

# Livelihood Vulnerability Assessment in Context of Drought Hazard: A Case Study of Baringo County, Kenya

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**Abstract:** *This study was undertaken in arid and semi-arid county of Baringo which is prone to perennial droughts, with the majority of its population affected by the recurrent. The primary objective of this research is to assess population vulnerability to potential drought risk. The vulnerability assessment was based on 2009 socio-economic data variables. The population vulnerability was processed using poverty rates, population density, and livelihoods. An analytical hierarchy process criterion was used in determining vulnerability using the three socioeconomic variables. The vulnerability analysis results indicate that, 27.87% of the marginal livelihood and 25.62% pastoral livelihood are highly vulnerable. In conclusion, marginal, pastoral, and agro-pastoral livelihoods are highly vulnerable to drought hazard with its population capacities undermined by high poverty rates; in this respect government should promote poverty reduction projects and improved markets infrastructure and access.*

**Keywords:** Vulnerability, Livelihood, Drought, Poverty

## 1. Introduction

Kenya is a drought prone country because of its eco-climatic conditions. The country contains few high potential climate regions of regular annual rainfall average of above 2000mm. approximately 80% of Kenya's land mass is arid and semi-Arid characterized by average annual rainfall of between, 200mm to 500mm per year, and are prone to harsh weather conditions, [11]. Approximately 70% of Kenya's land mass is affected by drought; this covers parts of the Rift Valley, North Eastern, Eastern province, and Coast Province, [13]. Approximately 75% of Kenya's population, earns its living from rain-fed agriculture and due to the vast areas prone to drought, Kenya's vulnerability to food insecurity is the highest among the majority of pastoralist and small scale agriculturalist in arid and semi-arid lands of the country, [12].

Vulnerability according to the Colorado Water Conservation Board, [2] is a condition resulting from social, economic, and environmental factors or processes, which increases susceptibility of agricultural systems to the impact of drought hazard. Vulnerability assessment in context of Baringo County will be assessed based on socioeconomic and environmental indicators such as livelihoods, poverty index and population density. The conflicts experienced by the inhabitants of the northeastern parts of Baringo, mostly the land based and cattle rustling further exacerbate the population vulnerability. The conflicts most often affect livelihood, though the communities involved have since developed coping mechanisms of migration to the safer places as they wait for matters to take root

The Scientific observations, [1] find two main vulnerability approaches; the top-down and bottom-up approach. The Top-down methods of vulnerability assessment involves creation of inventories or indices for specific areas using quantitative indicators of various dimensions. This approach plays a role in understanding relationship between social

vulnerabilities and exposure when combined with climate data. This method however has limitations. The limitations [1] of this method is found to be inadequate to capture full extent heterogeneity of resources in terms of age, ethnicity and income levels as places of poor people tend to be placed at high risk.

The main causes of livelihood vulnerabilities and food security in the case of [8] as reflected by the lessons learned from southern Africa vulnerability initiatives, to be threats or risk resulting from the climate variability, political conflicts, trade liberalizations and burden of infectious diseases. The southern Africa vulnerability initiative approach is based on the interactions between the population both at micro and macro scale, changes in infectious disease trends, climate change, trade liberalization and water management reforms which are likely manifested in household or community as stressors. The exposure to HIV, drought, import competitions, water privatizations, and other shocks from risks such as floods, currency devaluation, and violent conflicts impacts dearly on the [8].

The livelihood vulnerability assessment in context of drought hazard, [10] focuses on interactions between the livelihoods, the livestock population, and availability of pasture and water. The research [8] observes vulnerabilities in context of drought interaction with pastoral livelihood in context of the greater horn of Africa as chronic that can be addressed through livestock initiatives such as destocking, rehabilitation of boreholes or water points as a means of strengthening the pastoral livelihood resilience. The household vulnerability approaches such those in [16] which suggest that agricultural productivity and production, labour availability and land tenure, food storage and processing transportation and distribution population factors and conflicts predispose the household to food insecurity. This approach focuses on agricultural productivity in the livelihood context and socio economic stressors such as conflicts as the critical factors in vulnerability assessment.

Baringo County in Kenya is in arid and semi-arid lands of the Rift valley province of Kenya, it experiences frequent droughts, and drought related losses like any other county situated in the northern regions of Kenya. The livelihoods in Baringo County is primarily pastoral, agro-pastoral, mixed and marginal farming livelihood. The population is experiencing varying levels of vulnerability based on their vulnerability to drought hazard. The livelihoods however are exposed to drought differently due to limited choices. A previous study [3] found that, families who engage in one form of livelihood activity such as farming or livestock keeping only are more vulnerable than those who engaged in various livelihood activities for such as mixed farming, or agro-pastorals. This means that only one form of livelihood leaves the people more exposed, as their coping capacities are limited.

The primary objectives of this research is to evaluate the population vulnerability using a combination of socioeconomic variables such as poverty rates, population densities and livelihoods that increase the exposure to frequent drought hazard in the county. The existing vulnerability assessment method is complex and time consuming as it uses multiple indicators from various stakeholders which take time to assemble hence making it not a reactive tool for vulnerability and drought risk assessment. This research considers the basic socioeconomic variables such as poverty index, population density, and livelihood to determine the vulnerability and the use of Geo-information tools.

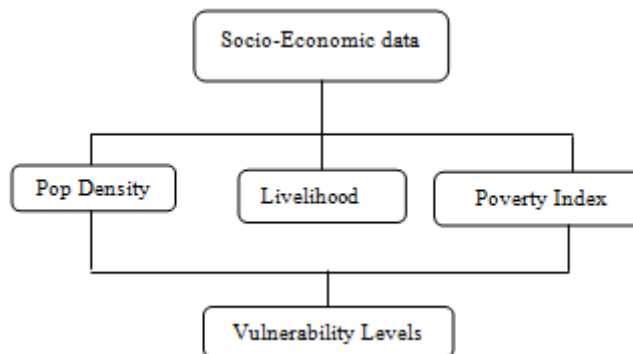
## 2. Methodology

Baringo County is characterized by desert shrubs with drier thorny acacia trees and thorny bushes with small patches of grassland, with temperate forests and evergreen forests composed of semi deciduous bushes and wooded grassland towards the south, [4]. The mean annual zonal rainfall averages between 450 mm to 900 mm to the semi-arid, 800 to 1400 mm in the semi-humid, 1000 to 1600 to the sub-humid zones and 1100 to 2700, [9] with lowland daily mean temperature varies from 15°C to 35 °C [5]. The county population is 555,561 with 60,995 living in urban and poverty rate of 57.4%. [7]. The main livelihood in the study area is made up of the pastoral, agro-pastoral, mixed farming, and marginal farming. The map in figure 1 shows the geographical location of the study area in Kenya. The data used in this research are summarized in table 1 below with the details of products, sources, access link, formats and its spatial resolutions and their frequencies.

**Table 1:** Data sources

Data	Source	Form	An access link
Poverty Index	KIHBS, 2005/6	Vector	www.knbs.or.ke
Population Density	KNBS, 2009	Vector	www.knbs.or.ke
Admin files	RCMRD	Vector	RCMRD, Nairobi.

The research methodology is summarized framework in figure 2 below



**Figure 1:** Research Framework

**Note:** Pop.Density = Population Density;

The research methodology as summarized in the framework in figure 2 where the vulnerability to drought hazard framework is determined by a combination of socioeconomic variables. The vulnerability levels used socioeconomic data variables such as the Livelihoods, Poverty rates and Population density in a geographic Information system is weighted sum analysis.

The analytical hierarchy process (AHP) was applied to determine the weights a variable contributes into the vulnerability assessment. The weights subjected to analytical hierarchical process were sourced from expert's opinion working in the study area and those who are conversant with the subject through dissemination of a questionnaire.

The livelihood is a means by which households obtain and maintain access to the resources necessary to ensure their immediate and long-term survival [14]. Geographical aspects such as climate, soil, topography among others and marketing or trade aspects such as roads proximities to urban centres define a livelihood zone map, which affects consumption by households. Livelihood dynamics such as livelihood recovery in an event of hazard affects the population vulnerability.

The poverty ratings by the Kenya National Bureau of statistics uses the foster-Greer-Thorbecke (FGT), a measure of poverty within an economy that combines information on the extent of poverty as measured by the headcount ratio with the intensity of poverty measured by the total poverty gap. This information provides an indicative measure of population purchasing power parity, and the poor the persons are the vulnerable they may be to the hazards. Population density is the number of persons per square kilometre. The location administrative level data was obtained from Kenya national bureau of statistics [7]. This input variable is very important in determining the population vulnerability to hazard. The vulnerability product was derived using equation 1 below.

Vulnerability = (W) Poverty Index + (W) Livelihood + (W) Population density; (1) Where; W stands for Weights.

## 3. Results

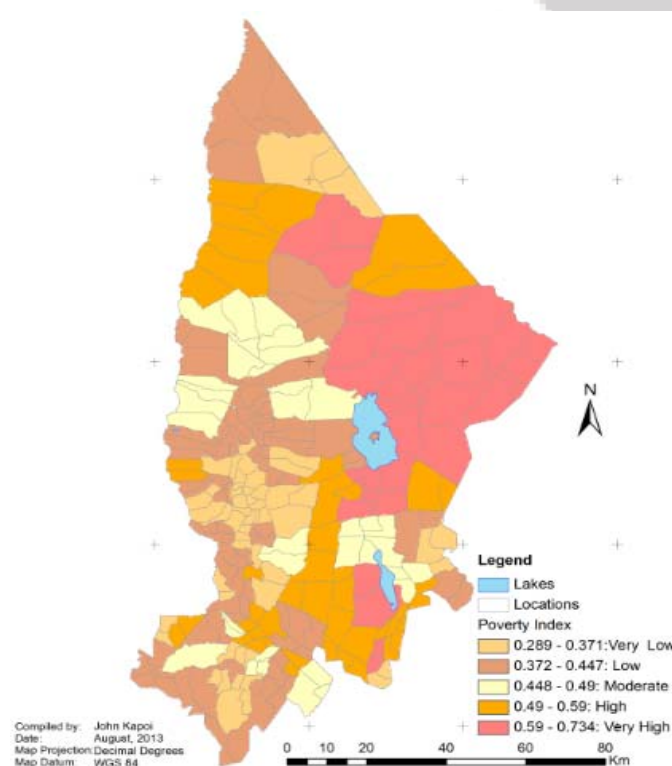
The poverty rates according to the The Foster-Greer-Thorbecke, a measure of poverty within an economy that

combines information on the extent of poverty as measured by the headcount ratio with the intensity of poverty measured by the total poverty gap is summarized in table 2 below.

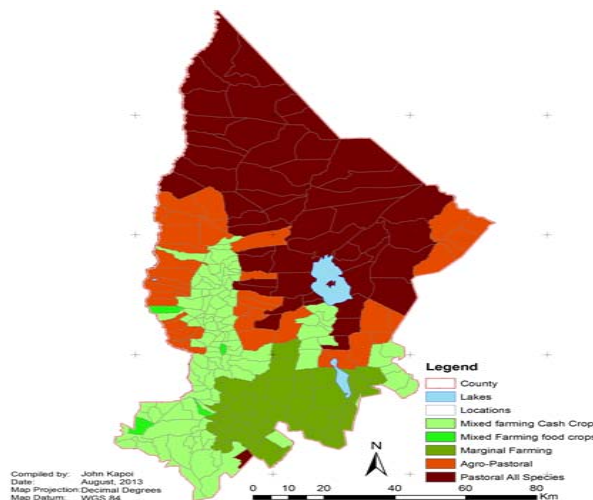
**Table 2:** Livelihood poverty rates

<i>Livelihood analysis</i>				
Poverty levels/index	Pastoral	Agro-Pastoral	Marginal	Mixed
Very Low (0.289-0.371)	7.70%	13.80%	8.30%	26.60%
Low (0.372-0.447)	22.80%	30.60%	14.60%	46.10%
Moderate (0.448-0.49)	8.20%	25.90%	13.00%	17.40%
High (0.50-0.59)	21.80%	12.50%	49.70%	5.20%
Very High (0.60-0.734)	39.50%	17.30%	14.40%	4.80%

The poverty rates were classified into five main classes, as shown by the map in figure 2. Very low, low, high and very high poverty rates. The low poverty rates in the study area ranges between (0.29 to 0.371) at very low classification and (0.372 to 0.447) at low poverty rates while moderate rates are (0.448 to 0.49) and high at (0.50 to 0.59) and very high at (0.60 to 0.734). The livelihood analysis derived from the livelihood map in figure 3 within the same poverty rates (0.49-0.734) indicate that 64.12% of the marginal, 61.3% of Pastoral, 29.8% of agro-pastoral and 9.9% of mixed of the population live in this poverty



**Figure 2:** 2009 Poverty rates map



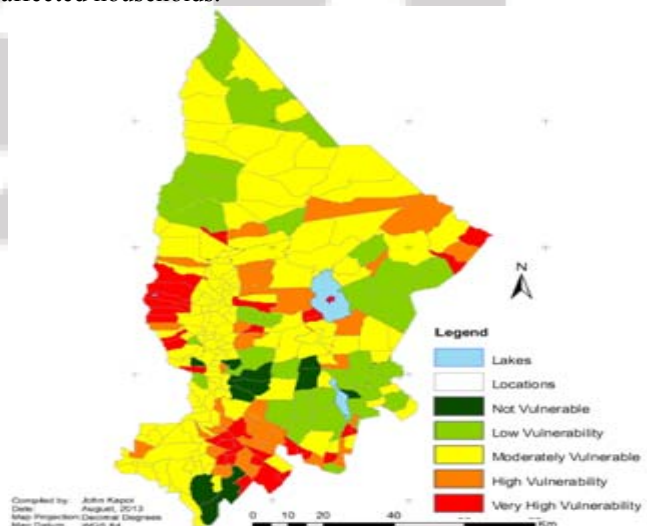
**Figure 3:** Livelihood map

The population vulnerability to hazards based on their capacities in the county as classified in figure 4, is about 20.45% on higher scale, 50.51% moderate, and 29.03% on low vulnerability. The specific livelihood vulnerabilities are at 44.78% for marginal farming livelihood, 31.33% agree-pastoral and 17.03% for pastoral livelihood. The population in pastoral livelihood is less vulnerable due to their coping mechanisms and their low population densities. Table 3 and figure 4 of livelihood vulnerability map shows the vulnerability levels in the livelihoods

**Table 3:** Livelihood vulnerability

<i>Percentages of the vulnerabilities</i>				
Levels	Pastoral	Agro-pastoral	Marginal	Mixed
Not/ Very Low Vulnerability	0.03%	0.12%	1.60%	18.70%
Low Vulnerability	27.70%	28.10%	37.10%	8.10%
Moderately Vulnerable	55.30%	40.50%	16.60%	69.30%
Highly Vulnerable	14.50%	9.30%	25.50%	3.50%
Extremely Vulnerable	2.50%	22.00%	19.30%	0.40%

The analysis of vulnerability analysis indicates that the most highly vulnerable livelihood is marginal farming livelihood. 44.78% of the livelihood are highly vulnerable, 16.58% moderately vulnerable and 38.64% are on low and very low vulnerability making it very difficult to predict the most affected households.



**Figure 4:** Livelihood Vulnerability map

About 31.33% in agro-pastoral livelihood is highly vulnerable with 40.45% and 28.22% moderately and very low to low vulnerability. Pastoral livelihood proportions indicate that 17.03% is highly vulnerable, 55.27% moderately vulnerable and 27.69% lies in low to very low vulnerability. The least vulnerable livelihood in the study area is mixed farming where 3.9% is highly vulnerable with 69.26% under moderate and 26.83% in low and very low vulnerability. Figure 8 shows the map of the vulnerability levels in the study area

#### 4. Conclusion

The research finds pastoral, agro-pastoral and marginal livelihood zone to be highly vulnerable to drought as compared to mixed farming livelihood zones. The vulnerability level is largely influenced by the poverty and high population densities. The socio-economic data used, i.e. poverty rates, livelihood and population densities, provides a basis for future vulnerability and drought risk assessments and applications. This combination of this information will reduce cost of conducting household food security assessment as it narrows the regions affected to very few and specific classes.

The socioeconomic aspects that exacerbate the population vulnerabilities in the livelihoods such as the resource based conflicts on land, water and pasture and the literacy rates has been linked by various studies to be of concern in vulnerability assessment, future research on vulnerability assessment should put this into consideration. The government should promote poverty eradication projects in the area that aims at improved market access and infrastructures such as road networks, enhanced agriculture based services that targets agricultural production through support in breeding for pastoral, farm input subsidies (fertilizers, seeds, farm chemicals and farm mechanization especially in cultivation) to marginal, mixed and agro-pastoral communities

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