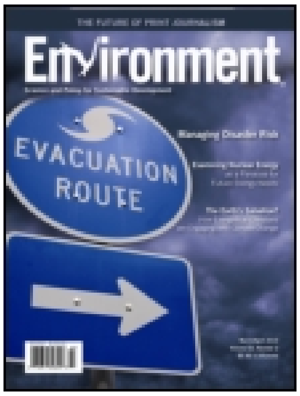

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Environmental Security, Military Planning, and Civilian Research: The Case of Water

Shannon O'Lear [a] , Chad M. Briggs [a] & G. Michael Denning [c]

[a] Department of Geography and Environmental Studies Program , University of Kansas

[b] Global Interconnections LLC (GlobalInt) in Washington , D.C.

[c] Graduate Military Programs, University of Kansas

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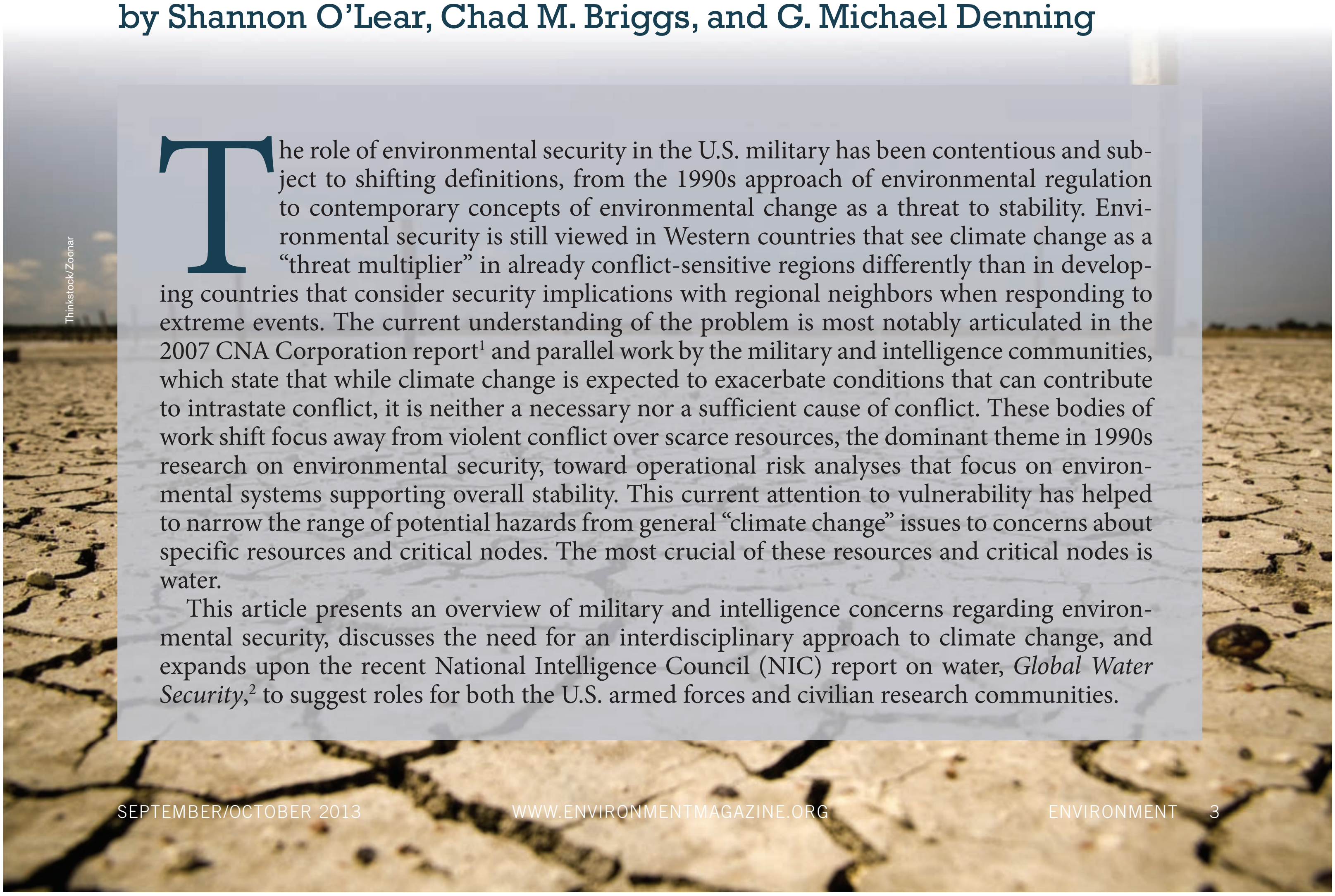
THE CASE OF WATER

by Shannon O'Lear, Chad M. Briggs, and G. Michael Denning



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The role of environmental security in the U.S. military has been contentious and subject to shifting definitions, from the 1990s approach of environmental regulation to contemporary concepts of environmental change as a threat to stability. Environmental security is still viewed in Western countries that see climate change as a "threat multiplier" in already conflict-sensitive regions differently than in developing countries that consider security implications with regional neighbors when responding to extreme events. The current understanding of the problem is most notably articulated in the 2007 CNA Corporation report[1] and parallel work by the military and intelligence communities, which state that while climate change is expected to exacerbate conditions that can contribute to intrastate conflict, it is neither a necessary nor a sufficient cause of conflict. These bodies of work shift focus away from violent conflict over scarce resources, the dominant theme in 1990s research on environmental security, toward operational risk analyses that focus on environmental systems supporting overall stability. This current attention to vulnerability has helped to narrow the range of potential hazards from general "climate change" issues to concerns about specific resources and critical nodes. The most crucial of these resources and critical nodes is water.

This article presents an overview of military and intelligence concerns regarding environmental security, discusses the need for an interdisciplinary approach to climate change, and expands upon the recent National Intelligence Council (NIC) report on water, *Global Water Security*,[2] to suggest roles for both the U.S. armed forces and civilian research communities.

Environmental Security and Climate Change

The U.S. military and the country's broader national security community have included some concept of "environmental security" as part of our country's overall security posture for the past two decades. Beginning with the 1997 National Security Strategy, "climate change" has been treated as a rather broad and general threat to the nation's security. In 2006, CNA's Center for Naval Analysis convened a Military Advisory Board of 11 retired three- and four-star flag officers to examine the national security implications of climate change. In 2007, CNA released the board's report, "National Security and the Threat of Climate Change," which coined the phrase "threat multiplier" to describe how climate change is expected to act upon instability in some of the most volatile regions of the world. The board identified that volatility is exacerbated by eroded economic and environmental conditions, reduced food availability, reduced access to clean water, increased disease, and increased migration associated with populations moving in search of resources. Consequently, the report goes on to predict that the United States will be called to respond more frequently to these situations; to provide stability before conditions decline or as a consequence of extremists; and to undertake stability operations and reconstruction efforts in post-conflict situations.[3] The report concluded with several recommendations to include the need to integrate fully the consequences of climate change into our national security and defense strategies.

National security actors in the United States have since included the discussion of global climate change in strategy and policy measures consistent with the board's recommendations. In 2007, Congress placed language in the National Defense Authorization Act that requires the military to consider effects of climate change on facilities, capabilities, and missions. In May 2010, the U.S. National Security Strategy included global climate change as a security issue: "The danger from climate change is real, urgent, and severe. The change wrought by a warming planet will lead to new conflicts over refugees and resources, new suffering from drought and famine, catastrophic natural disasters, and the degradation of land across the globe."[4]

Likewise, the Department of Defense (DOD) 2010 Quadrennial Defense Review (QDR) emphasized that climate change will have two broad outcomes, shaping "the operating environment, roles, and missions that we undertake" and having an impact on "our facilities and military capacities." The QDR continues, recognizing the need for a broad governmental response: "Working closely with relevant U.S. departments and agencies, DOD has undertaken environmental security cooperation initiatives with foreign militaries that represent a nonthreatening way of building trust, sharing best practices on installations management and operations, and developing response capacity."[5]

The challenge with integrating climate change hazards with military planning has been that "climate change" is at the same time too general a term of reference yet is also too limiting. Many popular conceptions of climate change suggest global warming of air temperature, while in reality, accumulation of greenhouse gases affects global heat balances, meaning changes to ocean temperatures, sea ice and ice sheets (cryosphere), precipitation patterns, and biogeochemical cycles such as those influencing ocean acidification. These systems are all interrelated with each other and with food and energy production systems, transportation networks, and infrastructure on which our societies currently depend. Although physical systems are critically important to environmental security, equally important are other environmental changes (whether natural or anthropogenic) and human responses. Comprehensive risk assessments need to take account of how environmental changes fit together, in terms of both cascading impacts and appropriate response.[6] For example, sea-level rise of 20 cm may not appear to be a substantial risk to military facilities on its own, but it may have a significant amplifying effect on tropical storm surge risks, which in turn can overwhelm coastal energy infrastructure and spark cascading impacts on economic and energy security.

Water Security—Regional Complexities

A recent example of a comprehensive risk assessment is the report produced by Office of the Director of National Intelligence, "Global Water Security."[7] This report was requested by the Department of State to address the question: "How will water problems (shortages, poor water quality, or floods) impact U.S. national security interests over the next 30 years?" A key conclusion of the report is that water scarcity, mismanagement, and other water-related challenges around the globe are likely to hinder U.S. security interests in the near to mid timeframe. Water stress is seen as one of many factors (including poverty and

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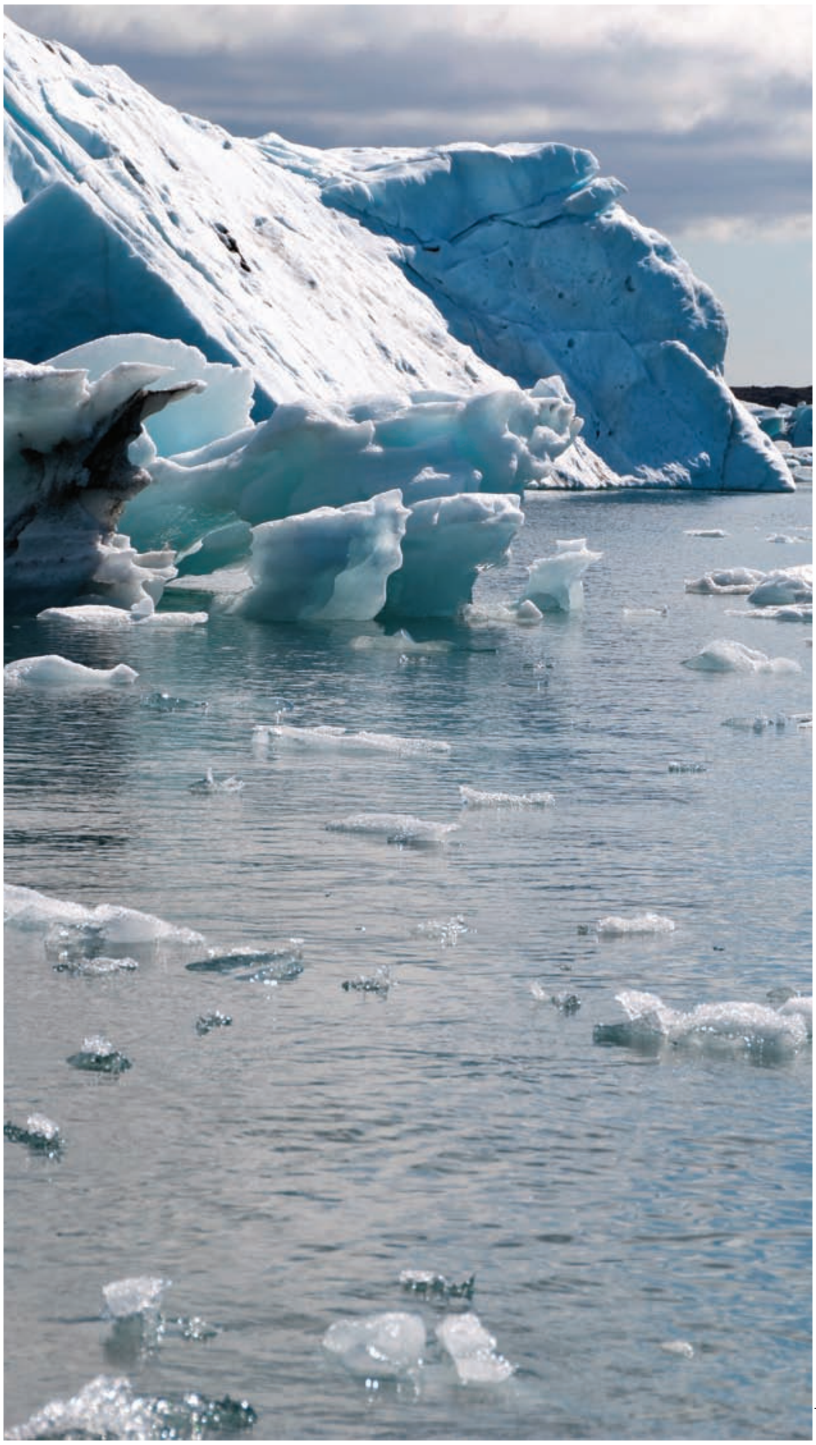
Global climate change will lead to new conflicts over refugees and resources, new suffering from drought and famine, catastrophic natural disasters, and the degradation of land across the globe.

weak political institutions) that could contribute to social tension. The report discusses water as a potential "Driver for Peace" (p. 4) more than as an indicator of conflict. Indeed, empirical cases of conflict between states directly over water supplies are historically rare.[8] The NIC report goes on to anticipate that drinking-water quality in economically developing countries (and, arguably, in wealthier countries as well) is expected to decrease from "salt water intrusion and industrial, biofuel, agricultural, and sanitation processes" (p. 3). The report concludes that, through 2040, the best solutions to water problems are expected to be found in improved management strategies such as pricing, allocation decisions, and addressing international trade in "virtual water"—"water consumed in the manufacturing or growing of an export product" (p. 12).

The complexity of how water interfaces with the strategic environment is perhaps best exemplified by its role in potential conflict between China and downstream neighbors, particularly India. Although water is not itself a cause of conflict, in this case the Chinese drive for water security may spark a series of actions that others may interpret as threats even while inside China they may be technical responses to very real risks. Large amounts of water are needed by the Chinese not only for food and industrial production, but also for guaranteeing energy extraction, transport, and production. While many of its largest cities exist on the coast or the northeast, its large energy reserves are often located far in the interior north and northwest, while the water resources of Tibet lie to the southwest. Since Mao's time, the Chinese government has fostered Soviet-era practices of development through large, supply-side projects to transport energy and water to its industrial cities. The largest of these is the South–North Transfer Project, designed to divert water from the Yangtze River basin north to the Yellow River. The project will finish construction in 2013.

Given the enormous demographic pressures of urban migration in China, the drive to provide sustained economic growth based on manufacturing, and the immense energy demands of the country, this one project will not be sufficient to provide adequate water for China's growing economy. Plans are in place to divert water from Tibetan rivers to the north, collectively known as the "grand western canal," damming and diverting the powerful Yarlung-Tsangpo River. The dam would provide 30 GW of hydropower (by comparison, Hoover Dam produces about one-tenth that amount), while the water diverted would provide irrigation and coolant water for central China and the Yangtze River basin. Sustained droughts in China would heighten this need for water. The regional security difficulty lies not only in Tibetan politics, but in the fact that the Yarlung-Tsangpo becomes the Brahmaputra once it crosses into India in Arunachal Pradesh, a territory disputed by India and China and heavily militarized. Diversions affecting the Brahmaputra would imperil India's own water security, including hydropower and irrigation projects, and would have further impacts downstream in Bangladesh. Although China may see its water projects as increasing its own security,



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Melting glacial icebergs in Jokulsarlon, Iceland.

India and Bangladesh view the Chinese actions as a direct threat to their national security. Specifically, China's actions have the potential to increase the risk of water-related population stresses, cross-border tension, and migration and agricultural failures for perhaps a billion people in India and Bangladesh, and its actions may be interpreted as a security threat by India, which already struggles with energy and water supplies. Absent an international framework for cooperation on such riparian issues (and none exists between India and China), the spillover security risks to U.S. interests are significant.

Water Security—Synergistic Complexities

Water's role in food and energy production, ecosystem health, livelihoods, and sanitation cannot be overstated. Perhaps more so than many other resources, water is multifaceted in its links to energy, food, and other systems of strategic concern. As already mentioned, the security concerns linked to water are neither traditional conflicts over scarce resources, nor merely humanitarian assistance and disaster responses (HA/DR) following a flood. Rather, water is crucially important because it underlies many of the complex systems upon which stability relies. Environmental, economic, political, energy, and social systems are complex in that they form a whole greater than the sum of their respective parts. A system interacts in the form of various networks, be they food chains, economic relations, infrastructure, and so on, and its health relies on its ability to withstand external pressures and losses within the system. Some scale-free networks like the Internet are designed and have grown to be highly resilient to random failures, while other networks are centralized and can be easily disrupted by disabling critical nodes. Water cuts across most complex systems, and supports basic needs such as food and energy. Droughts such as in the United States in 2012 not only affect food production, but hamper energy production from coolant water and hinder transport on rivers such as the Mississippi. Water also has the potential to overwhelm systems, as illustrated by Hurricane Katrina in 2005 or the Japanese tsunami in 2011. In extreme cases, such as global sea-level rise, entire countries in the South Pacific and Indian Ocean are at risk of disappearing.

The complexity of water is also evident in the way it interacts with tipping points, feedback effects, and cascading impacts. A marginal change in a complex system can shift its macrobehavior in a nonlinear fashion, amplifying the effects of what might otherwise appear to be a minor risk. Climate tipping points can easily shift a region from monsoon to drought without much warning, reflecting instability in weather patterns. Precipitation need only shift by 5–10% from average to create drought or flood conditions, and once, for example, a drought is started, it creates positive feedback effects that make rain less likely. These changes in water can also trigger cascading impacts, where an impact is amplified and spread throughout multiple systems.[9] The loss of a backup diesel generator at the Fukushima Daiichi plant in Japan after the 2011 tsunami not only set off a chain of events at the nuclear plant, but affected food systems, transport, and energy markets as far away as Europe. In Central Asia, a minor loss of snowpack resulted in loss of power capacity at the Toktogul Reservoir, requiring economic trade-offs between energy and food that severely impacted both the economy and the government of Kyrgyzstan.[10] More recently, a late-onset monsoon in India was blamed for over demand of electricity that resulted in a blackout affecting one-tenth the world's population.[11]

Given the complexities of global systems and their vulnerabilities to environment-related tipping points and loss of critical nodes, understanding the role and importance of water in maintaining security becomes a significant priority to the national security actors. Many systems rely on predictable delivery of water, and too much or too little at the wrong time can spell catastrophe for agriculture, power, transport, or other critical systems linked around the globe. The loss of underlying stability can quickly become a prime concern for the U.S. military, whether in responding to the Japanese tsunami (Operation Tomodachi) and Thailand floods in 2011, or when spikes in food prices contributed to instability in North Africa and the Middle East in the Arab Spring.[12] Yet providing adequate foresight for these complex interactions is highly challenging. Determining potential future impacts of climate change, for example, requires knowledge not only of climate and weather systems but also of particular geographical, cultural, and socioeconomic factors that make environmental hazards unique to each region and community.

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China's water projects would likely be interpreted as a security threat by India, which already struggles with energy and water supplies.

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China's South-North Transfer Project, which will divert water from the Yangtze River basin north to the Yellow River, is slated for completion this year.

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Droughts such as in the United States in 2012 not only affect food production, but hamper energy production from coolant water and hinder transport on rivers such as the Mississippi.

Military/Academic Interface on Water Security

Providing environmental security foresight for the U.S. government requires expanded efforts at scientific translation and human intelligence. In her response to the National Intelligence Estimate, Secretary of State Clinton identified the same in her outline of steps to address the challenges of water security. Her recommendations included the need to encourage science and technology developments to share and distribute U.S. expertise and to develop partnerships to exchange knowledge, data, resources, and regional expertise regarding water and water systems. A few examples of such partnerships are considered in this section to demonstrate how collaborative efforts can help to advance an understanding of and proactive stance toward water-related issues and environmental security.

One attempt to bridge the divide between military/intelligence and civilian academic efforts has been the

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Tsunami flooding on the Sendai Airport runway in Japan, in 2011.

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The hydroelectric station at the end of the Toqtogul Reservoir where a loss of power capacity required economic tradeoffs between energy and food that severely impacted both the economy and the government of Kyrgyzstan.

various incarnations of the Department of Defense Minerva Initiative projects. Started in 2007 by Secretary of Defense Gates, Minerva was intended to "improve DoD's basic understanding of the social, cultural, behavioral, and political forces that shape regions of the world of strategic importance to the U.S."[13] The University of Texas at Austin has focused on climate change and security in Africa, a University of California, San Diego (UCSD), project has examined the role of technological innovation in China, and new projects will research the role of food security (Duke University) and energy security (University of Vermont).[14] A 2-year project team attached to the U.S. Air Force (USAF) service colleges at Air University (AU) was tasked with the more applied goal of translating scientific data from energy and environmental security into planning tools for USAF, DOD combatant commands, and NATO, importing earlier work from the U.S. Department of Energy (DOE) Energy and Environmental Security Directorate.

The AU Minerva team, which largely focused on emerging risks in the NATO region and U.S. Pacific Command (PACOM) area, had to balance the relatively conservative methodologies of scientific projections, with energy and environmental security scenarios that often exhibited extreme conditions far outside the average. The primary goal was to help identify critical nodes in complex systems, from air operations to energy infrastructure, and provide risk assessments of how such energy and environmental risks might impact strategy or operational readiness.[15] One lesson from the project was that simple changes can have complex consequences, a reflection on the highly vulnerable nature of many security-related systems. The team, for example, collaborated with NASA/Jet Propulsion Labs to create a war-game insert of a volcanic eruption in the Aleutian Islands off Alaska, which in practice highly complicated transpolar flights between North America and Asia during potential crises.[16]

The role of water was central to AU Minerva's strategic assessments. Critical to the proper functioning of systems from energy production to agriculture,

transportation, and ecosystems, water was often the central medium for risk assessments of security and stability. Rather than focus on linear trends or expected risks, a focus on water (and its connection to energy) allows planning for "wild cards" or complex risks, where security is threatened by unique combinations of environmental changes and far-reaching impacts.[17] The connections between extreme heat/drought in Russia in the summer of 2010 and the subsequent Arab Spring revolts in late 2010 are an example of where changes in one system (in this case, water/moisture for food production) may contribute to existing instability in a far different geographical region.[18] Conversely, water also provides a potential pathway for cooperation among states, particularly through Phase 0 disaster response planning, a model used by PACOM in its efforts since at least 1997.[19] However, there is increasing need to identify the changing nature of environmental and disaster risks, rather than assume that the United States and its allies will have to respond to the same types and degrees of hazards that have existed in the past. Emerging data from the civilian scientific communities are critical to such efforts.

Another example of work being done to build research partnerships with tangible outcomes related to water issues is demonstrated by the Societal Dimensions Working Group of the National Center for Atmospheric Research.[20] The goal of the group is to advance understanding of human–environment interactions with a specific focus on the Community Earth System Model (CESM). The group is interested in relating the model and climate data to real-world societal issues. One subset of the group concentrates on water and how this climate model is or could be more useful to researchers and practitioners working on water issues in climate mitigation and adaptation. Part of the effort aims to improve understanding of hydrologic impacts of climate change and thereby improve the climate and hydrologic modeling. There is also a need for usable data, that is, data with a scale of uncertainty that allows the data to be integrated into planning for, for example, public utilities. The working group aims to build networks of academic researchers across all disciplines who are interested in water issues and connect them to specific projects and policy contexts that could benefit from thoughtful integration of climate models.

There is increasing need to identify the changing nature of environmental and disaster risks, rather than assume that the United States and its allies will have to respond to the same types and degrees of hazards that have existed in the past.

One example of getting climate and weather data into the hands of practitioners and decision makers—especially in the military—is the so-called "Pirate Performance Surface."[21] Here, climate models and weather forecasts are used to assess ocean conditions off the coast of Somalia. When the seas will be particularly rough for sailing, the U.S. Navy dispatches its ships elsewhere. However, when the seas offer good sailing conditions for pirate boats, the U.S. Navy reinforces measures to patrol the area. The Societal Dimensions Working Group aims to integrate climate model information into a wide range of practical contexts to improve the scientific basis for human action.

A final example of an effort to bring military and civilian efforts together draws attention to advanced civilian education opportunities within the military. The future general officers who will make tomorrow's efforts strategic and operational are today's captains and lieutenants. Because our military will continue to be the first to respond to any complex international crisis, our military leaders must have the intellectual education to confront the challenges of projecting hard military power in an operational environment that often demands "soft" power application. Such an education requires an understanding of political geography, regional economy, and different cultures. Academic leaders within each armed service's Professional Military Education (PME) command have established curricula to achieve the educational objectives at the tactical, operational, and strategic levels. The armed services' academies, command and staff colleges, and top level school universities are highly regarded for their processes that ensure an officer's leadership development. Civilian graduate schools offer a unique complement to the services' PME resident courses. For example, the University of Kansas and the U.S. Army's Command and General Staff College have collaborated to develop an International Studies Program to train Special Forces officers in interagency operations and in cross-cultural, multidisciplinary studies. This graduate-level program is in addition to the intermediate-level education programming at Ft. Leavenworth. It contributes to officer learning outside of the military education system and aims to broaden

officers' understanding of complex contexts in which they will be serving at the completion of their graduate work.

The Command and General Staff College and the University of Kansas also collaborated in hosting in April 2012 a conference, "Environmental Security: Academic and Military Perspectives," that was funded by a grant through the Army Research Office. The objective was to foster conversations between academic researchers and military experts on the multidimensional and escalating issue of environmental security. The topic is of concern both to academics and to military groups, but rarely is there a concentrated effort to engage in conversation between these groups to focus the energies of their different perspectives. The conference schedule included a panel of environmental specialists from regional U.S. Combatant Commands who provided a "boots on the ground" perspective of environmental issues and challenges in their areas, a panel of international military and environmental experts who provided non-U.S. views on environmental security, and a panel of experts who discussed definitions of security and risk from academic and policy perspectives. There were also several paper sessions in which researchers from physical, technical, and social sciences presented their work. One issue that the conference participants agreed on is that there is no single, overarching definition of environmental security that may be used to guide military action or prioritize academic research. Instead, it was recognized that environmental security encompasses a broad range of issues at multiple, simultaneous, and overlapping spatial scales.[22]

A recurring topic throughout the conference was water. Concerns about water capture "hard" security and human security issues ranging from water scarcity, shared transboundary resource flows, sanitation and health, agricultural productivity and food supply, economic productivity and energy development, and vulnerability in the face of floods, droughts, and increasingly unpredictable weather and climate patterns. These conversations bode well for continued communication among conference participants and their organizations. Academic researchers can help military organizations in their thinking about water, in their ability to work with uncertainty, and in shaping improved military policies and implementation practices.

The conference participants agreed that there is no single, overarching definition of environmental security that may be used to guide military action or prioritize academic research.

Where Do We Go From Here?

From a military perspective, environmental security issues emerge in different dimensions. There are concerns at the forward operating base level about procedures to address the military's ecological "bootprint." There are disaster management issues in which environmental aspects may be but one vector of concern in addition to social instability and emergency relief needs. There are needs to coordinate efforts between and among states and between military and local peace building efforts regarding issues that may have environmental aspects (e.g., water management, invasive species mobility, etc.). There are needs for data to support military decision making. For instance, surface water maps do not indicate water quality, and this information may be critical in some instances. There is also a need for interagency training to support coordination of efforts among government and military agencies. Any of these issues would also have to recognize both strategic (longer term) and tactical (immediate) views of environmental features.

From an academic view, the issue of environmental security is no less straightforward. We are living in increasingly artificial environments, so security is not just a term applied to military concerns but also to urban planning, international trade, agricultural practices, and patterns of consumption—all of which are issues of interest to academics. It is important to study specific examples of resilience, criticalities, and connections of processes with an understanding that state-centric or human-centric views of security will point to different policy objectives and research priorities. The topic of environmental security also raises questions about what or who is driving policy priorities and how science is (mis)communicated to policymakers. Of course there is no singular "military" or "academic" view, since each arena involves multiple and diverse perspectives. This diversity in itself is a strength in the effort of building a whole-government approach to environment-related concerns.

Security is a civilian concern with multiple, environment-related dimensions. The military role in security tends to become evident in times of crisis or disaster management, and it is usually reactive. However, a meaningful way forward would be to draw upon the

diverse views, skill sets, and experience across academic and military groups to identify a full range of scenarios for planning, training, and research purposes. Bringing military and academic groups together, not to mention nongovernmental organizations, could support efforts of scenario development. Scenarios build from existing baselines of military and academic understanding to assist in envisioning beyond what has been done before. Scenario development could guide research toward a particular end such as data collection or knowledge generation about specific human–environment dynamics.

A traditional military focus is on identifying threats, and threats imply intentionality. Environmental aspects of security, however, are not necessarily intentional, but they raise different concerns for risk and uncertainty. Academic and military groups could also work together to address issues of risk and uncertainty in ways that reflect and extend the research capacities of academic disciplines and that advance military readiness and understanding of risk.

We have moved beyond the historical notion that climate change and the related increased demand for limited resources are a primary driver toward regional conflict. Complex risk assessments must take into account the multidimensional and interdisciplinary nature of the strategic environment. Providing adequate resources for these complex assessments requires knowledge not only of climate and weather systems, but of particular geographical, cultural, and socioeconomic factors that make environmental hazards unique to each region and community. It is in this nexus that expanded efforts between the academic research community and the U.S. armed forces should be expending their energy. Indeed, the interdisciplinary nature of "environmental security" demands a comprehensive approach that draws on the strengths of civilian education to educate future strategic leaders.

Shannon O'Lear is an Associate Professor, Department of Geography and Environmental Studies Program, University of Kansas. **Chad M. Briggs** is a Strategy Director and principal consultant at Global Interconnections LLC (GlobalInt) in Washington, D.C. **G. Michael Denning** is Director, Graduate Military Programs, University of Kansas.

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