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Perceived Causes and Effects of Rainfall Variability in Baringo County, Kenya

Koskei Ednah Chemutai*
Kabarak University, P.O Box 20197, Kabarak, Kenya

***Corresponding author**
Koskei Ednah Chemutai

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Abstract: The main objective of this study was to identify causes and perceived effects of rainfall variability on access to water in Baringo County. The study used a descriptive survey design. Purposeful sampling and stratified proportionate random sampling procedures were used to obtain the sample. A total of 376 households were selected for the study. Questionnaire, key informant interview schedule and observations were the main instruments of data collection. Analysis of data was done using the Statistical Package of Social Sciences (SPSS). Descriptive statistics were used to analyze the effects and causes of climate change in Baringo County. Rainfall variability affected access to water in Baringo County. More frequent and severe droughts were perceived to be responsible for the reduced water level in Lake Baringo and intermittency of most rivers that were previously permanent. Deforestation is the main cause of rainfall variability in Baringo County hence there is need to increase awareness on climate variability and change and encourage people to use alternative sources of energy and plant trees.

Keywords: Effects, Causes, Rainfall variability, Baringo County.

INTRODUCTION

Climate, with particular reference to rainfall, is known to be changing worldwide [1]. Rainfall exhibits notable spatial and temporal variability in Africa [2]. Developing countries, Arid and Semi-Arid Lands (ASALs) and the poor in society are the most vulnerable and likely to be hit hardest by climate change due to their low adaptive capacity [3].

The adverse impacts of climate change will be most striking in the developing nations because of their geographical and climatic conditions, their high dependence on natural resources, and their limited capacity to adapt to a changing climate [4]. Within these countries, the poorest, which have the least resources and the least capacity to adapt, are the most vulnerable. Africa is one of the most vulnerable continents to climate change and climate variability due to weak adaptive capacity [5]. The existing developmental challenges such as endemic poverty, complex governance and institutional dimensions; limited access to capital, including markets, infrastructure and technology; ecosystem degradation; and complex disasters and conflicts have contributed to Africa's weak adaptive capacity [5].

Many countries in Africa are facing semi-arid conditions [6]. Approximately 80 % of Kenya is arid and semi-Arid Lands (ASALs) characterized by average annual rainfall of between, 200mm to 500mm per year, and is prone to harsh weather conditions [6]. A few areas in the northwest and east receive only 200 mm per year [7]. More than two thirds of the country is classed as ASALs [8] and these areas are home to approximately 30% (~12 million) of Kenya's people, a third of Kenya's population [9]. The major climatic hazard in the ASALs is drought. Most of the droughts exhibit such characteristics as false and late onset of the rains, pronounced breaks during the rainy season, and early cessation of the rains, leading to strong alterations in the pattern of seasonal rainfall distribution [10-12]. Baringo County in North-West Kenya is predominantly ASAL's.

Climate change and climate variability are already taking place in Kenya and their effects are being felt [13]. The climatic factors of greatest economic and social significance are temperature and rainfall with the latter, eliciting more concern than the former. Rainfall in Kenya is highly variable, especially in ASALs [7]. These climatic variations in Kenya have been associated with global climatic systems such as the El-Niño/South Oscillation (ENSO) phenomenon and Quasi-Biennial Oscillation (QBO) [14, 7]. They have also been associated with shifts in dry land or desert margins and the rise or fall of water levels in lakes and rivers. For instance, lakes Turkana, Baringo, Bogoria, Elementaita, Nakuru, Naivasha and Magadi are estimated to have occupied much larger area in the Holocene period [13]. As in the rest of the tropical regions, droughts and floods are common phenomena in Kenya. The two are triggered by the same factors and can be either mild or

disastrous. They are more common in the arid and semi-arid regions [15].

More than three-quarters of a billion people in the world most of them poor still do not have access to water [16]. By 2020, between 75 and 250 million people on the continent are projected to be exposed to increased water stress due to climate change. Access to domestic water is a day-to-day struggle for many citizens living in developing countries [17]. About 200 million of Africa's population corresponding to about 25 % currently experience high water stress [5]. The population at risk of increased water stress in Africa is projected to be between75-250 million and 350-600 million people by the 2020's and 2050's respectively. People living in rural areas are the worst affected, with only 41% of the rural population of Sub-Saharan Africa having access to clean water [18]. By 2020, between 75 and 250 million people on the continent are projected to be exposed to increased water stress due to climate change. Fourthy eight countries in Africa including Kenya would face water shortage by 2025. About seventeen million (about 43%) Kenyans currently lack access to improved water supply [19].

Baringo County suffers from intensive floods, severe droughts combined with short rainy seasons and drought related losses like any other county situated in the northern regions of Kenya. Given that many households in Baringo County are poor, they are vulnerable to rainfall variability. Household water needs in the County are met from nearby surface water sources or withdrawn from traditional wells [20]. However, in the dry season, wells, streams and rivers dry up forcing women and children who do the considerable labor involved in water collection to travel longer distances in search of water for domestic use from unprotected sources. High rainfall variability negatively impact on household access to improved water sources. Many households find it difficult to store quantities of rain falling in very short periods so that it can be used over the entire year. This study therefore seeks to establish causes and effects of climate change the effects of rainfall variability on household access to water in order to provide them with relevant and appropriate information that can inform their adaptation appropriately and reduce vulnerability to climate change.

METHODOLOGY

The study used purposeful sampling and stratified proportionate random sampling procedures to obtain the sample. Within Baringo County, the locations were stratified according to the agro-ecological zones. These are LM 5 (lower Midland), LH 2 (Lower Highland) and IL 6 (Inner Lowland). Lembus Central, Salabani and Ribkwo locations was purposefully selected for the study. They were selected because of having Agro-ecological zones LH2, LM5 and IL6, respectively to ensure that the researcher picks extreme climates only and ensure proper representation of the respondents within the whole Baringo County area coverage. Lastly, random selection of the respondents within locations was made proportionate to the population of each location as per the household census report of 2009 [21]. The study targeted 376 households which constituted 7.9 % of the total number of households in the three agro ecological zones. The selection of respondents was informed by household population by location level. This information was acquired from the County Development Officer at Kabarnet, the County headquarters. Lembus Central location has a population of 2,668 households, while Salabani has a population of 963 households and Ribkwo 1128 households. These were the three strata where proportional representation was obtained. 211 households in Lembus Central, 76 in Salabani and 89 in Ribkwo location was selected. A total of 376 respondents were selected for the study. Their participation during the interviews was, however, based on random sampling.

Purposive sampling was used to select key informants to be interviewed. These were selected from among meteorologists, NGO officers, chiefs, NDMA officers and water officers based on their positions of authority. These key informants were selected for the interview in consideration that they have insights on the subject of climate and water use of RWHT by the households in the County.

The study used both primary and secondary data. Primary data were obtained from households and key informants through personal interviews by use of structured questionnaire and Key Informant Interview Schedule. Secondary data was obtained from past aerial photographs. The study focused mainly on household heads for interviewing to ensure uniformity of data collection process. The questionnaire was used to collect data from households on causes and effects of rainfall variability in Baringo County. The questionnaire was administered to all the 376 households in the study area. Key Informant Interview Schedule was used to collect in-depth data on rainfall variability. Observation was used to supplement and enrich data collected via the interview. Additionally, photographs in the study area were taken by researcher. The photographs have helped to illustrate the effects of rainfall variability. The use of photographs augmented findings from other data collection procedures.

RESULTS AND DISCUSSION

The study established that the amount and distribution of rainfall within and between the years varied in Baringo County. Almost all the households (98 %) interviewed agreed that the amount and distribution rainfall has changed over the last five years. They noticed a decrease in the amount of rainfall or

shorter rainy seasons. All the key informants interviewed including chiefs, water officers, NGO's (ACTED) and NDMA officers agreed that rainfall is changing and is no longer as it was years back. All the respondents that were interviewed believe that the climate is changing and is no longer as it was some years back. They indicated that these changes were mainly associated with rainfall amount and distribution. People's perception is that rainfall is lesser today than was in previous years.

The reasons cited by respondents interviewed for observed change in rainfall variability over the last 5 years in Baringo County are given in Figure. 1 below. Among the households interviewed, 58 % of the respondents were of the view that deforestation is responsible for rainfall variability over the last 5 years in Baringo County while 30 % of the respondents were of the opinion that climate change caused rainfall variability. Finally, 12 % of the respondents said that they had no idea about rainfall variability. The results implicate deforestation as the main cause of rainfall variability. This could be as a result of an increased awareness by extension officers on importance of vegetation. To the few respondents, there was complete lack of awareness of the issues involved in rainfall variability in Baringo County hence there is need to increase awareness on rainfall variability.

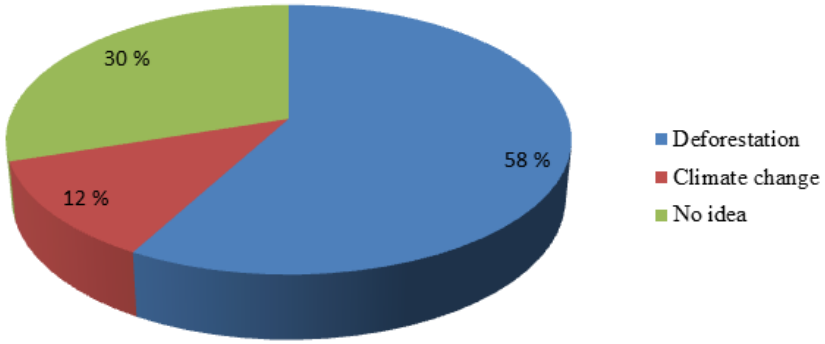

Fig-1: Reasons for observed change in rainfall variability over the last 5 years in Baringo County

Most of the forest in Baringo is located in the highlands. It was established that logging is the main cause of deforestation in Baringo County. More of Baringo's woodland is being cut down for charcoal and wood-based industries. Farmers also fell trees to increase space for farming [22]. Both cutting and burning of trees are practiced as shown in Plate 1.1d. Charcoal stacks are often seen right next to the cleared areas. Aerial photos from 1969 and 1979 over a highland area were also available (Plates 1.1e and 1.1f), confirming that areas with cultivated land are increasing while areas of forested and uncultivated land are decreasing. Large patches of open land surrounded by forest are visible even on very steep slopes. Researcher field observations of the situation today verified a continued decrease of the forests the latest decades (Plates 1.1e). Only small forest lands remain in the highlands due to an expansion of cultivated land (Plates 1.1b and 1.4d). Deforestation in Baringo County is also evidenced by many sawmills in the *area* (Plate 1.4c) and open areas west of Lake Baringo such as the Njemps flat in Salabani. Some trees have been flushed away and the areas affected by gully erosion have both expanded and increased in number as illustrated in plate 1.4a. Here the open ground has expanded much during the analyzed time. The vegetation cover is very sparse and the overgrazing is severe (Plate 1.4a).

Plate (a)

Plate (b)

Plate (c)

Plate (d)

(a) Open ground in Salabani location (b) Large patches of open land surrounded by forest (c) Sawmill processing logged trees in Lembus Central (d) Cut trees in Lembus Central
Source: Field data, August, 2015

(e) Highland area with small terraced fields

(f) Steep slopes with burnt land in the highland
Source: Secondary data (1969-1979)

According to Baringo residents, rainfall variability affects access to water in their County. The nature of effects of rainfall variability varies across the year. The end of the dry season is the most uncertain period because none of the available sources is dependable. More frequent and severe droughts were perceived to be responsible for the reduced water level in Lake Baringo and intermittency of most rivers that were previously permanent (see plate 4.3). River Endao in midland which is one of the major sources of water in the area was reported to have changed its course several times in the recent past and has since become seasonal because of climate variability and change.

Plate-4.3(a) dried river (Endao) in Salabani

Plate-4.3 (b) Lake Baringo
Plate-4.3: Water sources affected by rainfall variability
Source: Primary data (2015)

CONCLUSION AND RECOMMENDATION

The amount and distribution of rainfall varied in Baringo County. The area suffers from droughts combined with short rainy seasons and drought related losses. The rainfall is lesser nowadays than it was in the past years and deforestation is the main cause of rainfall variability. People expand cultivated lands and use wood as source of fuel. Many water sources dry up during the dry period forcing women and children to travel longer distances in search of water. Baringo residents should be encouraged to use alternative sources of energy to minimize over-dependence on wood fuel and plant trees.

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