EXPLORING COMPLEX NETWORKS OF WATER VULNERABILITY IN AFRICA

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The issue of water vulnerability in Sub-Saharan Africa is of critical importance. Current research on Sub-Saharan Africa highlights water access, supply, and cleanliness as central components to state stability, the promotion of peace and human rights, and African economic development. However, despite both the centrality and complexity of water-related problems, fundamental interdisciplinary research remains minimal. This project addresses the need for interdisciplinary and multilevel research through applied case studies in the Rift Valleys of Uganda, Ethiopia and Malawi using spatially relevant analysis, archival research and field studies to address the complex factors that trigger or exacerbate water vulnerabilities. Using an innovative methodology, this research team balances geographic, social, historic, and legal aspects of water-related instability with multilevel interviews of experts in the region to transcend typical unimodal and linear investigations. Research includes watersheds, resource management, and conservation from national, transnational and international perspectives. This comprehensive approach will have the complimentary success in addressing a specific vulnerable region in Sub-Saharan Africa as well as providing a template for the continued comparative analysis of water insecurity in other parts of Africa and beyond.

Overarching Research Goals

- Examine the connection between the environment (water, resources, and climate) and stability.
- Demonstrate the need for multilevel analysis of environmental stress and resilience.
- Apply innovative methodologies that account for anthropogenic and natural environmental processes and recognize ethno-cultural, economic, legal, historical and political issues underlying regional instability.
- Develop an interdisciplinary framework that can be employed to study human-environmental interaction and stability in any geographic location.

Specific Goals

Through applied case studies in Uganda, Ethiopia and Malawi, the interdisciplinary faculty and cadet team at West Point will:

- Examine the nexus of livelihoods, development and health with water, climate and the environment.
- Investigate activities that promote resilience and strengthen the adaptive capacity of local populations and environments in rift valley ecosystems.
- Employ a multiple-methods approach to understand how regional environmental pressures may influence stability.
- Use innovative maps and localized variables of livelihoods, health, land use, and the environment to determine causal mechanisms of household-level vulnerability in three separate case study countries.

Uganda Trip Summary

From July 18 to August 2, 2013, Dr. Amy Krakowka and Major Dylan Malcomb of the Department of Geography and Environmental Engineering, traveled to Uganda with four cadets (James Link, Ethan Kindley, Kyle Okular and Tyler Tingstrom) to conduct interdisciplinary research for the Water and Environmental Security in Africa project. This research consisted of semi-structured interviews with international organizations, non-governmental organizations (NGOs), leading academic institutions and government representatives at the national and district. These interviews were focused on: (1) water vulnerability in Uganda's historical and contemporary context; (2) environmental, political and legal issues related to water access, quality and sanitation; and (3) capacity and coordination challenges associated with Uganda's polycentric response to environmental and water issues.

Initial Findings from Uganda

The complex nature of water vulnerability in Uganda remains an issue of critical importance for both human and environmental stability. Water vulnerability was consistently highlighted during interviews as a major concern in all communities that include urban, peri-urban (peripheral urban communities), and rural settings. Our team identified several connections between humans and their environmental that highlight the importance of appropriately scaled research. Looking at vulnerability from a continental or regional perspective, which is often the norm in academic research, tends to focus on issues that a country may face. It can identify regions that have large-scale vulnerabilities, such as unstable governments, drought, reduced agricultural yields etc. However, this macro-level analysis fails to elucidate the causal mechanisms that drive instability at a local and household level.
If viewing Uganda from a regional perspective, it would be easy to conclude that the areas in the North, which are arid, contain the most water vulnerable populations. While it is true that access to consistent water is a significant issue for the people of Northern Uganda, they are not the only people in Uganda experiencing water vulnerability. Using an interdisciplinary and local scale approach, it becomes apparent that one can experience water vulnerability living next to large bodies of water or in humid climates. For example, agrarian populations next to the Nile could not use the river to irrigate their crops. This source of water could have been particularly useful this past year because Uganda was experiencing a prolonged dry season. The restrictions on the use of the water in the Nile are enforced by Egypt and treaties established during the colonial rule, this is an example how macro-politics influences micro-vulnerability.

Perhaps the most water vulnerable people are those living in outside of Kampala in rapidly growing peri-urban environments. The fast growth of these areas coupled with the complete lack of infrastructure to include sanitation, roads and electricity, make supplying clean water an almost impossible task. Compounding this problem is that the majority of these unplanned developments occur in wetlands, which not only significantly degrades water sources by eliminating the wetlands natural filtration systems, but also makes these developments prone to flooding. A common practice in the peri-urban areas around Kampala is to place waste in plastic bags and toss them somewhere else, significantly contributing to the degradation of water quality. In both urban and rural settings, Ugandans dispose of waste by burning it or dumping it into unlined landfills. Various organizations run by foreign nations attempt to provide resources such as knowledge on sanitary practices; however, population density and growth in urban environments are growing beyond government and NGO capabilities. The wetlands are being rapidly destroyed by the encroachment of humans and their untreated sewage Informal settlements have polluted every wetland and spring surrounding Kampala and removing what was once its primary water source.

Other examples of water vulnerability again come from groups of people that live near water. On the shores of Lake Edward in Katwe, without the construction of expensive cages, the task of filling up a jerry can with water becomes extremely dangerous because of the very real threat of getting attacked by crocodiles or even hippos. Lake Victoria is an important source of water for three countries that has led to rapid and recent population growth. It is now a contested and polluted resource that requires concerted international cooperation and management.
There are three countries, all with different environmental laws and practices sharing lake Victoria and the level of pollution are significant. Lake Victoria is the second largest fresh water lake in the world and is the source region for the White Nile and the Katonga River. The Lake supports Africa's largest inland fishery.

In rural areas of Uganda, agriculture remains the primary occupation; however, only one to two percent of Ugandan farmers have irrigation systems. Consequently crops are irrigated primarily by rainfall. Climate variability complicates when farmers decide to plant their seeds resulting in districts such as Kamwenge in the west of Uganda having crop yield reduced by 70 percent.

Not only does a micro scale approach highlight specific locations of water vulnerability, it also can identify the individuals. For example, the primary task of getting water is usually the responsibility of women and children. The ease of access to water can drastically change their daily routine and has the potential to free up significant amounts of time. This time can be used for entrepreneurial endeavors, which ultimately creates greater resilience.

Key Conclusions:

- Water vulnerability is not Just an issue of water quantity, precipitation or climate. People living right next to large bodies of water can be water vulnerable. This finding strongly suggests that a traditional approach of building more wells only solves part of the problem.
- An interdisciplinary approach is paramount to understanding all of the nuances of water vulnerability.
- An interdisciplinary and scalar analysis of vulnerability is crucial to understanding processes that occur at multiple socio-environmental levels.