



## Household vulnerability mapping in Africa's Rift Valley



Amy Krakowka Richmond<sup>\*</sup>, Dylan Malcomb, Kristine Ringler

Department of Geography and Environmental Engineering, United States Military Academy, USA

### ARTICLE INFO

#### Article history:

Received 19 May 2015  
 Received in revised form  
 20 July 2015  
 Accepted 21 July 2015  
 Available online xxx

#### Keywords:

Vulnerability  
 Geospatial modeling  
 East Africa  
 Field work

### ABSTRACT

This study develops an interdisciplinary framework to investigate the relationship between environmental processes and human wellbeing that can be adapted to any geographic location. Based on the use and availability of open-source data, the methodology advanced in this research has the capacity to examine household-level drivers of vulnerability that are rarely accounted for in regional and global indices. A household level vulnerability analysis is conducted for four countries – Malawi, Uganda, Rwanda, and Ethiopia. This research seeks to develop a vulnerability model that can be both applied to vulnerable countries in the East African Rift and offer insight into internal dynamic processes and drivers of vulnerability. The enhanced methodology presented in this paper can assist stakeholders and policy-makers in determining what drives vulnerability at a household level, where vulnerable populations are, and suggest what type of aid to target specific locations to be of greatest benefit.

Published by Elsevier Ltd.

### 1. Introduction

Over the past three years our team conducted nearly a hundred semi-structured interviews in four East African countries. When we talked to the head agricultural officer in the Chikwawa district of Malawi, he explained that household vulnerability is most pronounced in this southern portion of the country as a result of a series of droughts and dry spells that began in 2005. Here the average household cannot sustain its food beyond nine months per year and most require food aid. In the Mulanje district of Malawi, the forestry officer speaks of rampant deforestation destroying the landscape and how small household plot sizes surrounding the tea plantations are not meeting the needs of a rapidly growing population. In Uganda, one development organization we interviewed stated that the population explosion is the driving factor behind the overuse of resources, water pollution and air pollution. Uganda presently has a total fertility rate of 5.86 and one of the youngest (average age) populations in the world. In Ethiopia our discussions often turn to issues of how to get water to thirsty people and increasing agricultural production, and in Rwanda, interviews could rarely escape the effects of population density on constrained resources. These stories are common throughout the African landscape. Each of these experts provided our research team with passionate and valuable insight on the drivers and unique character

of vulnerability within their respective countries and regions. Experts within each of these countries have unique stories to tell that highlight the unique drivers of vulnerability; the lesson for key decision-makers to listen.

Despite the complex socioeconomic and environmental challenges experienced by households at a local level, vulnerability analysis has become a crowded field of analysis, most often using generic quantitative methods to explain such challenges. Most recently, it has become a popular initiative for researchers and organizations to determine – at a continental or global scale – where humans and environments are most exposed to environmental and climatic changes (Brooks & Adger, 2003; Busby, White, & Smith, 2010). It has been argued that vulnerability analysis can be used to allocate resources (Eriksen & Kelley, 2007) or prioritize international development assistance (Füssel, 2010). In some cases, maps can monitor the progress in reducing vulnerability over time (Busby et al., 2010; Füssel, 2010), although few studies have demonstrated temporal scale. Academically, models seek to identify the causal processes that enhance vulnerability and further explain attributes of vulnerable systems (Kelley & Adger, 2000). However, even these studies rarely account for the subjects or stakeholders of research (notable exceptions in the field are Adger and Kelly (1999), Schroter et al. (2005), Polsky, Neff, and Yarnal (2007)). In the end, maps claiming to be policy-relevant rank countries based on generic and barely sub-national metrics of vulnerability. Are such global assessments really beneficial to the localized organizations and agencies charged with funding and

<sup>\*</sup> Corresponding author. 745 Brewerton Ave, West Point, NY, 10996, USA.  
 E-mail address: [amy.krakowka@usma.edu](mailto:amy.krakowka@usma.edu) (A.K. Richmond).

helping vulnerable people?

Few organizations in our interviews admitted that vulnerability maps were a factor in their decision-making. When we asked experts how vulnerability in their country compared with other states in the region, their answers and enthusiasm often fell silent. After nearly a hundred interviews in four countries, few experts spoke of vulnerability at a scale beyond their district or country. As such, we sought in this study to create an applied methodology that was useful to those organizations tasked with identifying and helping vulnerable people. This research seeks to develop a vulnerability model that can identify vulnerable populations in the East African Rift Valley (Malawi, Uganda, Rwanda and Ethiopia), and offer insight into internal dynamic processes and drivers of vulnerability. While these four countries share similar environmental processes (Fig. 1), the ethno-cultural, economic, legal, historical and political issues underlying human wellbeing in each country is unique. This research uses a socioecological framework to study the relationship between environmental processes and human wellbeing that can be adapted to any geographic location. The methodology advanced in this research has the ability to examine household-level drivers of vulnerability that are rarely accounted for in regional and global indices. As such, our research question is: how can vulnerability of a socio-environmental system (regardless of scale) be determined and communicated effectively using GIS modeling.

## 2. Framework

As Bankoff, Freks and Hilhorst highlight in their 2004 book on mapping vulnerability, determining what makes people vulnerable is a question that is curiously as simple as it is complex. Vulnerability –like happiness–is dynamic and changes based on time and geographic scale. This research considers vulnerability – a human state that limits wellbeing – as it relates to environmental stress. However, environmental stress – in turn – is significantly influenced by socioeconomic variables. This human–environment interaction can be exacerbated by population pressure, resource shortages, environmental change, and natural hazards. Evidence suggests that this trend will persist because environmental change will continue to stress marginal environments, especially in places with weak governance, making clear the relationship between vulnerability and environmental factors (Butts, 1994; Homer-Dixon & Levy, 1995; Wisner & Luce, 1993). Non-sustainable environmental practices, migration, and resource shortages, all elements common in developing states, may further de-stabilize states with weak governance (Gleditsch, Nordås, & Salehyan, 2007; Schwartz & Randall, 2003). Pervasive political instability and a lack of government control generally means that these states characteristically lack effective institutions and the financial and material resources to mitigate the effects of non-sustainable practices that degrade the environment or safeguard the population from the effects of environmental stress. They are more vulnerable to the consequences of environmental stress and typically suffer from four causally related social effects: 1) reduced agricultural production; 2) economic decline; 3) population displacement; and 4) civil disruption (Galgano & Krakowka, 2010; Homer-Dixon, 1999). This raises the complexity of the problems faced by external governmental and non-governmental relief agencies as they try to develop relief plans (Krakowka, Heimel, & Galgano, 2012). Unstable conditions at the household level, such as land tenure issues, exacerbate and are exacerbated by weak governance. These local level challenges are often not addressed in larger scale policy as is pointed out by Smucker et al. (2015) in regards to climate change adaptation policies in Tanzania. An effective definition of environmental vulnerability and wellbeing coupled with a household level vulnerability methodology can aid in the understanding of

human–environment interactions. Our methodology identifies sources of environmental stress and connections to household level socioeconomic dimensions. Definitions of vulnerability, wellbeing and environmental stress vary immensely (Kelley & Adger, 2000). In this paper we define vulnerability as the inability to withstand the effects of social or environmental changes. Wellbeing is defined as the state of being content, healthy and prosperous. Environmental stress is considered unsustainable pressure on ecosystems.

A household vulnerability model provides much more detailed information than traditional national-level assessments. Much of the existing vulnerability research has focused on comprehensive assessments that look at vulnerability over large spatial regions, consequently allowing comparisons to be made across countries. These studies in most cases do not actually identify specific geographic locations or groups of people within countries that are vulnerable. On the other hand, studies that focus within a country tend to focus on districts as the scale of analysis, which is policy relevant at a national level but leads to generalization of large districts. Stephen and Downing (2001) shows that in Ethiopia, regional themed vulnerability discussions do not adequately consider localized concerns and frequently result in aid not reaching the most vulnerable populations. Different groups of people can experience exposure to a particular hazard in different ways. For example not all rural people in Ethiopia were affected by a drought in the same way. As Stephan points out, drought will be experienced differently depending on which socioeconomic group the affected population belongs to, their economic and social-political resources, or even the altitude at which they live.

Some leading research has been at the community level. Disaster resilience literature established the Baseline Resilience Indicators for Communities (BRIC) to assess a community's disaster resilience (Cutter, Ash, & Emrich, 2014; Cutter et al., 2008, Cutter, Burton, & Emrich, 2010; Singh-Peterson, Salmon, Goode, & Gallina, 2014). These indicators are generally organized into 5 themes (economic, institutional, infrastructure, community, and social resilience) and are used to determine community level resilience. Cutters original work (2008) focused on 736 counties within the United States Federal Emergency Management Agency's (FEMA) Region 4. Using the BRIC framework and methodology as a tool, this study focuses on the drivers of vulnerability, which are similar to disaster resilience indicators but focused more on household-level dynamics. Once these drivers are determined, indicators of vulnerability are established and organized into themes, which we term baskets (similar in approach to Busby, Smith, White, & Strange, 2012). Fig. 2 depicts a conceptual model for the causal processes and dynamics that drive vulnerability at a household level in the East African Rift based on extensive fieldwork. Six dimensions of this analysis are depicted on the outer circle, which represents household wellbeing. Indicators in red (in web version) around the center circle are pathways commonly attributed in research to the social-ecological environment in southern Africa and capture how households exhibit vulnerability. Indicators in orange (in web version) serve as metrics used to measure along a spectrum of vulnerability (inner circle) and household security (outer circle). This model is commensurate with the approach found in Oxford's Multidimensional Poverty Index, also at a household-level of analysis. While this research is not a categorical statement of the human condition in southern Africa, Fig. 2 illuminates near and distant connections of vulnerability analysis with other fields already active in discussions of vulnerability.

## 3. Case study countries

All four countries in this study are situated in the Albertine Rift Valley. The moderate climate and volcanic soils in this region

Download English Version:

<https://daneshyari.com/en/article/6538483>

Download Persian Version:

<https://daneshyari.com/article/6538483>

[Daneshyari.com](https://daneshyari.com)