five core teams and three support teams comprised of representatives from a variety of agencies and staffs at West Point and directed by an Executive Team comprised of representatives from the Garrison and the Academy (Fig. 2). The West Point Energy Council subsequently developed the following vision for energy and environmental security at West Point:

> West Point as a flagship installation and Army leader that operates using an integrated systems' approach to reduce energy consumption and cost, enhance cadet education and leader development, and involve the entire West Point community toward achieving energy and environmental security.

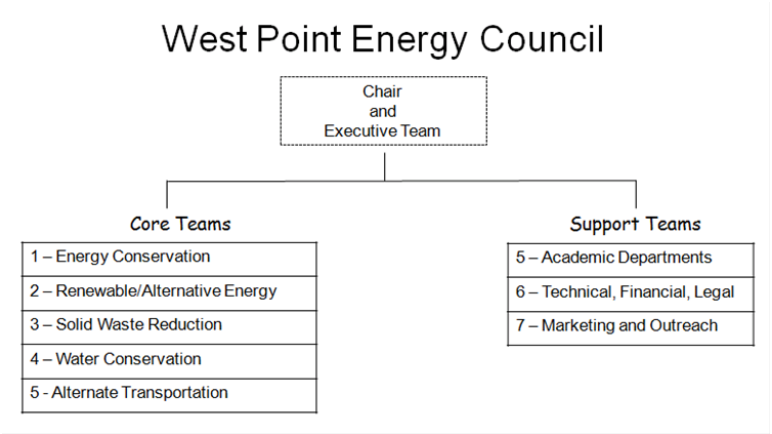


**Figure 2. This diagram depicts the organizational structure of the West Point Energy Council.**

This vision and the West Point Energy Council logo (Fig. 3) document both the Academy's and the Garrison's focus; the Academy is focused on cadet education and leader development and the Garrison is focused on reducing energy cost and consumption. The partnership between the Academy and the Garrison is unique.

**Figure 3. West Point Energy Council guiding logo. This logo symbolizes the synergy between personnel on the Academy and Garrison sides of West Point as all work towards improving post energy and environmental security.**

The Academy brings with it experienced faculty and motivated cadets with a thirst for knowledge about energy, alternative energy, the environment, and the desire to conduct research (Fig. 4).

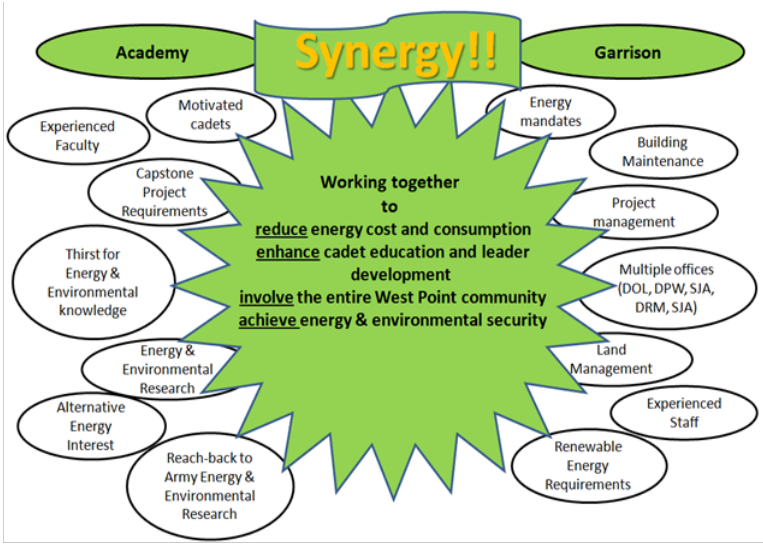


**Figure 4. This figure showcases the collective strengths of the Academy and Garrison partnership, working together to achieve energy and environmental security for West Point.**

As Figure 4 indicates the Garrison has experienced staff, energy mandates, and renewable energy requirements. Combining the Academy and the Garrison efforts provides synergy to West Point's efforts. To guide West Point to achieve the stated vision, the Energy Council developed six energy security goals. The first five goals are based upon the energy security goals articulated in the Army Energy Security Strategy (Army Senior Energy Council, 2009). The sixth goal was created to support West Point's unique leader development mission. The six Energy Security Goals are:

- Reduced energy consumption
- Increased energy efficiency across platforms and facilities
- Increased use of renewable/alternative energy
- Assured access to sufficient energy supply
- Reduced adverse impacts on the environment
- Enhanced cadet education and leader development on energy and environmental security

The West Point Energy Council was tasked to develop a strategic program for energy and environmental security that identified ways to green West Point and develop green projects that would achieve the stated vision and goals. Because of West Point's distinctive attributes, each proposed green project is evaluated using the following guiding principles:

- Achieve the West Point mission and meet energy and environmental targets and objectives.
- Enhance cadet education and leader development.
- Include new energy technologies.
- Support by West Point's unique geography.
- Blend in within the landscape.
- Support public relations, outreach, education, and awareness.
- Provide intellectual support to the Army and the Nation.
- Develop using a systems thinking methodology.

In developing the way ahead for these green projects, the West Point Energy Council will follow a systems engineering thought process and methodology (Fig. 5). Each proposed green project will be evaluated based on its individual merit and cost effectiveness, but also based on how well each project's capability complements (or detracts from) the entire system, to include reduced energy cost and consumption, ca-

det education and leader development, and the West Point Energy Council's overall technical, academic, and outreach objectives. This holistic approach prevents projects from being viewed in isolation. Instead, this approach encourages projects to be selected based on how well they complement and support other potential projects as well as their own intrinsic positive effects on monetary and intangible criteria.

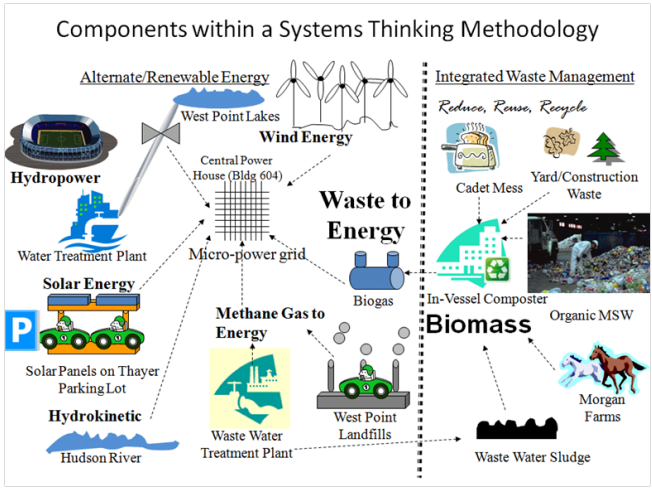


**Figure 5. Potential green projects for West Point that are evaluated within a Systems Thinking Methodology to determine their feasibility.**

Each core team (Fig. 2) will identify and evaluate requirements, and then recommend green projects that will assist West Point in achieving energy and environmental security. Throughout the planning and evaluation process, cadets will be involved on planning teams and will pursue relevant independent studies and classroom research so they can assess the challenging energy and environmental issues facing our nation and our world. Given a recommendation for a proposed project, the West Point Energy Coun-

cil's Executive Team will then apply the systems engineering thought process and methodology to determine if the project should be pursued and make their recommendations to the Commander, West Point Army Garrison who will then make a recommendation to the Superintendent.

In its first year of operation, the West Point Energy Council identified a weakness concerning the lack of integration of the West Point student body, the Corps of Cadets. To integrate the Corps of Cadets more fully into the new vision, the West Point Energy Council identified a variety of energy and environmental security deficiencies on the United States Military Academy reservation, and proposed cadet projects to evaluate these deficiencies and provide recommendations to solve them. The list of recommended projects was made available to instructors in various academic departments. Such projects included water conservation, energy conservation, behavioral change, and solid waste management.

One of the most successful projects in solid waste management has been the re-invigoration of the Corps of Cadet recycling program. The West Point Energy Council initially identified a variety of recycling problems on post. Cadet teams were given freedom to select a recycling problem, clearly define the scope of the problem, propose and evaluate a variety of alternatives to solve the problem, make a recommendation, and develop a plan for implementing the recommended solution. In the Department of Geography and Environmental Engineering, the West Point Energy Council asked cadet teams to categorize and quantify the food waste from cadet tables after required meals in the Mess Hall. For seniors in the Department of Systems Engineering, the West Point Energy Council

asked cadets to identify how to improve plastic bottle and can recycling within the Corps of Cadets. As part of the scope statement, cadets were tasked to identify a location where the Directorate of Cadet Activities could operate a bottle and can redemption program in which a portion of the redemption proceeds would fund cadet company activities. Cadets worked on these projects throughout the semester, and at the conclusion of each project, cadets briefed the West Point Energy Council on their recommended solutions.

As an example, the seniors working on plastic bottle and can recycling identified a location for the redeemable operation. Immediately, the West Point Energy Council acted on the cadets' recommendation and one month later secured a room and appropriate resources, and began the reinvigorated recycling program in February 2011. Simultaneously, cadets and faculty in the Department of Geography and Environmental Engineering initiated participation in a nation-wide collegiate recycling competition called RecycleMania in conjunction with the new Corps wide recycling program.

The coupling of the recycling program and redeemable operations with the RecycleMania competition proved hugely successful in motivating cadets to recycle. Cadet companies were awarded the full 5¢ deposit for each New York state redeemable item turned in by their company. In addition, all recyclable items (redeemable and non-redeemable) were counted and recorded with the first, second and third place companies earning cash prizes generously provided by our Directorate of Cadet Activities. Although many cadets were motivated to recycle for altruistic reasons, the chance to earn company funds accelerated the program's implementation. In only its first semester of

participation, West Point finished 27th of 363 colleges nation-wide in the per capita classic (pounds of recyclables/person) and 7th of 231 schools in cardboard only (cumulative pounds of cardboard/person).

At the conclusion of the RecycleMania competition, however, the cadet recycling program came to a halt, and cadets reverted to throwing recyclables into the trash. In subsequent discussions with cadets, this failure was attributed to a lack of cadet leadership devoted to continuing the recycling program. Once the cadets identified this weakness, plans were made to address it. During the academic year, a new leadership position devoted to environmental issues had been created within the Corps of Cadets. This single position, however, was the only one recognized within the entire 4400 plus student body of the Corps of Cadets, and this cadet leader did not have the personnel resources to keep the recycling program running without the intensity of a national competition. Without strong cadet leadership, the recycling program would ultimately fizzle as has happened in the past. Further strengthening this assumption, the recycling competition by-company results clearly indicated that cadet companies led by self-motivated strong cadet leaders had substantially greater participation rates than cadet companies with disengaged student leaders.

Consequently, to address the need for increased, engaged cadet leadership in Corps-wide energy and environmental security issues, cadets proposed multiple new cadet leadership positions within the Corps of Cadets. These positions would be implemented at all levels within the Corps from Brigade staff down to individual cadet companies. Cadets holding these positions would be responsible for a number of actions including leading recycling and solid waste initiatives within the Corps of Cadets, developing ways to moti-

vate cadets to lead a life of conservation and instilling the principles of reduce, reuse, recycle and conserve. These actions will assist the Superintendent to achieve his goals in recycling, energy, and water conservation as outlined in his Strategic Planning Guidance (USMA, 2009); aid the West Point Energy Council to achieve its vision of making West Point a flagship installation and Army leader in the areas of reducing energy consumption and improving energy and environmental security; and support the Army to achieve its Energy Security Goals (Army Senior Energy Council, 2009).

These new cadet leadership positions will also be integral to a fresh challenge that West Point will embrace in the coming months. West Point competed with other Army facilities to develop a preliminary plan to become a net zero energy installation by 2020. In April 2011, West Point was selected as one of six Army installations to be designated a pilot Net Zero Energy installation. A net zero installation is one which produces as much energy on-site from renewable energy generation or through the on-site use of renewable fuels as the post consumes in buildings, facilities, and fleet vehicles over the course of a year (Booth et al., 2010). Meeting this exciting challenge will take the combined efforts of these new cadet energy officers, the West Point Energy Council, and virtually everyone on post.

Cadets who are not chosen to serve as leaders at either the company or brigade level can still participate in environmental sustainability actions. The primary vehicle for these actions is the new cadet club, Green Think. Green Think was an outgrowth of the Recyle-Mania competition and serves as a formal club dedicated to improving West Point in general and cadet life in particular from an environmental sustainability

standpoint. Membership is open to any cadet at the Academy and club officers are elected by the membership. One of the first actions addressed by this club was improving recycling during the busy Graduation Week when cadets are moving out of the barracks. By thinking through the types of waste streams generated, appropriate options for recycling electronics, clothing and furniture were put into place and publicized to cadets. These actions resulted in less material being thrown in the trash and showcase the impact this club can have on future activities at West Point.

**Environmental Engineering Sequence cadets**

The actions and steps described so far document how at the broadest level West Point is seeking to promote an environmental stewardship ethic in each of its 1000 plus annual graduates. These procedures describe the minimum exposure to environmental issues a cadet will have during his or her time at West Point. Some cadets, however, will have deeper exposures depending on their academic choices.

For example, all non-engineering majors are required to choose a three course engineering sequence in order to learn the engineering design process. The Academy offers seven different three course engineering sequences, and each sequence is geared towards fulfilling the Academy's Engineering and Technology goal for its graduates. These goals include substatements like: graduates can in an environment of uncertainty and change, identify needs that can be fulfilled via engineered solutions; graduates can define a complex technological problem accounting for its social, economic and political dimensions; graduates can apply mathematics, basic science and engineering science to model and analyze a physical system.

The Department of Geography and Environmental Engineering offers an environmental engineering sequence. This sequence teaches the engineering design process through the lens of current environmental issues thus deepening the environmental education of the 200 cadets annually who elect this engineering sequence.

The first course in the environmental engineering sequence is Environmental Science. This course focuses on defining and analyzing the impact humans have upon the Earth. The course is organized into four major blocks. The first block introduces the basic concepts of ecology; how matter cycles and energy flows, the characteristics of healthy ecosystems, and the implications of exponential population growth. This block concludes with a look at urban sprawl and the hope of green engineering. The second block explores the concept of risk. How are maximum contaminant levels in air and drinking water determined? What is the lifetime cancer risk to a city resident drinking contaminated water? Classic environmental laws, regulations and executive orders are examined. Students learn how scientists study the effects of toxins in a lab and then extrapolate their results to the real world. The third block of the course spotlights energy. It starts with a review of fossil fuels and then proceeds through alternative energy sources such as nuclear power and renewable sources like wind, biomass, solar and geothermal. The final block of the course concerns air pollution and solid waste. Students use a Gaussian plume model to calculate downwind contaminant concentration. They also explore how to design landfills to reduce environmental contamination. In each block, all topics are taught in the context of current events to build in relevancy and realism.

The first environmental engineering sequence course illuminates the depth and scope of environmental issues facing the world today, and the second and third sequence courses offer some approaches to resolving these issues. The second course is entitled Environmental Engineering Technologies. Its focus is on technologies that are appropriate for developed countries. The key technologies examined are those used to purify drinking water, treat wastewater, and reduce air pollution. The first major block of the course describes how a municipal drinking water plant uses physical and chemical processes to filter, clean and disinfect drinking water so that it meets U.S. drinking water standards. Once these processes are understood, students are introduced to the biological processes used to treat wastewater and make it clean enough for discharge back into the environment. Field trips are taken to the West Point drinking water and wastewater treatment plants allowing cadets to observe real life examples of the processes they have studied in their textbooks. The course also covers common methods of treating factory air emissions such as cyclones, bag houses and air strippers. Although these technologies are introduced in detail, the basic principles of pollution prevention are constantly emphasized. In other words, the clean up problem is easier and cheaper to solve if the pollutant is eliminated or minimized.

These technologies work well for developed countries which have the infrastructure to support them; these technologies, however, may not be transportable to developing countries which lack electricity, fuel, and an educated workforce. Thus, the third course in the environmental engineering sequence tackles environmental issues, primarily clean drinking water, from the standpoint of developing countries. The emphasis on developing nations is espe-

cially useful as our students will be young officers in an Army engaged in nation building in undeveloped countries. These officers may be deployed to conflict zones where communities lack clean drinking water or proper sanitation facilities. By educating these future officers about household scale drinking water filters and appropriate outhouse design, we are equipping them with skills which may gain them the trust and approval of village elders seeking to improve the lives of their villagers. Thus, low tech solutions such as sand filters, clay pot filters, disinfection by boiling, and gravity fed community water systems give students an arsenal of solutions appropriate to the tasks they may be engaged in as young Army officers.

Other engineering sequences offered at the Academy also consider environmental issues. These sequences include the systems engineering sequence, which takes any issue and solves it using a systems approach, and the civil engineering sequence, which has been designed to focus on solving infrastructure problems including drinking water and sanitation in order to promote nation building. The roughly 200 cadets annually who graduate with the environmental engineering three course sequence, plus those cadets who studied environmental problems as systems or civil engineering sequencers, take a specific skill set and mindset with them into the Army. These officers seed the Army with basic engineering design process skills and an environmental ethic honed by thoughtful academic work.

**Cadets majoring in the Environmental Program**

Each cadet must choose an academic major in the fall of his or her sophomore year. The Academy offers 36 majors, among them environmental engineering

and environmental science. Each year approximately 30-40 cadets choose one of these environmental disciplines as their academic major.

**Environmental Engineering**

The environmental engineering major develops problem solvers for environmental issues. This major is ABET Inc. accredited and requires cadets to take 44 academic courses. Twenty-six courses are required as part of the core curriculum and guarantee that our engineering majors also have a background in humanities, history and language. Fifteen discipline-specific courses are required and cover key aspects of environmental engineering such as drinking water, waste water, air pollution and solid and hazardous waste treatment. The remaining three courses are field electives chosen from a variety of courses taught in the Department of Geography and Environmental Engineering as well as the other engineering departments. Cadets majoring in environmental engineering all sit for the Fundamentals of Engineering Exam in their final semester, the first rung along the path of licensure as a Professional Engineer. Upon graduation, these 15-20 cadets bring a unique skill set to the Army. As young officers, they may be asked to remedy a foreign village's drinking water system or improve a state-side motor pool's waste program. In either case, their engineering design process background will serve them well as they confront sustainability issues in their units.

## Environmental Science

West Point also offers a major in environmental science. Environmental science is a 40 course major which attracts 20-25 cadets each year. Twenty seven of the 40 courses are required as part of the professional major and guarantee that each environmental scientist is familiar with all disciplines including humanities, social sciences and language. Cadets majoring in environmental science are also required to take the three course environmental engineering sequence. The environmental science major itself is a broad, integrative science-based major which seeks to develop a student's curiosity about the natural world, the student's ability to study natural processes using a scientific approach, and to inculcate an individual and collective sense of environmental stewardship. These goals are achieved by enhancing the core science education by requiring additional courses in the natural sciences such as geology, biology, meteorology and ecology. The broad background provided by the core curriculum coupled with a strong study in depth component creates a well educated student capable of analyzing a problem from multiple perspectives before recommending a course of action.

The environmental science major culminates in an Environmental Security course, taken in the cadet's final semester. This course directly explores the relationship between a degraded, unhealthy environment and conflict which may ultimately require engagement of the U.S. military. If, on the other hand, the underlying environmental issues can be addressed, the seeds of violence, terrorism, infectious disease and the drug trade may not take root.

The Environmental Security course begins by defining the term environmental security and comparing

and contrasting environmental security with national security. The students write a short paper in which they create their own definitions and recommend several immediate actions the United States could undertake to increase our environmental security. With this framework, the students then turn their attention to the inter-related major causes of environmental insecurity: lack of food, lack of access to clean water and sanitation facilities, and prevalence of infectious diseases. The students study the United Nations Millennium Development Goals and examine global progress toward each of the eight goals. They also analyze the new combatant command, AFRICOM. AFRICOM's mission statement is unique compared to the other geographic combatant commands as it places a premium on host nation development rather than war fighting. This difference intrigues cadets as they anticipate their very real commissioning into the Army. AFRICOM is trying to reduce terrorism without firing a single shot; instead the goal is to ameliorate the conditions which lead to extremism.

The second half of the Environmental Security course focuses fully on energy, as energy underpins virtually all issues. If we have a stable supply of clean, reliable energy, then we can grow enough food, clean enough water, and combat disease much more effectively than at present. The course concludes with an individually authored student paper in which the cadet chooses an emerging environmental security issue of interest to the Department of Defense as listed by the Institute for National Security Studies. The student defines the core issue, describes the issue's economic, technological, and social-political dimensions, and ultimately recommends a course of action. Classroom discussions tend to be prolonged and insightful as the

course integrates the students' entire undergraduate education and puts that integration into the context of their chosen profession of arms.

## Conclusion

About 1000 students graduate from West Point each spring, and these students receive both Bachelor of Science degrees and commissions in the United States Army as second lieutenants. Virtually all of these graduates serve five years in the Army, some serve much longer. Each of these new lieutenants will be a leader, capable of creating and enforcing change in the Army as his or her rank grows. Given this unique opportunity, West Point exposes each cadet to the ideals of sustainability and environmental stewardship through activities such as the Corps-wide RecycleMania competition, environmental officers at all staff levels, and the environmental club Green Think. A subset of these graduates, about 200 per year, has the opportunity to explore environmental issues in a deeper academic context by choosing to take the environmental engineering sequence. A different subset of graduates, about 40 each year, investigates these topics in a deep, systematic way by majoring in either environmental engineering or environmental science. These two majors allow the cadets to confront the environmental issues facing the Army today, become familiar with existing developed world technologies, and to think about simple technologies that may work in a developing world hampered by lack of available infrastructure. These three subsets of cadets take their awareness of environmental issues with them as they become the Army's junior officers. The knowledge and experiences they have gained at West Point will

make them agents of change as the Army continues to move forward on sustainability issues.

In summary, the Army needs officers that are capable of leading and making sound decisions concerning energy security, energy and water conservation, and solid waste management as these environmental issues are critically linked to national security (Army Senior Energy Council, 2009). West Point can infuse the Army with junior leaders imbued with a sustainability ethic and capable of making wise environmental stewardship decisions. In addition, West Point is uniquely positioned to combine the collective strengths of the Academy and the U.S. Army Garrison West Point through joint academic, West Point installation, and Army ventures that educate future Army officers on technologies related to energy and environmental security.

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United States Military Academy 2009. Strategic Plan

# 13

## Army National Guard Launches Sustainability Initiatives

*Joseph Knott and Monica Slade*

## Introduction

The Army National Guard (ARNG) is a community-based operational force and primary Federal Reserve of the Army, providing ready units to support global and domestic requirements.

Today's ARNG is a full partner in America's defense, an integral part of the Army's operational force, and capable of operating on a 24-hour battlefront with the versatility and effectiveness of its active duty counterparts. Army National Guard units deploying since 9/11 have been the best-trained, best-led, and best-equipped ARNG force in America's history. In this era of persistent conflict, the commitment of the Citizen Soldier to go whenever and wherever duty calls remains undiminished.

In keeping with the Guard's calling to "lead by example," it is the policy of the ARNG to incorporate an Enterprise Sustainability philosophy into every aspect of Guard planning, training, equipping and operations. An Enterprise Sustainability approach means that we consider how our actions will affect the Guard mission, energy use, the natural environment, the vitality of our communities and the well-being of our Citizen Soldiers and their families. The ARNG Enterprise Sustainability will ensure that the Guard has the ability to operate into the future without decline either in the mission or the natural and built systems that support it.

The National Guard will institutionalize sustainability in the ARNG by synchronization of efforts across multiple lines of operation to create enterprise-wide Sustainability Management. This will enable the ARNG Directorate, located at Arlington Hall Station (AHS), in Arlington, Virgina, along with individual

state ARNG Commands, staff, and policy proponents to assess risks and impacts across all of the ARNG's core enterprise areas and develop strategic plans that focus our efforts and resources where they will achieve the greatest effect. This strategic evaluation and planning, along with increased cross-functional awareness of programs and efficiencies, will allow us to leverage successful initiatives and maximize efficiencies.

The ARNG Directorate is developing sustainability goals and objectives, along with metrics to measure performance and drive resource decisions, to implement within the ARNG Directorate at AHS, and ARNG commands in all States, Territories, and the District of Columbia. The National Guard is developing processes wherein up-front investments in more efficient designs, technologies, equipment, or services will result in lower total life-cycle costs. The National Guard is reaching out to stakeholders, regulators, and our partners in the communities to gain their input and leverage their capabilities. They are also developing programs where Soldiers, families, and civilians have a personal commitment to sustainability and are active participants in programs that enhance readiness and extend our operational capabilities. The ARNG's approach to sustainability must balance outcomes and oversight with objectives and management.

**Background and Problem Description**

The ARNG, both at the Federal (ARNG Directorate) and State level, faces growing challenges in meeting Federal and State requirements which demand improved performance across the energy and environmental spectrum of their operations. The ARNG is already addressing the growing encroachment

pressures on the training lands needed to adequately train its soldiers. It is also experiencing the effects of competition for other limited resources, such as fuel and materials, while managing operational tempo (OPTEMPO) at a historically-high level. These challenges must be met to allow the National Guard to continue to meet evolving (and expanding) mission requirements. ARNG state organizations operate on a dispersed landscape with a complex mosaic of stakeholders and partnerships, which require the effective execution of diverse mission requirements. As a result, a fully integrated strategy and performance management system is essential to ensure a cross-functional and coordinated effort within each state and at the ARNG Directorate at AHS. A sustainability-based management philosophy will challenge Guard organizations with initiatives that align in support of ARNG readiness and support both Federal and State mission accomplishment.

The ARNG's initiative of an enterprise-wide sustainability program is an aggressive and innovative approach that integrates sustainability into the Army Guard from top to bottom in all areas of operations support. The major focus is engagement with our stakeholders through broad partnerships with government, business, communities, academia and other institutions. Taking actions, on the direct and indirect effects of Army Guard operations, on critical resources will enable us to better achieve mission success — now and in the future.

ARNG operations are energy intensive, require considerable access to and dependence on natural assets, rely heavily on supportive communities, and are executed by one of the largest, most diverse workforces in the world. The ARNG Directorate's strategic vi-

sion is to create a culture that incorporates energy and environmental considerations in all missions and as central elements in the foundation for operational sustainability. In accordance with our Guard heritage, our role as community soldiers places us in a unique position to provide leadership. In our response to energy security considerations: the need to protect our natural resources; and the well-being of our Soldiers and the community, the National Guard is implementing strategies to enable these natural and human capital assets to most effectively sustain the ARNG mission and promote operational excellence. Ultimately, the ARNG must create a culture wherein all members, partners, support contractors, and communities make energy, environment, and the overarching term of "Sustainability" a value in everything we do, every day, and one that fosters innovation and excellence in all current and future Army Guard operations.

To become a national leader, and to sustain our current and future operations, the National Guard must imbed this sustainability ethic with effective policies and practices that safeguard the environment and our quality of life in a manner that our nation needs and expects. In fact, the ARNG has such a broad sphere of influence that such a sustainability initiative will further enhance the National Guard as a global leader and help transform our entire nation.

The ARNG today places unprecedented demands on its Soldiers, its communities, its natural resources and various other assets, e.g., systems and infrastructure, in order to enable the accomplishment of the ARNG mission. The Guard leadership recognizes a critical operational need to embrace practices that will better sustain the limited natural, cultural and economic resources entrusted to us by the American public. These resources, including our training sites and

ranges, are essential to providing a ready and effective response to the states' and country's needs (PKS 2011).

Our Guard heritage, and our role as 'Citizen Soldiers,' places us in a unique position to provide direction, both within the Army and our communities. We are often called upon to act boldly. The Army National Guard's future readiness relies on what actions we take today to use resources efficiently. The ARNG must preserve accessibility, capability and capacity of our training areas, and improve coordination across multiple lines of operation in order to become sustainable! At the headquarters level, the ARNG Directorate is providing guidance and resources to all state ARNGs to assist with their implementation of sustainability policies, practices and initiatives.

**ARNG Directorate Sustainability Initiatives**

The ARNG Directorate, following the lead of the Army and Department of Defense (DOD), is working sustainability into all aspects of operations. This effort intensified with the Director, Army National Guard's (DARNG) signing of an ARNG Sustainability Policy in January 2011 which applies to the ARNG Directorate as well as to ARNG personnel across all 54 States, Territories, and the District of Columbia. This policy formalizes the requirement that all members of the ARNG adopt a sustainability philosophy for every aspect of planning, training, equipping and operations. The policy mandates sustainability education and training for all ARNG military and civilian personnel and also appoints the DARNG as the ARNG's Senior Sustainability Official.

## Sustainability Strategy and Strategic Plan

In an effort to incorporate sustainability into the strategic evaluation and planning process, the ARNG Directorate conducted 'Sustainability Strategy and Strategic Plan' development sessions at AHS in early 2011 with input from a sustainability working group consisting of representatives from all of its Directorates and Divisions. The ARNG Sustainability Strategy will broadly define how the ARNG will implement sustainability throughout the ARNG Directorate. It supports the strategic vision and mission of the ARNG Directorate and complements all Army, State, and Federal sustainability policies, laws, and executive orders. The ARNG Sustainability Strategic Plan will be incorporated into the overall ARNG Strategic Planning Guidance and is expected to be used as a template to focus and develop the strategic direction for State ARNGs.

## Sustainability Performance Standards and Indicators

The ARNG Directorate is also working with functional leaders to identify the performance standards and metrics that will appropriately guide the management of various initiatives, facilitate funding, and insure performance measurement across the ARNG. These standards and metrics will provide a foundation for uniform Sustainability reporting within each State (PKS 2011).

Performance standards and metrics were developed in the following areas: energy, water, air, fleet vehicles, procurement of green goods and services, waste, land usage, facility construction, operations,

maintenance, environmental management system, stakeholder involvement and education (PKS 2011).

**Community Involvement**

As Citizen Soldiers, the ARNG also recognizes effective communication need to extend outside its organization into our communities. Community Involvement (CI) involves two-way communications between the ARNG and diverse range of community stakeholders. The key to sustainability for the ARNG is to always stay grounded in our communities and ensure our communities understand our goal to be a force for freedom while also being good stewards of the environment.

The operating environment for the ARNG has changed dramatically over the past 20 years. The overall OPTEMPO increased from a force-in-reserve to a fully integrated operational combat force continuously mobilized during an era of persistent conflict. Keeping our forces trained and ready requires sustainable training sites. In today's world, sustainability means much more than keeping our training sites and other installations well-maintained and fully functional to equip and train our forces to defend us at home and abroad. Sustainability also means we must build and maintain interrelationships that support our mission, environment, and community (IMS 2009).

By engaging the community, our training sites and other installations gain greater appreciation and understanding from the community for its training activities, including noise effects and vehicle traffic. Additionally, awareness and involvement with community activities such as development, planning, and zoning helps the ARNG work with community leaders early and often to minimize or avoid encroachment

issues. Intergovernmental relations along with other public-private partners help leverage resources and build political goodwill for the ARNG at all levels of government. Sustainability is the realization that our relationships with both our internal as well as external stakeholders are as important to every aspect of the ARNG mission as is any element of combat-focused training (IMS 2009).

**Sustainability Communication Strategy**

The ARNG Directorate Sustainability Communication Strategy and Plan provides the ARNG Directorate's guidance for communicating the value, need, and benefits of the ARNG Sustainability Program to AHS personnel. It also provides the Divisions with responsibilities and guidance to ensure full implementation and success of the plan. With the release of the ARNG Sustainability Policy, this communication plan will help to ensure that everyone at AHS has the basic information they need to begin to adopt a sustainability philosophy into every aspect of their work. A coordinated communication effort will assist the ARNG at the state and federal levels to institutionalize sustainability (PKS 2011).

**Sustainability Awareness Training**

In order to better understand the concept of sustainability and its applicability to our National Guard operations, Sustainability Awareness training is required of all ARNG military and civilian personnel, which commenced at AHS in early 2011. Initially, the senior leaders and their staffs from across all ARNG

Divisions/Directorates will be trained. By doing so, the ARNG leadership will more quickly demonstrate a sustainability ethic and become the role models for this new "way of doing business." Sustainability will only be effective if embraced throughout the organization – with a commitment from each Soldier and civilian – which has proven to be a powerfully unifying force in achieving desired results in both military and civilian organizations.

**Sustainability Education Partnerships**

The National Guard believes in empowering its workforce with the necessary tools to become a more sustainable organization and to enhance mission effectiveness and efficiency. To this end, a partnership was formed between ARNG and Arizona State University to develop an online Sustainability Leadership Graduate Certificate Program commencing in 2012. The program will provide training to members of Army and ARNG leadership, both military and civilian, including state ARNG employees, to enhance their ability to incorporate sustainable planning and practices across the entire Army enterprise. Courses will emphasize the application of sustainability tools, techniques, and concepts across multiple lines of operation.

The program consists of five courses, including Foundations of Sustainability, Tools and Techniques for Sustainability, Operationalizing Sustainability, Energy and the Built Environment, and Sustainable Acquisition and Logistics. Completion of these courses will confer a graduate academic certificate. The five courses may also be applied toward a Masters degree in Sustainability. Additionally, all courses are eligible for G.I. Bill education benefits and tuition assistance programs (Arizona State 2011).

## Energy Savings Performance Contracts

The ARNG Directorate will conduct a demonstration/validation project at AHS for optimizing energy use and efficiency through the use of an Energy Savings Performance Contract (ESPC). This ESPC will allow AHS to accomplish energy savings projects without up-front capital costs and without special Congressional appropriations. The federal government spends billions of dollars on energy costs each year. This large-scale financing of projects can be prohibitively expensive for a federal agency (DoE 2011).

The ESPC is a partnership between the ARNG and an energy service company (ESCO). The ESCO conducts a comprehensive energy audit for AHS, identifies improvements to save energy, designs, constructs, and maintains a project that meets the needs of AHS. ESCO also assists the ARNG with developing a funding plan and arranges the necessary funding. The ESCO guarantees that the improvements will generate energy cost savings sufficient to pay for the project over the term of the contract.

Key components of the project include renewable energy systems, automated building controls, updated HVAC equipment, and a recycling program. The projected savings to AHS are approximately $800,000 annually (Benham 2010). The project also meets the requirements mandated by Presidential Executive Order 13514, signed by President Obama on October 5, 2009 which directs a sustainable plan for energy for the federal government.

## State Sustainability Planning and Partnering

The ARNG Directorate provides additional guidance to state ARNGs in the form of sustainability

planning workshops and partnering efforts. This support includes providing the state ARNG a step by step process to initiate sustainability within their state across all operational areas. The ARNG Sustainability Team works closely with state leadership and staff to integrate sustainability into the State's existing Strategic Plan ensuring integration with mission objectives, policy requirements, and encroachment considerations. The planning workshop includes both short and long-term goals, measurable objectives, performance indicators and targets, strategic initiatives, potential sustainability projects, organizational responsibilities, and estimated resources. Follow-on sessions are conducted as needed after the initial workshop to ensure continued progress towards a State Strategic Plan that has Sustainability fully integrated (PKS 2011). To date, eight states have conducted Planning Workshops, including AZ, CA, CO, MN, MS, NV, PA, and TX.

The next step for continued engagement in the Sustainability planning process is assisting state ARNGs in developing Sustainability partnerships with national, regional, and local organizations, including government, public universities, private industry, and non-government organizations (NGOs). The ARNG Sustainability Team assisted the Texas Military Forces (TXMF) in holding their inaugural partnering event, "The Power of Partnerships," in Dallas-Fort Worth on 29-30 June 2011. The event was the first of its kind and will serve as the model for future state ARNG Sustainability initiatives. The purpose of this event was to collaborate with a diverse range of stakeholders to identify common goals and mutually beneficial partnering opportunities focused on sustainability. Approximately 100 participants were in attendance, and breakout sessions for the workshop were in the three

key operational areas of Materiel, Infrastructure, and Readiness. The expected synergies will assist with accomplishing mission readiness requirements focused on maintaining the availability of the land, air, and water necessary to train, operate and successfully execute our missions now, and in the future.

**Compatible Land Use**

In recent years, ARNG installations are experienced an increase in encroachment from a variety of sources to include: population growth, urban land use, and environmental requirements which compromised training realism. The Army Compatible Use Buffer (ACUB) program proactively addresses encroachment by preserving high-value habitats and limits incompatible land use in the vicinity of military installations (USAEC 2011).

On 2 December 2002, Title 10, Section 2684a, of the United States Code authorized the DOD to partner with non-federal governments and/or private organizations to limit encroachment on lands neighboring the installation. Subsequently, Headquarters, Department of the Army, G-3 Directorate of Training, issued guidance in a memorandum dated 19 May 2003, Subject: Army Range and Training Land Acquisitions and Army Compatible Use Buffers. The memorandum defines the requirements of an ACUB proposal in order for an installation to execute any land acquisition (USAEC 2011). The ARNG implemented this authority through the ACUB program to preserve permanent access, capacity, and use of training sites on 49,455 acres in support of nine ARNG installations, including: Camp Roberts, CA; Camp San Luis Obispo, CA; Camp Blanding, FL; Fort Custer, MI; Camp Ripley, MN; Camp Shelby, MS; Camp McCrady (Fort

Jackson), SC; Camp Rilea, OR; and Fort Pickett, VA (ARNG 2003-2010). Several state ARNGs are preparing and/or submitting additional ACUB proposals for training sites in Arizona, Arkansas, Pennsylvania, Texas and Virginia. In addition, Congress has shown increased support for the DOD's overall Sustainable Ranges Initiatives. Congressional support allowed the ARNG to secure $20 million in military funding and $122 million in leveraged funding from non-DOD sources for current and future ACUB projects (ARNG 2003-2010).

**Sustainability Buffer**

The ARNG Directorate will conduct a Sustainability Buffer demonstration project for a major ARNG training site that leverages the benefits of the ACUBs to test a renewable energy project via partnerships with industry. Key components of the project will include protection of Threatened & Endangered (T&E) Species habitat, and greenhouse gas reduction, in support of ARNG Readiness. The ARNG Directorate will provide technical assistance, facilitate the development of the ARNG renewable energy ACUB proposal, and monitor program execution.

**State ARNG Sustainability Initiatives**

State ARNGs are launching sustainability initiatives and practices of their own. Often, state ARNGs have adopted sustainable processes to address an immediate need, remedy an expensive and inefficient waste disposal method; monitor heating equipment to find and fix hidden energy leaks; and invest in renewable energy generation to improve energy security. State ARNGs found sustainability initiatives support

readiness and reduced and avoided needless costs, eliminated waste, and promoted energy security.

**Solar in Nevada**

The Nevada National Guard broke ground in March, 2010 on its $15 million Super Solar project designed specifically to help stabilize the energy supply for its training sites and readiness centers. The project will produce 1.4 megawatts of solar power for the Nevada Joint Force National Guard Headquarters in Carson City and more than 1.5 megawatt combined for two other sites in Las Vegas (NVARNG 2009).

The solar photovoltaic cell project is being built with no state or federal money. Instead, a public-private energy partnership, along with a power purchase agreement between the Nevada ARNG and its utility provider, enables the Guard to purchase energy for 20 years at a level price similar to what it pays now for energy. Under the agreement, the solar equipment is financed, built, owned, operated and maintained by Sierra Nevada Corporation in partnership with NV Energy (NVARNG 2009).

The abundant Nevada sun is expected to help the solar project produce more power than the facilities can use during the day, and enable the sale of excess to NV Energy. The project presents an economically viable way to energize facilities without using fossil fuels, and is expected to save the Nevada Guard $2.3 million in power costs over the 20-year life of the agreement (NVARNG 2009).

**Sludge disposal in Pennsylvania**

State ARNGs also realize cost savings simply by rethinking their mundane processes. Hauling away

the heavy sewage sludge that remains in settling tanks after chemical treatment was a costly exercise for the Pennsylvania ARNG Training Center at Fort Indiantown Gap. The training center's Bureau of Environmental Management was paying significant costs each year to have a company remove the sludge, send it to a dewatering facility nearly 20 miles away in Hershey, PA, and then transported to a landfill (PAARNG 2011).

With the investment of a sewage press, the Bureau of Environmental Management found it can press the water from its sludge reducing the material to a much lighter substance, load it into a 24-cubic-foot roll-off dumpster and transport it to a landfill as solid waste using its own equipment and staff. The technology is a much more efficient and sustainable way of handling their waste stream and is expected to save this important ARNG training site thousands of dollars annually (PAARNG 2011).

**Net Zero Energy and Water Initiatives in Oregon**

On 19 April, 2011, the Army announced the locations identified to be pilot net zero installations as part of the Army's Net Zero Installation Strategy. Net zero is further defined as the self-production of energy or water for the installation with no requirement from the local sources. The goal is for installations to be 'net zero', based on net zero energy, net zero water, and net zero waste by 2020 (i.e., net zero installations will consume only as much energy or water as they produce and eliminate solid waste to landfills). The Army has identified six net zero pilot installations in each of the energy, water, and waste categories and two integrated installations (net zero in all three categories) (DoD 2011).

The Oregon ARNG's Camp Rilea was selected as the pilot installation for net zero water use. A net zero water installation limits the consumption of freshwater resources and returns water back to the same watershed so as not to deplete the groundwater and surface water resources of that region in quantity and quality over the course of a year. In addition, the OR ARNG has volunteered to pilot a unique and challenging Net Zero Energy Initiative, which includes all of their installations across the state. The OR ARNG has already laid the groundwork by installing several solar photovoltaic (PV) arrays on various sites throughout the state. The 103 KW capacity solar PV array at their recently completed Ontario Readiness Center is anticipated to make that site the first Net Zero energy site in the ARNG once the data is available. The OR ARNG's ambitious Net Zero energy plan also calls for a 20MW solar PV array to be installed at Christmas Valley, and a proposed 4.4 KW set of wind turbines at Camp Rilea, where they are also looking at wave technologies as well, up to a potential total of 20 MW (Hutchison 2011).

The use of green remediation technologies by Oregon ARNG's largest ever restoration project at Camp Withycombe earned the FY 2009 'Secretary of the Army award' for environmental restoration efforts on an installation. In preparation for a highway construction starting in 2012, Camp Withycombe worked to clean up the proposed highway corridor and transfer the land to the state. The area to be transferred included six former training ranges. Though closed for live-fire training in the 1990s, the former ranges accumulated lead bullets during their use of approximately 100 years. If Camp Withycombe had used a traditional approach to site cleanup, more than 30,000

tons of contaminated soil would have been excavated and hauled to a hazardous waste landfill. This solution would have cost approximately $11 million with excavation, disposal and transportation costs, and would have produced high levels of emissions (due to transport). By contrast, the green remediation soil treatment system was implemented at a cost of $5.9 million, saving more than $5 million (Gaskill 2010). This green treatment system used a separation process to remove bullets and fragments; the soil was then treated and reclaimed; and more than 50 percent of the soil was used in reforestation to refill a mountain. Nearly 300 tons, or approximately 25,205,000 bullets, were sifted out and reclaimed for recycling. Revenue generated by the lead recycling was reinvested into restoration (Gaskill 2010).

**"LEEDing the Way" in Arizona**

For the Arizona Army National Guard (AZARNG), long-term sustainability has been the guiding principal for over a decade across all areas of operation, including: Soldier training, environmental stewardship and compliance, and daily support operations. The organization's sustainability program has roots in the AZARNG's response to the series of "Greening the Government" Executive Orders. Based upon recent directives, and the agency's 2009 Sustainability Policy, this initiative evolved into a comprehensive, fully integrated, sustainability program. The policy is designed to foster: green construction, waste prevention and reduction, energy, water, and natural resources conservation, as well as interagency cooperation and to partner with diverse stakeholder groups. In every aspect, the AZARNG's sustainability plan reinforces

the organization's primary strategic goal to provide the highest caliber of training to every citizen soldier, in support of both state and federal missions.

Established in 2002, the AZARNG's Qualified Recycling Program (QRP) serves to reduce waste, while earning non-appropriated funds. The QRP provides for the recycling of cardboard, plastic, aluminum, paper, antifreeze, batteries, oil, and scrap metal. Since its inception, the QRP has generated $20K-$30K annually, which pays for new recycling equipment and expanded environmental impact reduction programs (AZARNG 2011).

All new AZARNG construction and facility modernizations meet the U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) certification ratings of 'Silver' or better. Over the past six years, the organization completed a number of LEED Silver and Gold facilities, including three Readiness Centers, a Field Maintenance Shop, a Fire Station, an Armed Forces Reserve Center (AFRC), and the renovation of a historical Headquarters Building (AZARNG 2011).

The AZARNG uses both rooftop and ground mounted solar energy systems, along with wind turbines as alternative energy sources. Since 1998, energy-saving measures (such as building lighting and HVAC retro-commissioning, enhanced metering, substitution of energy-star rated products, and the use of a BAC net Energy Management and Building Automation System) reduced the overall energy consumption of the AZARNG by 51% (AZARNG 2011).

Fundamental to all AZARNG actions is the preservation and conservation of the state's natural resources. The AZARNG is involved with timber sales and reforestation efforts, as well as, migratory birds, wildlife, endangered species, and local Native Ameri-

can tribes' cultural studies. To provide for sustainable training environments and address issues of encroachment, the AZARNG and its partners are working with legislators to protect airspace and flight paths, and are implementing an ACUB program at Camp Navajo, a Maneuver Training Center located in Northern Arizona. Working cooperatively, the AZARNG and its partners have taken advantage of each other's unique resources and skills, and established a truly regional commitment to shared goals for the environment and the military mission (AZARNG 2011).

**Sustainability as part of Strategic Planning in Colorado**

In 2008 the Colorado Army National Guard (COARNG) began the journey of formally integrating sustainability into its strategic planning process. In Army terms, Sustainability means finding ways to accomplish today's mission while still allowing for the accomplishment of future missions. The COARNG conducted strategic planning/sustainability workshops in 2009. As a result, several Action Plans were generated with sustainability as a primary focus.

The COARNG's military mission faces many challenges such as urban growth, air quality, energy source depletion, threatened and endangered species and demands for land and air space. Through sustainable efforts like environmental compliance and stewardship, environmentally preferable purchasing, implementing an environmental Management System (eMS), and partnering with communities to plan and avoid encroachment, the COARNG is beginning to eliminate some of these challenges. It is the COARNG's obligation to ensure soldiers today, and the Soldiers of the future have: the land; water and air

resources they require to train; a healthy environment in which to live; and the support of the communities and the American people (McCane 2010).

The COARNG is working hard to move towards sustainability integration and away from the "silo affect" which has a tendency of functional areas to focus on their own areas without communication, or collaboration, with other Directorates and with little consideration of the context in which they operate. Integration broadens viewpoints by increasing "inter-functional" communication and collaboration, lowers risk, and opens people to opportunities (McCane 2010).

Executive Order 13423 directs federal agencies must use the eMS as the primary management approach to address environmental aspects of internal agency operations and activities and the environmental aspects of energy and transportation functions. The COARNG has long been a leader within the ARNG for "green building." The Construction and Facilities Management office requires all of new construction and major renovation projects be built to at least LEED Silver standards. With the world's limited resources, structuring an intelligent relationship with the environment is of great importance for the COARNG. Colorado, like much of the western United States, has a tenuous relationship with both its energy and water resources. Energy consumption is also the COARNG's number one eMS significant aspect. Building with mindfulness to these concerns is vital to the COARNG's values and essential to ensure the longevity of the COARNG's mission (McCane 2010).

Some examples of the ongoing efforts of the COARNG's sustainability integration efforts include: construction of a Grid Tied Photovoltaic Energy System at Field Maintenance Shop #3 in Grand Junction, Colorado; initiation of a comprehensive Energy &

Water Awareness Program (EWAP) and Solid Waste Reduction & Recycling Program (SWRRP); reduce the usage of ozone depleting substances and products with high Global Warming Potential (GWP); reduce the amount of HCFCs used in HVAC appliances and cooling systems, as well as requiring all future HVAC systems to utilize EPA-approved HFCs; and the development of an online hazardous chemical inventory system (McCane 2010).

All of the COARNG's maintenance and aviation facilities and U.S. Properties and Fiscal Office warehouse utilize hand-held scanners to conduct monthly hazardous chemical inventories which are uploaded to an online inventory database. All other facilities and activities access the inventory via their computers to update their inventories. This has resulted in better accounting of hazardous chemicals and has reduced the amount of hazardous waste and expired shelf-life items generated by COARNG operations (McCane 2010).

Integrating sustainability fosters innovation, and the COARNG is well on its way and is working hard to integrate sustainability into the consciousness of all COARNG and Department of Military and Veterans Affairs personnel.

**Buffering Against Encroachment in Minnesota**

Camp Ripley established its ACUB program, known locally as "*Central Minnesota Prairie to Pines Partnership…preserving our heritage.*" The purpose was to create and enhance a natural buffer around Camp Ripley by taking advantage of available opportunities to prevent encroachment and enhance conservation and land management. By securing a buffer, Camp

Ripley can continue to offer and provide critically important, high quality military training and operations to ensure combat readiness, as well as mitigate community development encroachment around the installation. Through implementation of Camp Ripley's proposal, Camp Ripley will also contribute to preserving the local heritage and enhancing a regional conservation corridor (MNARNG 2011).

The local citizenry has always been very supportive of Camp Ripley and proud of the role that Camp Ripley serves in preparing our Soldiers for the battlefield. Their support is obvious from the number of landowners that have come forward voluntarily and without solicitation. In FY 2010 alone 27 landowners representing 8,034 acres enrolled their property within the Camp Ripley ACUB program. This brings the total enrollment to 306 parcels totaling 42,000 acres. Of the 306 parcels enrolled, our partners the "Minnesota Department of Natural Resources and the Minnesota Board of Water and Soil Resources" completed 12 and 47 land transactions, respectively; encumbering over 9,800 acres with a direct expenditure of federal funds and 17,410 acres through other contributions (MNARNG 2011).

The sustainability initiatives and projects at these and other state ARNGs exemplify the Guard's commitment to improved energy efficiency and security, streamlined systems, cost-saving technology and sustainable design. The impetus for sustainability comes not only from ARNG Headquarters but also from newly recruited members.

## Conclusion

Sustainability, for the Army National Guard, is an organizing principle that drives our ability to ef-

fectively equip, train, and deploys soldiers today, and into perpetuity, without a decline in the mission, or the natural and built systems that support it. The ARNG's initiative of an enterprise-wide Sustainability program is an approach that incorporates a sustainability philosophy from top to bottom in all areas of operations support, including engagement with stakeholders, regulators, and partners in our communities. We are developing a fully integrated strategy and performance management system that will drive resource decisions within the ARNG Directorate and ARNG commands in all states and territories, as well as processes that guide up-front investments in more efficient systems resulting in lower total-life-cycle costs. The ARNG is also developing programs where Soldiers, their families, and our civilian workforce have a personal commitment to sustainability and are active participants in programs that enhance readiness and extend our operational capabilities.

The ARNG today faces unprecedented demands on its Soldiers, communities, natural resources and various other assets, that enable the accomplishment of the ARNG mission. We must strive to become systems thinkers if we are to benefit from the interrelationships of the *triple bottom line* of sustainability: mission, environment, and community (U.S. Army 2004). Our Readiness relies on the actions we take now to ensure that our Soldiers today—and the Soldiers of the future—have the land, water and air resources they need to train; a healthy environment in which to live; and the support of local communities, government officials, and the American people. The Army National Guard will meet those obligations by becoming a more sustainable organization.

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# 14

## Building Green

*Thomas Napier, Richard Schneider, Annette Stumpf, and William Goran*

## Facilities and the Army Mission

### *Soldiers Deserve Quality Facilities*

With the 1973 end of conscription and transformation to the All-Volunteer Force (AVF) in the United States came major cultural changes in many facets of the military. Among those was the way in which Army facilities came to be viewed as critical to national security. In the years following AVF, it became clear that the key to success in creating a truly outstanding force was to re-enlist the most capable members. But these new careerists were basing their decisions, in part, on the Army's willingness to meet their quality-of-life demands for decent housing, child care facilities, health benefits and social services, religious faith support, morale, welfare, recreation, and other amenities enjoyed by mainstream Americans.

Today, from the initial pockets of leadership striving to meet those demands, the Army has done a complete about-face not only by becoming a national champion of sustainable facilities, but by putting words into action in a very significant way. Pivotal to its cultural change in facilities delivery have been the Army's adoption of Leadership in Environmental and Energy Design (LEED) and unprecedented follow-on initiatives, including those to achieve 25 net zero installations (energy, water, waste) by 2030. The commitment of a large bureaucracy to completely revamp a conventional business model in just a few short years is nothing short of remarkable.

## Army Facility Goals

Facilities represent a considerable investment to the Army. In 2010, the Army's inventory consisted of some 969 million square feet of buildings with a present value of about $298 Billion (Office of the Assistant Chief of Staff for Installations Management [OACSIM], 2010). Over 800 new construction projects were executed in each fiscal years (FY) 10 and 11, at a cost of roughly $7.0 billion and $9.5 billion, respectively.

**Figure 1. Mission and facility interface.**

In 2004, the Office of the Assistant Secretary of the Army for Installations and Environment (OASA IE&E) published the *Army Strategy for the Environment: Secure the Future, Sustain the Mission*. In it, the Army describes a triple bottom line of sustainability: preserve Mission, Environment and Community. Being unsustainable in facilities design, construction, operation, and disposal undermines the Army's ability to sustain its operations and accomplish its mission. Today, the interdependence between mission excellence, energy security, environmental stewardship and community relations has never been so apparent.

In the context of facilities and the built environment, sustainability includes the following goals:

- Minimize the impact of facilities on the lands and ecosystems on which they are built, considering both site and region
- Conserve water and return water to natural systems in an uncontaminated condition
- Conserve energy and minimize the negative impacts to the atmosphere associated with energy production and consumption
- Conserve natural resources and reduce waste
- Eliminate occupants' exposure to pollutants and health hazards within facilities

## Early Army Sustainable Design and Development Efforts

### *A Context: Motivated by Executive Orders*

The primary drivers for the Army initiating sustainability activities were a series of Executive Orders (EO) issued in the 1990s which directed waste reduction, recycling and energy and water use reduction. EO 12873, Federal Acquisition, Recycling, and Waste Prevention, October 1993, set the stage by requiring that federal agencies incorporate waste prevention and recycling in their daily operations and preference be given to products and materials with a recycled content to increase demand and support market expansion in recyclables. EO 12902, Energy Efficiency and Water Conservation at Federal Facilities, March 1994, mandated the improvement of energy efficiency and water conservation, and an increase in the investment in solar and other renewable energy for all types of federal buildings, whether owned or leased.

EO 13101, Greening the Government through Waste Prevention, Recycling, and Federal Acquisition, September 1998, expanded requirements of earlier EOs, requiring that the head of each executive agency incorporate waste prevention and recycling in the agency's daily operations and work to increase and expand markets for recovered materials through greater federal government preference and demand for such products. EO 13123, Greening the Government through Efficient Energy Management, June 1999, focused on energy conservation, mandating that the "The Federal Government, as the Nation's largest energy consumer, significantly improve its energy management to save taxpayer dollars and reduce emissions that contribute to air pollution and global climate change." EO 13123 set energy reduction and greenhouse gas reduction goals and required that sustainable design principles be applied to the siting, design, and construction of all new federal facilities.

Responding to the Executive Orders, Deputy Assistant Secretary of the Army Paul W. Johnson established initial Army policy regarding sustainable design and development in (OASA [I&E] 2000). In his policy memorandum, he defined sustainable design and development as "the systematic consideration of current and future impacts of an activity, product or decision on the environment, energy use, natural resources, the economy and quality of life" and went on to state that "It is Army policy that the concept and principles of Sustainable Design and Development shall be incorporated into installation planning and infrastructure projects." He required that the "Assistant Chief of Staff for Installation Management (ACSIM) develop implementing policy and that the U.S. Army Corps of Engineers (USACE) provide technical guidance to support that initiative," stating that

"the guidance would ensure Sustainable Design and Development be considered in Army installation planning decisions and infrastructure projects to the fullest extent possible, balanced with funding constraints and customer requirements." More importantly, he defined sustainability as addressing the full facilities life cycle, "integrating sustainable design and development into installation planning and throughout the project planning, programming, design, construction, operation and maintenance process."

**First Sustainable Design Policy for Army Facilities**

For the U.S. Army and USACE, sustainable design concepts were first published in Engineering Technical Letter (ETL) 1110-3-491. ETL 1110-3-491 provided basic criteria and information incorporating sustainable design concepts in the planning, design and construction of all new Army facilities and the rehabilitation/renovation of existing facilities. It pre-dated the U.S. Green Building Council's (USGBC's) first green building rating tool, LEED v 1.0. ETL 1110-3-491 applied to all HQ USACE elements and USACE commands having Army military construction (MILCON) and design responsibility. The ETL defined sustainable design as the "design, construction, operation, and reuse/removal of the built environment (infrastructure and buildings) in an environmentally and energy efficient manner." It went on to define sustainable design as using the foundations of sustainability that we still consider primary today:

> …incorporating energy efficiency concerns of the 1970s with the concerns in the 1990s related to damage to the natural environment; emissions of greenhouse

gases and ozone depleting chemicals; use of limited material resources; management of water as a limited resource; reductions in construction, demolition and operational waste; indoor environmental quality; and occupant/worker health, productivity and satisfaction.

## Army Sustainable Facility Research

As the Army pursued sustainability for its facilities, it relied heavily on a unique resource within the USACE research and development (R&D) community. The Construction Engineering Research Laboratory (CERL) has long focused on helping military installations become more sustainable through its research and technical expertise. CERL initiated R&D activities focused on the sustainable design and construction of Army facilities in October 1999. A focused sustainability research project was developed as an effective response to EO 13101 and to establish a coordinated sustainable design research agenda (ERDC-CERL 1999).

The research team evaluated the potential role of USACE to become the recognized source of sustainable design expertise for the Army, Department of Defense (DOD), and the nation and identified roles for the Corps and the technologies that could be developed or mobilized to attain that end (Flanders 2000). The research eventually lead to the development and fielding of the Army's first green building rating tool, Sustainable Project Rating Tool (SPiRiT) (USACE 2001) and later the adoption of USGBC's Leadership in Environmental and Energy Design for New Construction (LEED-NC) as the Army's rating tool in January 2005 (USGB 2005).

Early CERL research focused on an evaluation of the current state of practice in sustainable design in

DOD, federal government, and the private sector, including international sources. The research also evaluated sustainable design metrics currently in use. The findings explored several terms and definitions describing sustainable development and included policies and resources encompassing two main themes, energy and environment. Findings also recommended the development of Army sustainable design metrics.

The first draft of an Army green rating tool, Sustainable Installations Rating Tool (SIRT), evolved from this research in 2000. Later that year this tool was refined to focus on vertical construction, the end result being the draft Sustainable Project Rating Tool (SPRT) Version 1.2 in August 2000. The research also recommended ways for DOD to obtain and maintain sustainable facilities and infrastructure.

**Army Implements a Green Building Rating Tool**

Among the many national and international organizations exploring, developing, and/or applying sustainability or green building metrics, USGBC's approach to sustainability was rapidly gaining recognition during the time that CERL was developing the Sustainable Project Rating Tool for the Army. Founded in 1993, the USGBC published its first LEED Green Building Rating System, Version 1.0 in January 1999 and had published a first update, LEED for New Construction (LEED-NC 2.0) by March 2000. Headquarters USACE and ACSIM sponsors were familiar with LEED 1.0 but were not satisfied with its potential as an Army green building rating tool. It wasn't until the USGBC published LEED-NC 2.0 that the Army gained interest in using LEED to promote sustainability in the design and construction of all new facilities

for MILCON. While Army leaders liked LEED, they still wanted an Army-focused product.

The Army entered into negotiations with USGBC on the use of LEED-NC 2.0 as the basis for an Army green building rating tool. Development efforts on the Sustainable Project Rating Tool were redirected to blend Army elements with the commercial standards of LEED-NC 2.0 to form a unique tool for the Army. The result was SPiRiT, the selected acronym for the Sustainable Project Rating Tool. SPiRiT was LEED-NC 2.0 with language edited to reflect an Army installation versus urban and commercial settings. Private sector standards and criteria were replaced with Army standards not present in LEED and structured with a 100-point scale weighted according to Army priorities. The Army entered into a formal licensing agreement with the USGBC in April 2001 and SPiRiT v1.4 was mandated as Army policy for all vertical construction effective April 14, 2001. SPiRiT was fielded under a revised ETL 1110-3-491 in May 2001 and remained in use until LEED-NC 2.2 was adopted by the Army in January 2006.

SPiRiT, similar to LEED, had various levels of performance: Bronze, Silver, Gold, and Platinum. The initial minimum performance for Army facilities was SPiRiT Bronze. The minimum threshold increased fairly rapidly. "Convinced that the [SPiRiT] process was an excellent method for improving the quality of the facilities built to support readiness, training, and soldier wellbeing," Assistant Secretary of the Army Mario P. Fiori added his endorsement to the use of SPiRiT (OASA[I&E] 2002). The tool was updated and republished as version 1.4.1 in June 2002. By December 2002, stating that "the design and construction community had acquired significant experience

at using the SPiRiT rating process and applying sustainable design practices," ACSIM Commander Maj Gen. Larry J. Lust, raised the minimum threshold to SPiRiT Silver for the FY06 program (OACSIM, 2002). Citing "considerable progress laying the foundation for sustainable facilities in the Army" that had been made, Fiori raised the bar again to SPiRiT Gold in March 2003, where it remained until LEED was adopted (OASA (I&E), 2003). The USGBC continued to evolve LEED, but as they did so, publishing LEED-NC 2.1 in November 2002 and LEED-NC 2.2 in October 2005, Army development of SPiRiT did not keep pace. Revised versions of SPiRiT paralleling revisions that had been made to LEED-NC were prepared but never fielded. The last draft update was SPiRiT, Version 2.1, in September 2004.

In May 2003, USACE and ACSIM collaborated on a program to validate the Army's self-scoring process for SPiRiT. Under the SPiRiT program, project delivery teams (PDTs) were to self-score their projects, meet as a team to reach a consensus on a final score, then endorse the final project SPiRiT score. Five projects were reviewed by a four-member SPiRiT validation team between July and August 2004. The SPiRiT Validation Team concluded: "Considering that the SPiRiT policy was issued late for full sustainable consideration in the planning and design phases of FY02 projects, the Project Delivery Teams did an exemplary job." They further concluded that "by applying the improvement opportunities recommended…future project delivery teams could achieve Silver and low Gold without additional project costs." LEED continued to evolve as the private sector's green building rating system of choice. As Army project delivery teams became accustomed to using SPiRiT and more

familiar with LEED as it was reflected in SPiRiT, the Army decided it was time to consider adopting LEED. CERL, now part of the Engineer Research and Development Center (ERDC), was asked to conduct a study and make recommendations, not only on the adoption of LEED, but the appropriate performance threshold.

It was at this point the Energy Policy Act (EPACT) of 2005 established energy management goals for federal facilities and fleets and amended portions of the National Energy Conservation Policy Act (EPACT 2005). It set federal energy management requirements in several areas, including metering and reporting, energy-efficient product procurement, energy savings performance contracts, building performance standards, renewable energy requirement, and alternative fuel use. Of particular interest are the requirements for federal building performance. They include:

- Directs new federal buildings—commercial or residential—to be designed to consume 30% less energy than a baseline established by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) and the International Code Council's International Energy Code (ASHRAE 2004).
- Includes the application of sustainable design principles for new buildings.
- Requires federal agencies to identify new buildings in their budget requests and those that meet or exceed the standards, which DOE must include in its annual report to Congress.

CERL conducted a study forecasting LEED scores for projects evaluated under the first SPiRiT validation activity, making the recommendation to adopt LEED-NC v.2.2 and to establish the minimum performance level at LEED Silver. Key to this recommendation was the requirement that new Army facilities be designed

to increase the energy efficiency to meet EPACT requirements. The Army accepted the recommendations and LEED was adopted as the Army's sustainable design rating tool early in 2006, to start with the FY08 MILCON program (ASA [I&H] 2006). CERL drafted the *Army LEED Implementation Guide* the following year and within another year, all Army new construction projects were mandated to be registered with USGBC (Schneider 2006).

**Sustainable Army Master Planning**

The Army Real Property Master Plan (RPMP) provides a roadmap to ensure a proactive approach to meeting long-term mission requirements. The RPMP establishes a vision and future direction for efficiently managing, acquiring, or reducing real property at Army Installations to support the current mission, transformation, and management processes. Army master planning requirements are defined in AR 210-20 (Department of the Army 2005).

Installation master plans have followed traditional campus planning models until fairly recently. With the publication of SPiRiT in 2001, the Army started to consider how to integrate sustainability principles in the real property master planning process in a holistic fashion. A recent redraft of AR 210-20 (unpublished) introduces the concept of Form-Based Coding, adds a new concept of sustainable development, planning for health, adds Area Development Plans as a RPMP product, and updates sustainable design and development factors.

The revised regulation requires that the concepts and principles of sustainable development be incorporated into all installation planning and infrastructure

projects. The goal is to satisfy mission requirements while maintaining a safe, healthy, and high quality environment for current and future generations. The goal of sustainable development is to make the most effective use of limited resources, and to create more compact and sustainable communities that still meet security and safety requirements. Master planners shall strive to maximize sustainability and work towards achieving the Army net zero goals in their planning process. Key planning principles include sustainable development, sustainable building design, natural and cultural resource preservation and planning for healthy communities (encourage physical activity, such as walking from building to building).

IMCOM recently issued Policy Memorandum 11-32-1 – Operationalizing Sustainability (IMCOM 2011). This Memorandum describes how to incorporate the IMCOM principles of sustainability (mission excellence, community collaboration, environmental stewardship, economic benefit, and systems thinking) through collaborative, integrated, long-range planning and cross-functional team-based execution. IMCOM garrisons are using the Installation Strategic Sustainability Planning (ISSP) process to operationalize sustainability by applying the principles of sustainability in an evolution in planning and plan execution to move the installation from the current state towards a net zero installation in its 25 year journey. The policy directs integrated planning and implementation efforts to tie together Sustainable Design and Development, Succession Planning, Army Compatible Use Buffer Program, Sustainable Range Program, Environmental Management System, Greenhouse Gas Emissions and the Green Procurement Program.

## Army Green Building Effort Matures

### *Tri-Service Sustainable Design Team Emerges*

Coordination for sustainability activities was initiated among DOD services and across USACE from the initial stages of rating tool development. A Tri-Service Networking Workgroup was formed with Headquarters USACE, OACSIM, Air Force, Navy and CERL representatives that met quarterly to share initiatives and issues. The services also participated in the Interagency Sustainability Working Group (ISWG) which is organized to share initiatives across all federal agencies. At the working level, coordination across USACE Districts and Installation Directorates of Public Works began with the Sustainable Design and Development (SDD) Training program, even before the adoption of SPiRiT. First sessions were held in June 2000, with all local federal agencies invited to participate. These first training sessions were instrumental in establishing a network of SDD contacts at Corps District offices. While unofficial at first, the network grew into an important base of SDD practitioners that numbers in the thousands today. The network was formalized by USACE in 2007 with each MILCON District now required to have a designated point of contact for sustainability and a LEED Accredited Professional assigned to each MILCON project. A USACE SDD Directory of Expertise (DX) was formally established in 2008 at the USACE Savannah District and supported by the Center for the Advancement of Sustainability Innovations (CASI) at ERDC–CERL. CASI was formed in 2006 as a Corps of Engineers center to support Army sustainability goals.

## Collaboration with the USGBC

The Army joined USGBC in March 2001. All civilian and military members of the U.S. Army are federal members of USGBC including Army National Guard and Reserve, and have full access to USGBC membership privileges. To date, some 2,000 registrants are on the USGBC website, primarily from USACE and Army Directorates of Public Works, but with an increasing number of participants Army-wide.

To advance the state of knowledge in SDD and professional practice for all civilian and uniformed members of the Army engaged in facilities planning, programming, design, construction, operations and disposal, the Army strongly encourages participation in USGBC activities, both at the local and national levels. The USGBC holds two annual events, Greenbuild and a Federal/Government Summit. Each provides an excellent opportunity for Army participants to collaborate with other DOD and Federal facility professionals.

Since the Army has a strategic interest in the development of LEED rating tools suitable for Army projects, Army employees have been active members of committees such as the Energy and Atmosphere Technical Advisory Committee and most recently the Implementation Advisory Committee (IAC).

Early in the evolution of USGBC, an imperative was to create a recognized base of experts knowledgeable in sustainable design, so the USGBC established a LEED credentials program. LEED Professional Credentials (LEED Green Associate, LEED Accredited Professional, and LEED Fellow) apply to individuals with current knowledge of green building technologies, best practices, expertise in the LEED Rating Sys-

tems. USACE supports the accreditation of staff by conducting various in-house and vendor-provided training.

**SDD Validation Committee**

In January 2009, the Army established an SDD Validation Committee to validate its internal certification process for sustainability scoring (SPiRiT/LEED) of MILCON projects in accordance with requirements of the Energy Independence Security Act of 2007 governing SDD. The committee included members from ACSIM (Construction, Base Realignment and Closure, Army Reserve, Facilities Policy, Army Environment, and the Army Housing Divisions), Headquarters Installation Management Command (HQ IMCOM) Public Works, HQ USACE, and ERDC-CERL. The committee was chartered to: 1) develop and execute a plan to meet statutory requirements for external certification of five percent of MILCON program projects, and 2) validate the Army's internal certification process for sustainability scoring of MILCON projects. The committee made annual selections of Army projects to be validated and certified. Annual validation site visits were conducted during 2009 and 2010 on selected projects by a field team consisting of committee members and others from their agencies, augmented by LEED Accredited Professionals as needed from various USACE District offices. In addition, USACE Division and Centers of Standardization (COS) representatives (MSCs) participated, representing their Districts and Design Standards if applicable.

In late 2010, the SDD committee was dissolved and the responsibility for certification project selection and validation were assigned to USACE as a part of its MILCON delivery responsibilities.

## Construction and Demolition Waste Reduction

Reducing waste is a fundamental component of sustainability and has a new emphasis with the net-zero installations initiative. In a facilities context, construction and demolition (C&D) waste is generated as debris produced by a building's demolition and by scrap materials produced throughout the construction process.

DOD's concerns about solid waste was manifest in its 1996 Pollution Prevention Measure of Merit, which directed installations to reduce their solid waste by 40 percent by 2005 (Department of Defense 1996). On some installations, C&D materials constituted up to 80 percent of the solid waste stream. Meeting the DOD Measure of Merit would be difficult with this amount of C&D waste being generated.

In the 1990s three Army installations initiated innovative programs to remove obsolete buildings. Rather than demolish obsolete buildings and landfill the debris, they sold buildings, or recycle rights during demolition, to the public. Buyers would deconstruct buildings and salvage the materials, mostly lumber. At these three locations alone, roughly 100,000 tons of useable building material was diverted from landfills.

However, most installations at the time were still disposing of debris in on-post landfills with little consideration for waste reduction. Some demolition specifications even required all materials to be deposited in the on-post landfill, and prevented contractors from extracting anything they may have found valuable.

Soon the Army began to recognize the benefits reusing and recycling building materials to reduce C&D waste. In 2001, the ASA I&E issued a memorandum

encouraging Army agencies to seek opportunities to develop partnerships with community and non-profit housing groups to salvage materials from obsolete buildings as an alternative to landfill disposal (OASA [I&E] 2001). Between 2002 and 2006 many additional deconstruction projects were completed throughout the Army. These projects reduced C&D waste by up to 90 percent.

In 2006 ACSIM issued a Policy Memorandum requiring each Army contract for demolition, new construction, and remodeling and renovation to reduce C&D waste by a minimum of 50 percent (OACSIM, 2006). This policy institutionalized C&D waste reduction throughout the Army. It has proven to be quite effective as the Army is achieving a C&D waste reduction rate of over 73 percent. With HQ USACE and Army Environmental Center support ERDC-CERL has been engaged in technical transfer activities for deconstruction and C&D waste reduction including authorship of several Army Public Works Technical Bulletins, Army and federal instructional events, and a Whole Building Design Guide Resource Page (Napier 2011).

**Toward High-Performance Sustainable Facilities**

The years since the Army first embraced sustainability have seen a flurry of regulations and mandates related to all areas defining SDD, with an emphasis on energy and water conservation. Far from being a distraction, the evolving national sustainability mindset has only served to validate Army imperatives to do the right thing from an SDD standpoint – to ensure military readiness and retention through quality facilities and services, to train soldiers to succeed in their

mission while protecting a fragile ecosystem, and to envision a future where net zero military installations are models of sustainability for the planet.

In FY08-09 the Army developed revised building designs by working with industry experts and architect-engineer (A&E) firms to develop a "best of the best" design for each Army facility. The requirements of this effort were to optimize the mission, function, quality and cost of the buildings. The International Building Code was used as the baseline building code. The baseline design was amended and supplemented to include anti-terrorism and force protection, EPACT 2005 compliance, LEED Silver certifiable, installation and mission-specific requirements, and select DOD Unified Facility Criteria considered critical to life-safety and mission.

Army military construction needed to keep up with the increasing mandates for energy efficiency and sustainability. USACE was asked to take the lead in determining building features, construction methods and materials to optimize energy reduction and sustainability for five new construction standard designs to be built in FY13. USACE was also asked to evaluate the design of each facility for full mission scope and to insure the selected standard designs met all applicable energy reduction and sustainable design mandates (e.g., LEED Silver, EPACT 2005, EISA 2007, EO13423, and EO13514).

The approach of the "MILCON Energy Enhancement and Sustainability Study of Five Army Buildings" was to take these existing building designs and optimize the energy performance of each to build the most energy-efficient buildings possible before looking at options like renewable energy sources and cogeneration (USACE, 2011). Energy models were

developed with various energy packages and options; sustainability features were identified for each building to meet federal mandates. Meetings were held with USACE COS to discuss how to improve the energy performance of the buildings and to have a reality check on assumptions, ideas and options. Cost estimates were developed to determine the difference between the baseline buildings and proposed enhanced design options. Finally, a LEED analysis was completed as an outcome of the energy modeling and estimating. Specific targets for the study included:

- Army buildings designed to be net zero ready;
- 65 percent reduction in overall energy consumption compared to 2003 energy usage;
- 30 percent domestic water reduction;
- 50 percent waste water reduction; and
- 25 percent operating cost reduction.

The project was a collaboration between USACE, CERL, National Renewable Energy Laboratory (NREL), and the Pacific Northwest National Laboratory (PNNL). The study showed that it is very challenging for individual buildings to reach the net-zero energy targets mandated by the Energy Independence and Security Act (EISA). Instead it is more effective to cluster "low-energy" facilities around a district heating/cooling/renewable energy plant to take advantage of shared savings and improved efficiencies. Guidance resulting from the study was published in ECB 2011-1. This study did not consider the implementation of ASHRAE 189 which is now required.

**A Sustainable Future for Facilities**

The USACE 2030 Integration Project is a look into the future of Army facilities. It addresses resiliency at

Army installations through evaluation of the Army's energy needs for supporting and training soldiers. The USACE 2030 team focused on achieving net zero energy, water and waste by 2030. By diversifying energy and water supplies and waste disposal on a community scale, Army installations have the opportunity to become self-sufficient. In addition to exceeding sustainability and energy mandates until 2030, the net-zero concept will minimize the risk of contamination of resources and lower the reliance on larger networks that have higher potentials to fail.

As the massive new construction programs of the 2000's wind down, greater emphasis will be given to the renovation and renewal to improve the energy efficiency and sustainability of existing facilities and Army communities. The Army has started on the path to true sustainability by championing the construction of green buildings and infrastructure, but even greater challenges lay ahead to reshape its communities to reach the net zero energy, water and waste targets.

The Army mission, soldier performance and the well being and quality of life for the Army family is enabled by high performance, energy efficient and sustainable facilities and infrastructure. USGBC awarded the Army team with the Leadership in the Public Section award in 2009 to recognize the huge transition that occurred in the facility delivery process. Now the Army is moving beyond establishing policy towards inspiring project delivery teams to use the latest technologies, strategies, and early energy modeling and life cycle costing tools to plan, design, build, renovate and deconstruct Army facilities so they will be enduring, meet mission requirements, reduce our environmental footprint, and result in a productive workforce. Recent improvements in Building

Information Modeling capabilities enable designers to test new ideas during the early design stage. More powerful installation-wide modeling capabilities are being developed by ERDC-CERL research teams. The net zero research effort is investigating how to make a holistic assessment of opportunities to add, renovate, or reconfigure installation facilities and infrastructure so the installation can become self reliant. Other ERDC-CERL researchers are studying how to optimize installation power generation and distribution (micro-grids) to reduce power requirements and take advantage of renewable resources while powering mission essential services. Additional research is being conducted on tightening building envelopes, and on improving operations and maintenance for existing facilities.

There is also a surge in development and transfer of emerging technologies that will help Army communities become increasing self reliant, high performance sustainable places to work and live. The real challenge lies in mapping out which new strategies and technologies are most practical and cost effective for a particular location and how to integrate all the new ideas into the existing infrastructure and new facilities in a systematic manner. Strategic planning and controlled experimentation with new ideas are required to help the Army ease the adoption and implementation of technologies, strategies and practices required to become truly self reliant. While the Army represents a small portion of U.S. construction activity, it is also the largest single entity building, operating, repurposing and demolishing facilities, and so the Army also has a significant impact on the industry as a whole. Over the last few years, the Army has helped the nation shift towards "building green", and the new goals

to have net-zero installations place the Army in strong leadership position for the decades ahead.

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# AUTHOR BIOS

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Dr. Hartman has been a civil servant with the U.S. Army for 24 years holding various positions including Visiting Professor of Sustainability at the United States Army War College, Director of the Massachusetts Military Reservation Joint Program Office, Director of Environment at Fort Bliss (Texas), and Chief of the U.S. Forces Korea/Eighth U.S. Army Environmental Programs Office. Prior to entering civil service, Dr. Hartman worked as a project engineer with the environmental consulting firm of Malcolm Pirnie, Incorporated. He has also taught Environmental Science with the University of Maryland (Asian Division).

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His awards include the Commander's Award for Civilian Service (three awards), the Secretary of the Army's Environmental Quality Award for Individual

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**Dr. Kristan Cockerill**

Kristan Cockerill has an interdisciplinary background and 20 years experience working to understand and improve the connections between cultural and scientific information related to developing environmental policy. Dr. Cockerill has coordinated policy projects at local, regional and federal levels and has conducted research assessing public attitudes about national laboratory environmental performance; nuclear waste; and military programs. Most recently her work has focused on social and communication issues relevant to water management decisions, including research projects to develop collaborative models for water management; to promote community water education; and to encourage sustainable communities in the southern Appalachians. Prior to entering academia, she was on the staff of the Army Environmental Policy Institute. As a professor she has taught a broad suite of interdisciplinary courses at Appalachian State University, Columbia University's Biosphere 2 Center in Arizona, and the University of New Mexico.

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**COL Kimberly O'Keefe:**

COL Kimberly A. O'Keefe is currently an Army Guard officer serving in the Resource Directorate of the Army Chief of Staff for Installation Management (ACSIM) in the Pentagon. Her latest assignments included Resource Branch Chief for the ARNG Environmental Division, Executive Officer for the Director of the ARNG and USAWC Fellow at the Army Environmental Policy Institute. She holds a Systems Engineering degree from West Point ('91) and an Engineering Management degree from University of Missouri, Rolla. She is a Certified Defense Financial Manager (CDFM) and holds Level 3 Acquisition Certification in Facilities Engineering.

**Colonel James J. Raftery, Jr., Ph.D.**

COL Jim Raftery is an Academy Professor in the Department of Electrical Engineering and Computer Science at the United States Military Academy at West Point, NY. He is the department's lead researcher within the Photonics Research Center. He graduated as a Distinguished Military Graduate from Washington University in St. Louis in 1988 with a B.S. degree in electrical engineering and was commissioned as a second lieutenant in the U.S. Army Signal Corps. He holds a M.S. degree in electrical engineering from the University of Missouri – Columbia, a Master of Strategic Studies from the U.S. Army War College, and a Ph.D. in electrical engineering from the University of Illinois at Urbana-Champaign. He has 15 years experience as an Army Acquisition Corps officer and has served three years as the Product Manager for Information Warfare within the Army's Program Executive Office for Intelligence, Electronic Warfare, and Sensors. He is DAWIA Level III certified in both the Program Manager and the Science and Technology Manager career fields. He is a senior member of the IEEE, and a member of the Optical Society of America and the American Society for Engineering Education. He is an author/co-author of more than twenty peer reviewed publications. His research interests are in semiconductor lasers and power-energy technologies.

**Dr. William (Bill) Doe III**

Dr. William (Bill) Doe is the CEO of Veterans Green Jobs, a 501 (c) 3 national non-profit, headquartered in Denver, Colorado. Bill is a career Army veteran having served on active duty in the Army Corps of En-

gineers from 1974-1996 and retiring as a Lieutenant Colonel. He was commissioned from the U.S. Military Academy at West Point and served overseas in Germany and stateside, including seven years on the geography/environmental faculty at West Point. He holds graduate degrees in Civil Engineering from the University of New Hampshire (M.S.) and Colorado State University (Ph.D.). Bill was a senior researcher and administrator in the Warner College of Natural Resources at Colorado State University for thirteen years, prior to becoming CEO. His areas of expertise include military lands, environmental and watershed management and the study of warfare ecology and military geography. He has authored numerous book chapters and articles on these subjects. He also teaches graduate level courses on these topics via distance learning. Bill grew up as an Air Force brat (the son of a career officer) living stateside and overseas with his family. He has been active in veterans and student-veterans affairs in northern Colorado and at Colorado State University, where he also served as the Assistant Director of Veteran Services. He routinely speaks at veterans-related functions in his community, including Veterans Day and Memorial Day.

**Dr. Marie Johnson & LTC Mark Smith (USMA)**

Dr. Marie Johnson is a Professor of Geology in the Department of Geography and Environmental Engineering at the United States Military Academy, West Point. She graduated magna cum laude from Harvard College and received her Ph.D. in geology from Brown University. Dr. Johnson serves as the Environmental Program Director.

Lieutenant Colonel Mark Smith is an Assistant Professor and Academy Professor at the United States Military Academy, West Point. He holds a Bachelor of Science degree from Oregon State University in Wildlife Science, a Master of Science degree from the University of Wisconsin-Madison in Wildlife Ecology, and a joint Ph.D. in Wildlife Ecology and Zoology from the University of Wisconsin-Madison. His research interests involve integrating military training and wildlife on military lands, and using a systems methodology toward developing "green" initiatives that improve West Point. He teaches Environmental Science, Environmental Geology, Environmental Engineering Technologies, Environmental Decision Making and Ecology. LTC Smith is an Air Defense officer with experience in a wide variety of assignments, to include joint and combined tours with NATO and European Union forces. LTC Smith has also severed two combat tours to Iraq (Platoon Leader during DESERT STORM, and NATO LNO to Multi-National Corps Iraq in support of the NATO training Mission in Iraq).

**Lt. Col. Joseph Knott**

Lieutenant Colonel Joe Knott is the Special Assistant to the G-4 for Sustainability & Energy at the National Guard Bureau, responsible for Sustainability planning and execution for all 54 States and Territories. Previous assignments include Engineer company and battalion commands, as well as DA Staff tours at the Pentagon where he managed the Army's Compatible Use Buffer program, and as a program manager in the BRAC office responsible for over $1.3B in military construction projects. LTC Knott also initiated the first-of-its-kind, $700M groundwater investigation

and cleanup project at the Massachusetts Military Reservation on Cape Cod, MA. In addition to numerous other military awards, LTC Knott has been awarded the Bronze Star for exceptional service during combat operations, the Army Meritorious Service Medal with 3 Oak Leaf Clusters, the Army Commendation Medal with 3 Oak Leaf Clusters, and is a recipient of the Secretary of the Army's PACE award for exceptional service to the Department of the Army. LTC Knott has a Master of Science in Environmental Management and Energy Resources Policy, a Bachelors of Science in Environmental Studies, and is a graduate of the Engineer Officer Basic and Advanced Courses, and the Army Command and General Staff College. LTC Knott is a 2008 Kinship Conservation Fellow and a Registered Environmental Manager.

**Mr. William Goran**

William Goran, Director, Center for the Advancement of Sustainable Innovations (CASI), US Army Corps of Engineers, Engineer Research and Development Center (ERDC). As director of CASI, Mr. Goran manages teams that perform studies, analyses and research projects focused on advancing sustainability across the Army and the Dept of Defense. CASI has conducted studies and research on long term water supply for military bases, Army needs related to rare minerals and metals, tradeoffs with renewable energy options, net zero water, energy and waste, sustainable forward basing criteria, the "green" dividend for sustainable facilities, sustainability behavior learning, and sustainability metrics for military facilities and operations. Mr. Goran is a geographer who also serves

as a strategic program planner for his laboratory (Construction Engineering Research Lab – CERL), which is co-located with the University of Illinois in Champaign-Urbana. He serves as adjunct faculty with the University of Illinois Geography Department, and he is a Department of Defense representative to the National Climate Assessment. Along with Sam Higuchi of NASA, Mr. Goran co-chairs an inter-agency forum on climate change impacts and adaptations.

**Mr. Richard L. Schneider**

Mr. Schneider has worked on facilities and infrastructure activities for the U.S. Army Corps of Engineers for over 37 years, twenty-nine years in architectural design, facilities management, installation master planning and sustainable design research at the U.S. Army Construction Engineering Research Laboratory (ERDC CERL) and eight years in master planning project management at the U.S. Army Engineer Division, Europe (USAEDE). He was the lead author of the Corps Engineer Research and Development Center (ERDC) team, which developed the Sustainable Projects Rating Tool (SPiRiT); he was instrumental in the Army's adoption of the U. S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) for New Construction, Green Building Rating Tool; and recognized as a leader in Army implementation of sustainable facility planning, design, construction and operations practices. He provides support to HQUSACE, CE Divisions, CE Districts, ACSIM and Army Installations in LEED requirement interpretation, and scoring as well as general design and planning issues associated with sustainable design; and he serves as the Army's single point of Contact for membership in the USGBC. Mr.

Schneider holds a Masters degree in Architecture from the University of Illinois, Urbana-Champaign, with a specialty in housing design, and is a LEED Accredited Professional (LEED-AP).

**Ms. Annette Stumpf**

Annette Stumpf is a Research Architect and Principal Investigator at the U.S. Army Corps of Engineers, Construction Engineering Research Laboratory (ERDC CERL). She is a leader in CERL's Sustainable Design and Development research effort and is a LEED Accredited Professional. Her research at CERL has focused on improving the facility delivery process through energy conscious design, sustainable design and development, and improving planning processes and charrettes using design automation and energy analysis tools. Annette is listed in the USACE Sustainable Design and Development (SDD) Directory of Expertise as an expert on the implementation of LEED and related sustainable planning, design and development issues. Annette is a founding member of the Center of Advancement of Sustainability Innovations (CASI) which was started at ERDC CERL in 2006. She provides research support and technical advice to HQUSACE, ACSIM, IMCOM, Army Installations and Corps of Engineers Districts. She manages the EKO SDD website: *https://eko.usace.army.mil/public/fa/sdd/*

Ms. Stumpf is a graduate of the University of Illinois with a B.S. in Architectural Studies and a Master of Architecture (with a Minor in Mechanical Engineering - specializing in building energy use and conservation). She is a LEED AP BD+C.

Recent projects of interest are the Army's LEED Validation Effort, MILCON Energy Enhancement and Sustainability Study of Five Army Buildings, Devel-

opment of Fort Leonard Wood's 25 Year Installation Strategic Sustainability Plan, and Early Design Energy Analysis Using BIM (Building Information Modeling). She was a co-author for several recent reports including "The Value of Green to the Army", the "CASI FY11 Work Plan", and "Net Zero Water for Army Installations: Considerations for Policy and Technology."

**Mr. Thomas R. Napier**

Tom Napier is a Research Architect and Principal Investigator with the U.S. Army Corps of Engineers, Construction Engineering Research Laboratory in Champaign, IL. Current research includes sustainability in Army facilities' design and construction, specifically, the reduction of construction and demolition waste through deconstruction, reuse, and recycling. Responsibilities include program development, research, and developing guidance and resources to support engineering and environmental personnel throughout the Corps and the Army. Recent activities include: supporting Army deconstruction projects; developing Army policy and guidance media; technical transfer and training at Army and industry venues, both in the United States and abroad; and improving the resilience of housing exposed to natural disasters. Tom is a past recipient of the Army's Engineer Research and Development Outstanding Team Award. Previous work includes condition assessment of historic buildings, non-traditional project delivery processes, performance specifying, implementation of innovative construction technologies, and other construction management-related subjects.

Tom is involved in U.S. Green Building Council Central Illinois Chapter and Building Materials Reuse Association; participates on the Chicago Rebuilding

Exchange Advisory Board; the Construction Industry Institute's Research Committee, and U.S. Environmental Protection Agency's National C&D Materials Recovery Strategy Committee. Tom has been active in his local Habitat for Humanity ReStore. He received Bachelor's and Master's degrees in Architecture from the University of Illinois. Previous experience includes housing design for the University of Illinois, design, Value Engineering and cost analysis with Steven Winter Associates, New York, NY, and teaching Construction Project Management at the University of Illinois.

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