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Impact of Climate Change and Climate Variability on the Occurrence of Extreme Climate Events: Opportunities for Social Sciences Research in Southern Africa

Mabaso Musawenkosi LH*

Human Sciences Research Council, Private Bag X07, Dalbridge, South Africa

Abstract

A growing sense of urgency has brought the problem of climate change and variability high up on the research agenda of natural sciences. Despite social drivers and societal impacts of climatic related extremes the social dimension of climate change and vulnerability has received little research attention. In southern Africa as in many other parts of Africa climate change and variability threaten human and social development and are projected to impede the realization of the global millennium goals. This paper gives an overview of the societal impacts of extreme climatic event exacerbated by existing social conditions, which includes the vicious cycle of poverty, pre-existing disease burden, social inequalities and marginalization reflecting household vulnerability, inadequate coping capacity and risk of severe consequences. Key priorities and opportunities for social sciences research in southern African countries are highlighted. The significance of social sciences research for improved understanding of social risk factors and conditions that make social systems vulnerable to climate change and variability related extreme events are discussed. The need for interdisciplinary research framework that integrates relevant information and approaches from both social and natural sciences is accentuated.

Keywords: Climate change; Impact; Climatic variability

Introduction

Natural climate change and variation has had a tremendous impact on the course of human history. Changes in climate occur naturally as a result of continental drift, various astronomical cycles, variations in solar energy output, and volcanic activity [1]. However, over the past decades increased production of the greenhouse gases as a result of human activities (mostly fossil fuel combustion and forest burning releasing carbon dioxide and other heat-trapping gases such as methane from irrigated agriculture, animal husbandry, and oil extraction) has fast tracked climate change leading to increased intensity and frequency of extreme climatic events such as floods and droughts with devastating effects on all natural and human systems especially in developing countries. To date climate change is considered one of the main global challenges for the 21st century [1].

In sub-Saharan Africa many regions and social groups are most vulnerable to climate change due to dependence on climate sensitive sectors and as a result of prevailing social, political and economic conditions [1-3]. Although the potential effects of climate change and variability on various aspects of human health has been extensively researched [4], the social aspect has received little attention. Most social sciences research on climate change and variability has focused on the political and economic impact assessments from a sectorial perspective [5]. Population based risk assessment which includes social risk factors, vulnerability indicators, adaptive capacity as well as risk perception and communication has received little research attention. This is partly due to the complex inter-linkages between predisposing social and natural conditions and partly to a challenge of developing and adopting a more integrated and interdisciplinary research approach [6].

In southern Africa as in many other parts of Africa climate change and variability is projected to impede the realization of the global millennium goals towards sustainable development [3]. Climate change and variability threaten human and social development by restricting the fulfillment of human protection and disempower people and communities by constraining their ability to enrich their livelihood [7]. The situation in Southern Africa is exacerbated by other multiple societal stressors including the effect of HIV/AIDS as a result of which a small climate event can trigger major social impact [2]. In the recent 17th United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP 17) in Durban, South Africa, a call was made for social scientists to play a critical role to provide meaningful knowledge that works in helping communities, nations and regions to respond to current and projected changes in climate [8]. Against this background, this paper gives an overview of key priorities and opportunities for social sciences research in southern Africa.

Climate change and climate variability defined

The terms climate change and climate variability are often used interchangeably when they in fact represent different parts of a continuum [4]. In order to understand the term 'climate change' it is very important to get the difference between 'weather' and 'climate'. Weather is a description of temperature, air pressure, cloud cover and other properties of the atmosphere at a given point in time. Weather conditions can vary by the hour or even by the minute.

Climate on the other hand, can be seen as a summary of what weather is usually like in a particular area for longer periods. Climate change therefore is a long-term continuous change that operates over decades

***Corresponding author:** MLH Mabaso, Human Sciences Research Council, Private Bag X07, Dalbridge, South Africa, Tel: +27 31 242 5608; Fax: +27 31 242 5401; E-mail: mmabaso@hsrc.ac.za

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or longer time scales and is slow and gradual. Climate variability refers to the short- to medium-term variation around the average climate, including annual and seasonal. Shorter term climate variability and the frequency of extreme climate events (anomalous temperature and rainfall) are projected to be altered as part of the physical consequences of long-term climate change [9]. Current climate variability and related extreme events are one of the most significant ways that existing social systems are likely to experience climate change [2].

Extreme climate events and social impacts in southern Africa

Figure 1 shows the variety of consequences that are influenced directly or indirectly by climate variability and related extreme events [1,2]. Social impacts are those that directly affect the physical and emotional well-being of individuals. These operate at various levels of the society including individual, household, community and national level.

In Southern Africa social vulnerability to changing climate extremes varies greatly within countries, sectors and social groups. This has been attributed to climate and geographic heterogeneity, varying exposure and capacity to anticipate, cope, resist and recover, including demographic factors such as age, gender, employment status, education, human settlement type, poor infrastructure, population density, mobility, access to information, lack of planning or insurance, poor health and emergency services, awareness and knowledge [2].

The social impacts of extreme climatic events have multiple cascading stressors exacerbated by existing social conditions. This includes the vicious cycle of poverty, pre-existing disease burden, social inequalities and marginalization reflecting household vulnerability, inadequate coping capacity and risk of severe consequences [10]. For example, Mozambique one of the poorest countries in the world with more than 50% of its 19.7 million people living in extreme poverty has experienced seven major droughts and seven major floods since the 1980' resulting in injuries, deaths and displacement of thousands of people [11]. In 2000 severe floods affected northern parts of South Africa as well as Mozambique and Zimbabwe causing 600 deaths and severely damaging infrastructure [12]. The 2001-2003 drought in Southern Africa had a dramatic effect because the effect of HIV/AIDS and poor nutritional status [2]. This was attributed to the vicious cyclical interaction between malnutrition and HIV, that is, loss of assets and skills as well as shortages of due to adult morbidity and mortality, and the related increase in numbers of dependents and the burden of care for sick adults and children orphaned by AIDS.

In 2007 floods in Zambia affected livelihoods in several districts and provinces as crops were washed away and/or submerged, and caused damage to infrastructure such as roads and bridges limiting education and medicine [2]. The combination of higher temperatures, prolonged droughts and floods coupled with scarce water resources and poor sanitation lead to the 2008-2009 cholera outbreaks which affected thousands of people in in Zimbabwe, South Africa, Mozambique, Malawi, Angola and Zambia [13]. All these events highlight the complex inter-linkages between natural conditions and predisposing social conditions. Another dimension of climate change and variability in southern Africa reported from the 1980's to the early2000s was the less severe but increasing frequency of climate shocks as a result of which many families were increasingly unable to recover after theses shocks [10].

Priorities and opportunities for social sciences research

The nature and extent of the involvement of the different social science disciplines (sociology, anthropology, psychology, economics, geography, political science, etc.) will depend on the scope of planned research and target population. This can involve collation of relevant social and natural sciences data / information and utilization of mixed method approach towards an integrated interdisciplinary framework for social risk and vulnerability assessment at different spatial and temporal scales (Table 1). Firstly, identifying vulnerable groups and associated risk factors at a local level is important for generating adequate knowledge base to support efforts for vulnerability reduction. Secondly, assessing households coping capacity will help identify important strategies and practices for building adaptive capacity and resilience at a local level. Assessment of community awareness and knowledge will help identify barriers that limit transfer of knowledge and responsive action, and in turn contribute in developing culturally and context relevant risk communication strategies. Lastly, the process of identifying research gaps in social sciences through collaborative interaction will help shape the research agenda by addressing institutional boundaries, promoting cross-professional cooperation and building interdisciplinary research capacity.

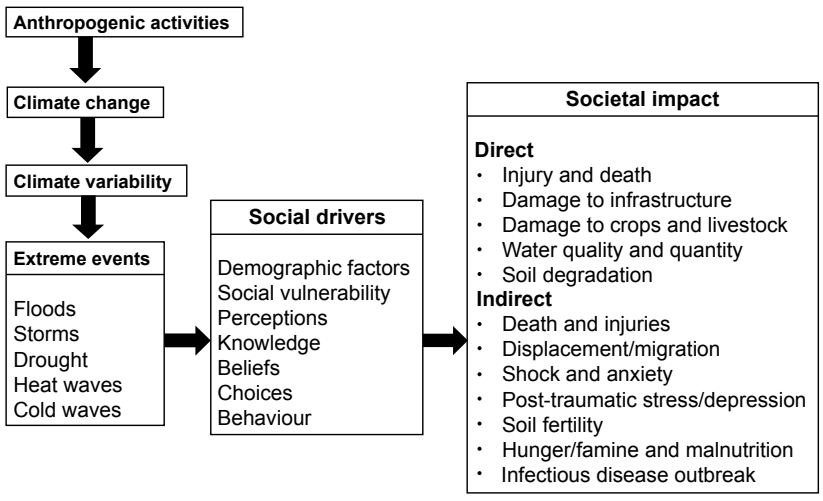

Figure 1: Conceptual diagram showing links between anthropogenic activities, climate change, climate variability, extreme events, social drivers and societal impact compiled using.

Research priorities	Data sources	Methodology
Identification of vulnerable groups and regions • Social determinants of risk/vulnerability to climatic extremes • Environmental vulnerability risk assessment and mapping	• Social and demographics variables from census and other populations surveys • Poverty/wealth indices • Land use/land cover • Climate surfaces • River flooding systems/stream flows	Descriptive studies • Prospective and retrospective analysis • Geospatial analysis using Geographic Information Systems
Assessment of coping capacity • Households willingness to mitigate and ability to adapt-social strategies • Ability of households to adapt to potential damage-social practices	• In-depth, structured and semi-structured interviews • Focus group discussions	• Qualitative and quantitative analysis
Assessment of community awareness and knowledge • Public perceptions of climate change and variability-attitudes, beliefs and cultural understanding • Views of who is responsible for climate change and variability-ownership of the problem • Degree of concern and sense of urgency-personal experience	• In-depth, structured and semi-structured interviews • Focus group discussions	• Qualitative and quantitative analysis
Identification of gaps in social sciences research • Review of literature • Systematic reviews • Policy reviews • Consultative and collaborative interdisciplinary workshops • Meetings and conferences	• Desktop review • Bibliographic databases • Policy documents • Interviews with key informants/stakeholders • Consultation with leading regional, national and international experts	• Bibliometric and textual analysis • Meta-analysis • Policy evaluations • Regional and country specific workshops

Table 1: Proposed research priorities, data sources and analytical approaches for social science research on climate change, variability and associated extreme events.

This does not imply a simplistic interdisciplinary approach that involve social scientists in a subservient role to natural scientists in order to deal with the social dimension, but rather an innovative collaborative approach where social scientists take advantage of recent technological advances and availability of new high resolution spatial and temporal climate and other biophysical datasets. Geographic Information Systems (GIS) or other geospatial platforms can be used for integrated analysis of the relationship between social, climate and biophysical determinants of vulnerability and mapping their spatial distribution at appropriate scale. Social scientist can also draw from their wealth of experience on issues of vulnerability, resilience and adaptive capacity to offer insight for potential adaptation strategies and barriers hindering individual, household and community responses [14].

There is therefore a need for strengthening existing institutional partnerships and establishment of multidisciplinary collaboration within countries and across the sub-region. Including, building and strengthening regional research capacity through joint projects to improve institutional capacities and mobilization of donor funds for coordinated support of regional and county specific initiatives. Sub-regional and country specific interdisciplinary workshops on the social dimension of climate change and variability will also help in identifying gaps and framing problems for future research direction.

"*Climate is deeply embedded in social and cultural processes, in particular the field of society-climate interaction. Thus, climate science is a genuinely trans-disciplinary scientific field, which poses special challenges and approaches requiring the skills of both physical and other natural science professionals as well as social and cultural scientists*" [15].

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