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Vulnerability and adaptation to climate variability and extremes: A case study of flooding in Niger state, Nigeria

Eze, Jude Nwafor

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CHAPTER ONE

1.0 Introduction

There is an increasing need to understand more about the impact of climate variability and extremes on the environment, and to identify processes that shape vulnerability and adaptive capacity of people in different parts of the world. This research focuses on the household level because it is here that impacts of climate variability are often most acutely felt with limited resources to adapt to climate extreme (e.g. flooding). In an attempt to clarify the issues and to identify the possible policy implications associated with climatic variability at the international and regional level, the United Nations Environmental Programme (UNEP) and the World Meteorological Organisation (WMO) established the Intergovernmental Panel on Climate Change (IPCC) in 1988 (IPCC, 1995). Selected portions of the (IPCC) framework of investigation have been used in this research. This framework describes the assessment of the scientific information relating to three aspects of climate variability issues. Firstly, changes in climate arising from increasing greenhouse gas concentrations in the atmosphere. Secondly, the environmental and socio-economic consequences of climate variability (IPCC, 1995). Finally, the third investigation involves the formulation of response strategies. The second and third aspects of the framework above, therefore, form the basis of this research. The impacts and vulnerabilities to floods in Niger State of Nigeria are investigated. In this investigation, the most extreme period of climate variability was between 1981-2000. This period is secured to investigate the environmental and socio-economic consequences of such climate variation.

The Intergovernmental Panel on Climate Change (IPCC) Third Assessment Report describes vulnerability as “the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes” (IPCC, 2001: 995). The report shows that Africa is highly vulnerable to various

manifestations of climate variability. In the area of water resources, for example, lake storage and major dams have reached critically low levels, threatening industrial activities due to drought. Coastal zones are vulnerable to sea level-rise including roads, bridges, buildings and other infrastructure that are exposed to flooding and other extreme events (IPCC, 2001). Other areas that are vulnerable include natural resources and biodiversity, which are at risk and might be irreversibly lost (IPCC, 2001). The extent to which ecosystems, food supplies and sustainable development are vulnerable depend both on exposure to changes in climate and the ability of the impacted system to adapt (Smit, 1993). With all this variability and uncertainty of possible future global-scale climate variability scenarios, it is crucial that research on vulnerability and adaptation due to climate variability is conducted at household level. Future adaptations to climate extremes are therefore an essential ingredient in impact and vulnerability assessments.

Adaptation to climate variability involves adjustments to enhance the viability of social and economic activities and to reduce their vulnerability to climate, including its current variability and extreme events as well as long-term climate variability (Smit 1993; Smit *et al.,* 2000). The term adaptation means any adjustment, whether passive, reactive or anticipatory, that is proposed as a means for ameliorating the anticipated adverse consequences associated with climate variability (Stakhiv 1994; Smit *et al.,* 2000). A variety of processes that shape vulnerability and adaptive capacity of people are driven by a range of causal mechanisms that need to be understood if effective adaptation is to occur e.g. economic wealth, technology, information and skills, infrastructure, institutions and equity (IPCC, 2001). Lack of technology, has the potential for example, to seriously impede a nation's ability to implement adaptation options by limiting the range of possible responses (Scheraga and Grambsch, 1998). It is argued therefore, that a region with the ability to develop technology may have enhanced adaptive capacity. According to Frankhauser and Tol (1997: 78) "successful adaptation requires a recognition of the necessity to adapt, knowledge about available options, the capacity to assess them (adaptation options) and the ability to implement the most suitable ones".

In coping with weather-related hazards, social networks also play a primary role in adaptation and recovery (Adger, 2003). Social capital refers to a set of networks, agreements, and flows of information between individuals and social groups. It is made up of the networks and relationships between individuals and social groups that facilitate economic well-being and security (Adger *et al.*, 2004). Social dynamics of adaptive capacity are defined by the ability to act collectively. Resource-dependent communities have historically acted collectively to manage weather-dependent, fluctuating and seasonal resources, such as fish, livestock, and water resources, on which their livelihoods depend (Adger, 2003). Governments, however, intervene to manage and regulate resources. When the vertical linkages between the civil society and the state are strengthened, institutional arrangements like collective management emerge. Such synergistic social capital promotes the adaptive capacity of societies to cope with climate change (Adger, 2003). When governmental intervention to plan for and forewarn communities in disaster planning, or to assist in recovery is largely absent, social capital, in effect, takes over as a substitute for help from the state. The rolling back of State assistance in times of crisis or "adjustment" often means that this substitution of social capital is a necessity, rather than a choice (Adger, 1999, 2000a; Adger, Kelly, and Ninh 2001).

Understanding of climate variability and extremes presupposes a grasp of the form and functioning of a system in question (community), including the manner and pattern in which the social network and food supply is affected by environmental perturbations (Watts, 1983), such as flood. This is notably the case among rural producers in transition but for whom the forces of production remain relatively undeveloped. The relation of social reproduction to the physical environment strikes to the core of a good deal of contemporary social theory, of which two domains are especially relevant (Watts, 1983). The first embraces natural hazards research and human ecology, addressing questions of adaptive structure in social systems. The second concerns the role of risks and risk aversion in peasant behaviour (Watts, 1983). Underlying these approaches is a belief in the desirability of focusing on environmental events that constitute threats to individuals experiencing them. These environmental perturbations carry the risk of mortality, of

losing the existential game in which success consists of staying in the game (Watts, 1983). Vayda and McCay (1977: 411) state that "Any event or property of environment which poses a threat to the health and ultimately the survival of organisms, including people, may be regarded as a hazard for them and that responding adaptively to such hazards involves in our view not only deploying resources to cope with the immediate problem but also leaving reserves for future contingencies".

Impacts of flood hazards on agriculture in Shiroro Local Government Area (LGA) were examined in this study. Agriculture forms a large part of the economies of several African countries. Most African countries derive up to 21 percent of their gross domestic product (GDP) from agriculture (Vogel, 2005). Agriculture is also an important sector in both the formal economy and in sustaining local livelihoods. Agriculture is, however, currently constrained by biophysical and socio-economic problems including land degradation, poor infrastructure and market access, lack of access to information and resources (Vogel, 2005: 30). Despite efforts to obtain current statistical data on the nature of agricultural production in Nigeria, available information was limited. Most African countries exhibit severe to moderate production declines in agriculture (Watts, 1983). By 1978, per capita food production in Angola, Benin, Ethiopia, Ghana, Nigeria, Zimbabwe, Senegal, Sierra Leone, Uganda and Upper Volta were less than 90 percent of 1961-65 average (Watts, 1983). Declining food production, moreover, translates into inadequate nutrition and in most sub-Saharan countries caloric intake fell below minimal nutritional standard (Watts, 1983). This is the case, however, in the communities along the Kaduna River in Shiroro Local Government Area, which will be shown later. Communities along the River Kaduna, in Shiroro LGA are subsistence farmers. The major food crops of these communities include Guinea corn, yam, maize, cassava and millet. These crops are usually grown along the flood plain of Kaduna River (SLG, 1999). Due to recent, frequent destructive flood occurrences, agricultural yields are very low. All the traditional farmers and fishermen, however, depend wholly on the output within the communities (ANEEJ, 2003).

A key aspect of this research also focuses on *understanding food security at household level*. Food security is about having adequate access to food, which can be acquired through trade as well as production (Devereux and Edwards, 2004). Production self-sufficiency, however, is not a prerequisite for food security, at either the household or national level (Devereux and Edwards, 2004). The most food secure individuals buy the food they eat instead of growing it, and even wealthy countries import some basic consumption commodities. Devereux and Edwards (2004) argue that the households and countries that stand to lose food production due to climate variability are also those that depend most on agriculture and have fewest alternative sources of income. Therefore, a falling harvest will certainly undermine the household and national food security (Devereux and Edwards, 2004). Understanding the full range of climate variability impacts on food security therefore requires understanding the implications for prices, incomes and trade as well as production.

Research on food security has evolved from an examination of concepts such as nutrition, food production and pricing policies, towards a narrower focus on the household food security systems (Algamir and Arora, 1991). In the 1960s, research revolved around expanding agricultural production and supply. Later in the 1970s, the variability of food supplies stimulated by the world food crisis led to research on buffer stocks, trade and food policies (Emmet, 1990; Algamir and Arora, 1991). In the 1980s, large-scale food projects, which concentrated on national food production and importation of large amounts of food aid, were implemented globally (Hay, 1986). In most third world countries, however, trends to conceal the household food security were developed. This changed in the mid-1990s i.e. with the world food summit in 1996, and the increasing focus on household food security. Interviews at the household levels have been conducted to assess the prevailing conditions in Shiroro communities and try to develop a profile of food security and how this is altered during extreme flood periods.

Household coping strategies to flood are also examined in this research report. These strategies are usually adopted during periods of stress to offset growing vulnerability. Coping strategies are a mechanism adopted by households to cope with a crisis, for

example, flood. Households do not respond arbitrarily to changes in climate variability and extreme (flood). Instead they develop self-insurance strategies to secure their longer-term livelihood (Corbett, 1988; Frankenberger and Goldstein, 1992). Examining household food security within the sustainable livelihood approach strengthens the emphasis that is placed on 'coping' strategies. Research conducted in Asia and Africa, for example, reveals that the preservation of the household assets required for the future livelihood security takes precedence over immediate food needs (Glantz, 1987; Corbett, 1988; Makhubu, 1998). Liverman (1986) has also conducted some vulnerability studies using different models. The models used, contribute a valuable beginning in the study of links between food shortage and climate variability. They are not, however, conclusive. This is because models are unable to capture the dynamics of crisis response to food shortage; the intricate processes of the household food poverty and individual food deprivation that develops during periods of stress (Makhubu, 1998). The models are, however, user- friendly in that they do highlight relative vulnerability due to different mechanisms and between different regions (Makhubu, 1998). *The research in Shiroro communities* tries to *venture beyond this approach* and asks more fundamental questions particularly around *household coping strategies and vulnerability* to climate variability.

An understanding of the local household strategies will enable the recognition of early indicators of food insecurity and the identification of appropriate responses (Davies, 1993; Makhubu, 1998). The effectiveness of flood management programmes and the design of early warning systems can be improved by recognising the chronic and persistent coping strategies of vulnerable groups. In a recent analysis of coping strategies, a shift from modelling and quantifying coping strategies to actually assessing vulnerable groups and their coping mechanisms has occurred (Davies, 1993) This is deemed more effective than the large scale monitoring of coping strategies that do not necessarily reflect the diversity and complexity of coping mechanisms.

It is therefore important that a thorough investigation is conducted at the grass roots level to clearly portray coping strategies harnessed during a time of crisis in Shiroro communities. Exposing the nuances of such complexity should improve future flood

management and mitigation strategies. In addition, the results will enable policy makers in Niger State to effectively address local problems as well as formulating a practical targeting flood management system, which will assist in the design, and implementation of flood mitigation programmes. Having introduced this research report giving it theoretical background, the rational of the study is now discussed below.

1.2 Rational of the study

IPCC working group II of the Third Assessment Report has carried out assessment on vulnerability and adaptation to climate variability across the continent, documenting methods and tools on how to assess the impact, vulnerability and adaptive capacity of an affected community. Despite these effects, methodological gaps still remain concerning scales of investigation, data, validation and interaction (IPCC, 2001). Procedures for assessing regional and local vulnerability and long-term adaptation strategies, according to IPCC (2001: 107), "require high-resolution assessments, methodologies to link scales, and dynamic modelling that uses corresponding and new data sets". Validation at different scales is, however, often lacking. "Regional integration across sectors is required to place vulnerability in the context of local and regional development" (IPCC, 2001: 107).

The key purpose of this research, given this theoretical background, is to extend the existing body of knowledge on vulnerability and adaptation to climate variability by examining the impacts of flooding on the people living in Shiroro Local Government Area in Nigeria as well as the processes and factors that shape vulnerability and adaptive capacity of people in the community. Classes of people and sectors that are affected by flood events are identified. The impact of flooding on the socio-economic life of people has not been the concern of major studies and therefore this study hopes to improve the knowledge of adaptation and vulnerability to climate variability in this region. The repeated incidence of flooding in Niger state calls for an urgent need to research on the vulnerability and adaptation to climate variability of the undermined communities, to climate variability.

This research is divided into seven chapters. Chapter ONE introduces the research work, rationale of the study, the plan of the research and aim and objectives of the study. In chapter TWO, a review of similar research carried out in different parts of the world, including the very few works carried out in Nigeria are profiled. The concepts of vulnerability and adaptation to climate variability are also expanded on. In chapter THREE, the background information of the study area and research methodology, including the study design, sampling, data collection, limitations of data collection and the method of data analyses are discussed. In chapters FOUR, FIVE and SIX analysis, interpretations and results are investigated. Finally, in chapter SEVEN the conclusion and recommendations based on findings are presented.

1.3 Aim and objectives

The aim of this research is to assess both the positive and negative socio-economic impacts of flooding, the factors that enhance the vulnerability to climate stress in the region and the *adaptive capacity* of the people living in Shiroro Local Government Area in Niger State, Nigeria. In pursuance of this, the following objectives are addressed,

(1) Identifying the vulnerable groups within the communities.
(2) Identifying how the local people currently perceive and cope with the floods.
(3) Assessments of adaptation providing the basis on which further adaptation will be built.

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Understanding vulnerability and the closely related goal of identifying ways of reducing vulnerability clearly entail a focus on the causes of, or processes shaping vulnerability. This research report employed the vulnerability led-approach to examine the underlying socio-economic and cultural factors that determine how people respond to and cope with flood hazards along the River Kaduna in Shiroro LGA. The vulnerability approach is therefore a useful tool with which to assess people's needs in terms of adaptation or improvements in their ability to cope with existing threats.

Household coping strategies are designed to cope with a crisis, for example flooding. An understanding of these household dynamics enables adaptation strategies to be improved. It is therefore important that a thorough investigation is conducted, at the grass roots level, to clearly portray coping strategies harnessed during both normal periods and during periods of stress, such as at times of climate stress in Shiroro communities. Exposing the complexity of such responses should improve future flood management and mitigation strategies. In this report, vulnerability and adaptation of communities along the River Kaduna, to floods at household level is described and examined. To fully understand the mechanisms of climate variability and extreme floods in this part of the world, a review of previous literatures on vulnerability and adaptation to climate variability and extreme (flood), must be established to provide a contextual frame for the reminder of the study.