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Global Resource Security

Scanning the Horizon on Food, Water, Energy, and the Environment – An Experts' Workshop Summary

On Thursday, October 1, 2009, the CSIS Global Strategy Institute and Sandia National Laboratories convened leading thinkers from the policy, modeling, and analytical realms for a discussion of resource scarcity and the impact on the environment and stability/security. Overall, participants concluded that further research is needed to better understand the linkages across food, water, and energy systems; our response to the resource conundrum must be long-term and integrated across sectors to address systemic risks and root causes at the global level.

Defining Geopolitical Implications of the Resource Conundrum

During the first session of the workshop, participants identified the state of resource scarcity globally, analyzed its broad-ranging impacts, and suggested new ways to address these complex problems.

The profound geopolitical importance of resource scarcity was a core element of the morning discussion. As China's strategic quest to secure energy and agriculture supplies illustrates, a nation's stability and prosperity can depend heavily on its access to and control over resources. Therefore it would be beneficial to expand the definition of national security, which traditionally has been confined to defense, to incorporate resource challenges.

The causes, impacts, and solutions to resource scarcities fall into the realms of governance, demographics, social structure, and economics. For example, the recent drought and famine in the Horn of Africa – the worst since 2000 – has reversed the area's economic and social development. The decrease in the water level in the Krishna basin of India, which is shared between three states, has both reduced the energy output from hydropower and forced agriculture to relocate. Tensions among competing consumers have risen alongside resource dislocations, such as between the agricultural and industrial sectors using water in the arid country of Jordan. A critical question links these diverse experiences of resource scarcity: Will mounting shortages lead to conflict, or cooperation?

The resource conundrum is poorly understood despite its importance to global stability and security. Workshop participants agreed that the limited data available relies on significant assumptions and that we should be cautious against overstating what is known. Furthermore, decisionmakers have not yet had access to the actionable information they need to inform policy because practitioners and scientists have not yet sufficiently illuminated long-term trends nor distilled exceedingly complex issues. In particular, the linkages between resource scarcities and related social/economic fields must be quantified and made more explicit. How, for example, does regional stability relate to access to resources, especially in fragile states? What is the feedback mechanism between ecosystem decline and conflict? What are the tradeoffs to interventions that aim to ease resource scarcity – like tapping groundwater in northeast India to meet food needs? To what extent are these relationships dynamic rather than fixed? What is the role of trade in mitigating regional scarcities?

The theme of resilience emerged repeatedly throughout the workshop. Participants agreed that resilience must be better understood and incorporated across the board, from trade systems to climate adaptation programs.

The group highlighted weaknesses in the capacity of institutions – across the public, private, and independent sectors – to answer crucial questions about resource scarcity. To adequately address resource challenges, institutions must manage complexity, adopt a long-term orientation, and tackle contentious issues directly. Resource scarcities should be considered as a confluence of many systems – environmental, social, political, and technical – addressed in an accordingly integrated and comprehensive manner that avoids reductionism.

However, there exists a major shortage of "boundary" people or institutions that can bridge disciplines and synthesize the disparate elements of these issues. Whether in academia, the public sector, NGOs, or the private sector, most experts remain within the narrow confines of their specialty.

The structure of the United States government, in particular, is poorly suited for thinking and acting in integrated terms and understanding complex tradeoffs. This begs the question: If resource scarcity were to be comprehensively addressed, how would this change U.S. foreign assistance and other mechanisms of global engagement?

New Security Challenges:
Redefining the 'What' & Reinventing the 'How'

The scarcity of food, water, and energy has the potential to abruptly and catastrophically impact the security of every nation. However, traditional security frameworks are not equipped to cope with global challenges like resource scarcity that increasingly cross over geographic, disciplinary, and institutional boundaries. Because risks relating to resource scarcity are systemic and non-linear, they become invisible when pieces of the larger system are analyzed discretely. While there is a great deal of information on food, water, and energy respectively, only scant data is available on the connections between them. The high degree of specialization that is prevalent in both the public and private sectors is partially responsible for this void, and hinders comprehension of this issue.

New approaches to acquiring and using information are therefore required. Information that is gathered from multiple inputs is preferable rather than accumulating data in a single, deterministic model. Furthermore, it is imperative that we use "collective intelligence," whereby we synthesize and derive meaning from information rather than merely collecting it.

Adaptive knowledge "ecosystems" that connect knowledge from multiple areas in response to these systemic and interdependent issues can thus complement existing security frameworks. One example of this approach can be found at the U.S. Department of Energy's Global Energy & Environment Strategic Ecosystem (www.globaleese.org). This effort is an international partnership in which participants contribute by factoring risks and uncertainties into assessments of global energy and environment challenges.

Methodologies: Approaches to Quantifying Trends in Food, Water, Energy, and the Environment

The afternoon session centered on the application of technology to fill significant research and policy gaps in this arena. Participants agreed that modeling can serve an important role in policymaking regarding resource scarcities. Models and satellite data can present complicated issues in more easily comprehensible formats and therefore assist decisionmakers in evaluating policy options. However, decisionmakers have underutilized modeling tools because they have been unfamiliar with the potential of the models and usually lack the technical capacity to interface with them.

Moreover, modeling is not fully compatible with the demands of decisionmakers. Oftentimes, models need to be simple enough to resolve a query within several hours, but most are too computationally intensive and cumbersome to serve this end. Furthermore, models rarely link or "talk to each other" enough, and data thus remains locked within disciplines.

Despite these challenges, panelists representing a range of institutions in the public and private sector highlighted tools that have successfully quantified trends in food, water, energy, and the environment. Tetra Tech has advanced modeling capacities that can directly inform watershed management and water treatment as they spatially and temporally quantify surface water processes. The models offer high utility in the overlap of water with food and energy. For example, the landscape models can determine whether crops are susceptible to floods and if water supplies are sufficient for hydropower generation. McKinsey, another player in the private sector, has modeled the nexus between water management and economics by developing a "cost curve" of water that shows efficiency of various water interventions by type and cost.

Participants also discussed Computable General Equilibrium Modeling, a tool that the World Bank utilizes to model numerous interactions in the global economy, such as for analyzing the impact of removing tariffs on a commodity's production and price. Although comprehensive in relation to the economy, this model has significant limitations in incorporating resource constraints; climate and demographics are absent from the model, resources that are included do not reflect availability constraints, and software issues prevent linking with non-economic models.

The importance of high-quality data surfaced as a common theme throughout the panel's deliberations. The satellite-based capabilities of NASA offer several innovations in this area. They enable observation and modeling of resources, which has been used to forecast crop yields in order to inform humanitarian responses and identify major depletions of groundwater in India.

The United States National Laboratories also possess strong capacities in the modeling realm. For example, Sandia National Laboratories created a Tigris - Euphrates water modeling tool, which was developed and used by the Iraqi government to predict the potential impacts of upstream reservoir construction. Oak Ridge National Laboratories has used its vast computing capacities to simulate and predict the effects of global climate change, such as timing, location, severity, and effects on people, habitat, and infrastructure. Although scientists recognized that there are uncertainties in climate change science, progress can be achieved by using (and improving) high performance computing and by conducting experiments/observations to fill knowledge gaps.