

# Assessment and Mapping of Vulnerability Due to Climate Change for Dry Forested Pastoral Ecosystem

Kiambi Gilbert M'mboroki<sup>1</sup>, Shem Wandiga<sup>2</sup> and Silas Odongo Oriaso<sup>3</sup>

<sup>1</sup>Ministry of Agriculture, Livestock Development and Fisheries (State department of livestock). P.O Box 83-60206 kanyakine Kenya.

<sup>2</sup>University Nairobi (Institute of climate change and adaptation).P.O Box 30197-00100 Nairobi Kenya.

<sup>3</sup>University of Nairobi (institute of climate change) P.O. box 30197 Nairobi Kenya.

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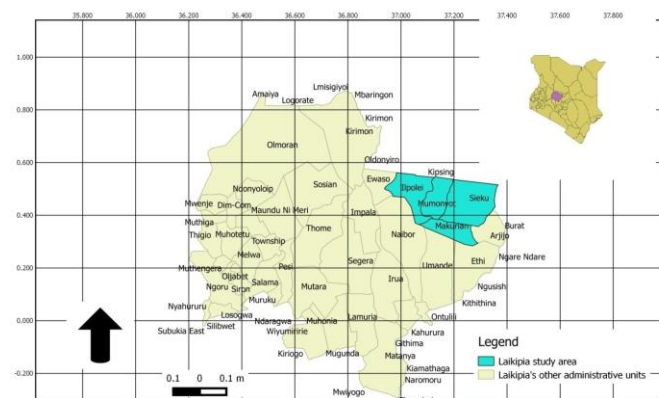
## ABSTRACT

The objective of the study was assessment and mapping of the community villages in order to rank degree of vulnerabilities to climate change. On sensitivity to vulnerability, the majority of the respondents indicated that it was high (59.6%), medium (16.3%) and low (20.8%). of which on response to exposure to vulnerability, the respondents who indicated high (61.7%), medium (24.2%) and low (11.3%). On vulnerabilities in response to adaptive capacity to vulnerability, was high (3.3%), medium (12.5%) and low (81.3%). This study demonstrated that participatory approach of addressing vulnerability to climate change which involved all stakeholders is effective in this dry forested pastoral ecosystem.

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## Introduction

Vulnerability emerged when human beings has to face harmful threat or shock with inadequate capacity to respond effectively. Vulnerability is the degree of exposure to risk (hazard, shock) and uncertainty, and the capacity of households or individuals to prevent, mitigate or cope with risk.



Laikipia map showing Mukogodo East Ward occupied by Yaaku community

Figure 1. A map of Laikipia County showing the study site.

As indicated by [10] that the first step in vulnerability mapping involves the creation of a climate change vulnerability profile, and that Vulnerability to climate change is generally understood to be a function of a range of biophysical and socioeconomic factors; in this study the (biophysical and socioeconomic factors were classified in to five livelihood capitals [5] and political capital to map vulnerability due to climate change. As reported by [8] that Intergovernmental Panel on Climate Change (IPCC) provides

a useful typology suggesting that vulnerability may be characterized as a function of three components: adaptive capacity, sensitivity, and exposure, the same was used by the study but utilised a community managed participatory tool and community respondents opinion on the same to get (sensitivity, exposure and adaptive capacity) to climate change at the community level. Figure 1 below shows the study area.

## Methodology

The study population comprised of 800 households in Mukogodo and Sieku locations in Mukogodo East ward while the sampling frame, from which the study sample was drawn constituted all the households living in the nine villages of these two locations. The unit of analysis was the household and the subject of analysis (the respondent) was the head of the household or their representative.

In each of the nine villages, a list of the households was compiled during the process of community managed disaster and risk reduction (CMDRR) as used by [1], [6], and [4] systematic sampling was used to pick numbers of households (actually about 30 percent of households) from each village [3]. Then random sampling was undertaken among the systematically selected households in each village, to constitute a study sample of 240 households.

Two formulae from [9], and [7] were used for computing the study sample size, but yielded rather large sample sizes that could not be sustained by the available resources for the study. According to [7] a minimum of 100 is recommended for a survey research and gives a reasonable unit for analysis.

[3] Indicated that at least 30% of the total population is representative. Thus, 30% of the accessible population is enough for the sample size. Thus in this study 30% of 800 households was (240) respondents.

Tele:

E-mail address: [soriazwo@gmail.com](mailto:soriazwo@gmail.com)

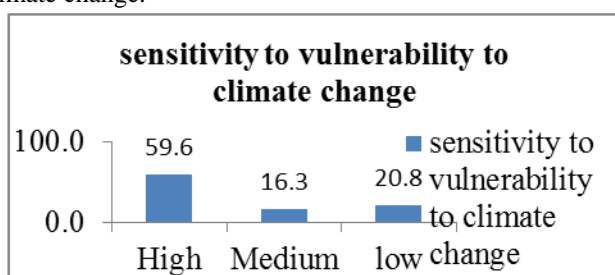
Hence resorting to the provisions of the Statistical Package for the Social Sciences (SPSS) programme, which suggest that any sample size of 200 and above will allow perfect functioning of all the analytical procedures provided by the programme.

Data from social ecological survey was analysed after entry in to Statistical Package for Social Sciences (SPSS) to get the respondents' views of the community vulnerability for the last the three decades. During the (CMDRR) exercise vulnerability assessment was undertaken based on sensitivity, exposure and adaptive capacity of the community and then geo position of the nine villages recorded using geographical positioning system (GPS) and map drawn with assistance of ArcGis.

### Results and discussions

Discussion were accomplished through use of respective selected indicators such as key impacts and corresponding vulnerabilities, sensitivity to vulnerability, exposure to vulnerability, Capacity developments initiatives and underlying courses of vulnerability to climate change.

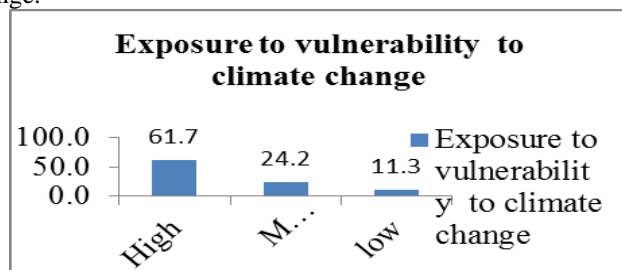
Figure 2 below shows sensitivity to vulnerability to climate change.



**Figure 2. Sensitivity to vulnerability to climate change.**

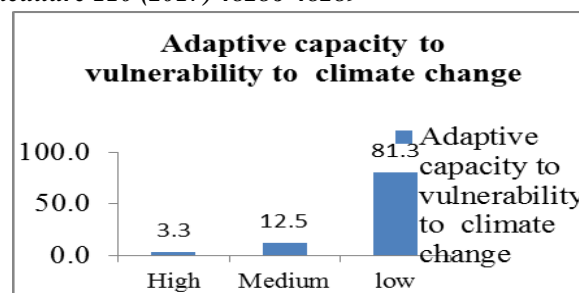
As indicated in Figure 2, Climate change vulnerability was assessed by sought of opinion of the respondents on the key impacts of climate change and their corresponding vulnerabilities in response to sensitivity to vulnerability, which was high (59.6%), medium (16.3%) and low (20.8%). When the sensitivity to vulnerability to climate change impact is high, then the community is highly susceptible to the impacts of climate change and disaster risk reduction and contingency plans needed to be in place.

Figure 3 below shows exposure to vulnerability to climate change.



**Figure 3. Exposure to vulnerability to climate change.**

Vulnerability was assessed by sought of opinion of the respondents on the key impacts of climate change and their corresponding vulnerabilities in response to exposure to vulnerability, which was high (61.7%), medium (24.2%) and low (11.3%). When the exposure to vulnerability to climate change impact is high, then the community is highly susceptible to the impacts of climate change and disaster risk reduction and contingency plans needed to be in place. Figure 4 below shows adaptive capacity to vulnerability to climate change.

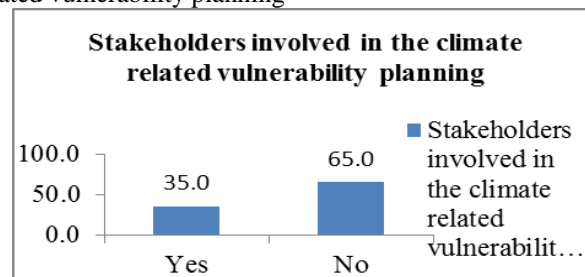


**Figure 4. Adaptive to vulnerability to climate change.**

As indicated in Figure 4, Climate change vulnerability was assessed by sought of opinion of the respondents on the key impacts of climate change and their corresponding vulnerabilities in response to adaptive capacity to vulnerability, which was high (3.3%), medium (12.5%) and low (81.3%). When the adaptive capacity to vulnerability to climate change impacts is low, then the community is highly susceptible to the impacts of climate change and disaster risk reduction and contingency plans needed to be in place.

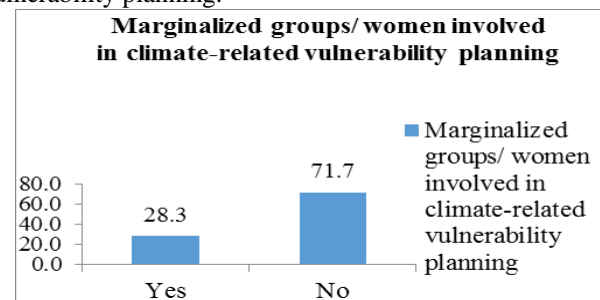
If sensitivity is high, while exposure is high and adaptive capacities high then the community internal response mechanism are enough to address the climate change impact. Many scenarios presents them self but the address is based on the situation at hand for each climate change impact.

Figure 5 below shows stakeholder involved in climate change related vulnerability planning.



**Figure 5. Stakeholders involved in the climate related vulnerability planning.**

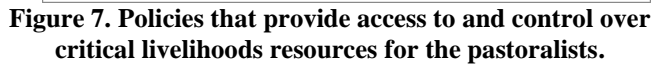
As indicated in Figure 5, 65.0% of the respondents gave their opinion that there were no involvement of stakeholders in the climate change related vulnerability planning. According to these results the community stake holders, were not involved in climate change vulnerability planning and therefore the study had to do so in the CMDRR exercise of which the composition of the participants. Figure 6 below shows marginalized and women involved in climate related vulnerability planning.



**Figure 6. Marginalized groups and women involved in the above planning.**

As indicated in Figure 6, 71.7% of the respondents gave their opinion that there were no involvement of marginalized groups and women in the climate change related vulnerability planning. According to these results the community marginalized groups and women, were not involved in climate change vulnerability planning and therefore the study had to

Figure 7 below shows policies that provide access to and control over critical livelihoods resources for pastoralists



The policies to guide on access and control of resources was said not to be in place but the study had no time and resource to undertake the task however recommendations are made to county and national government to undertake policy development on access and control of livelihoods resources for pastoralists. Figure 8 below shows vulnerability groups influence over factors that constrains the adaptive capacity.



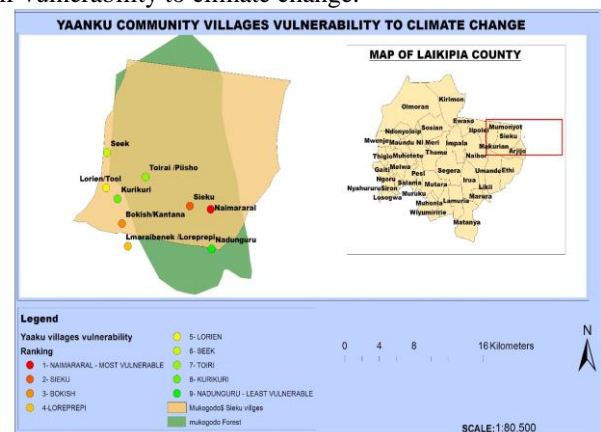
As indicated in Figure 8, 72.5% of the respondents gave their opinion that there were no vulnerable groups influence over factors that constrain the adaptive capacity. Therefore there was room to improve adaptive capacity to impacts of climate change of the community by proposal of various intervention to address issues of climate change in the community. Some of the intervention agreed at focus group discussion(CMDRR) were: provision of ideal livestock breeds for the forested ecosystem, provision of water accessible water both for livestock and human use, diversification of livelihoods as alternative source of income, a systematic off take and marketing system for sale of livestock that has efficient and effective flow of market information, provision of enough feed reserves for livestock and food for human.

Response	Percentage
Yes	26.3
No	73.8

**Figure 9. Existence of vulnerability maps for the current and under a changing climate.**

Identification done on what elements were at risk because of the exposure of their location to the climate change. The location of the element at risk (the rich and poor houses) determined the degree of exposure to climate change or the degree of vulnerability. That indicated that whether rich or poor, all persons who lived in that location had equal degree of vulnerability to the impact of climate change. The class elements were as listed below;

Elements; Men, Women, Children, Youth, Elderly, people living with disability (PLWD) and People living with HIV&Aids. Table 1 below shows village's ranked in order of their vulnerability to climate change.



**Figure 10. Map of vulnerability to climate change impacts of Yaaku villages.**

**Table 1. Ranking of villages on vulnerability to climate change.**

[illegible]

As indicated in the Figure 10, the villages are mapped for ease of identification and location. The vulnerability mapping of villages is based on a drought situation in assumption that even if the forested pastoral community moves in search of livestock feed and water during drought, the women and children with few milking herd are left at the village.

The capacities are a combination of all the strengths and resources available within a community, society or organizations that can help reduce the level of risk or effects of a disaster. Capacity included physical, social, institutional, political or economic means as well as skilled personal or collective attributes such as leadership and management (livelihood frame works capital plus The capacities are a combination of all the strengths and resources available within a community, society or organizations that can help reduce the level of risk or effects of a disaster. Capacity included physical, social, institutional, political or economic means as well as skilled personal or collective attributes such as leadership and management (livelihood frame works capital plus political capital) It identified the status of people's coping strategies which referred to the resources available for preparedness, mitigation and emergency response, as well as to who had access and control over those resources.

### Conclusions

It has been demonstrated that a participatory approach of addressing vulnerability to climate change which involves all stakeholders is effective in this forested pastoral community. Because it identified hazards and priorities them. Identified which villages of that community are more or less vulnerable than others for policy, planning for assistance purpose. Mapped the areas of vulnerability and give the strength or capacity of the community in relation to the hazard which is climate change.

Many climate change vulnerability scholars have drawn linkages between the capitals or entitlements (livelihood resources or assets) and adaptive capacity, particularly as it relates to social capital [2] and [11].

Therefore a methodology of priorities of projects which were to help address climate change impacts were ranked as: Provision of adequate safe water programmes, livelihood diversification programmes example beekeeping, pasture production & storage programmes, reseedling programmes, environmental conservation programmes, livestock disease control programmes, modern livestock market programmes, livestock breeds improvement programmes, grazing management and stocking rates programmes, Food preservation or cottage industries programmes afforestation programmes, affordable boarding schools programmes, road network or Infrastructure programmes, health facilities and personnel programmes and Structured community organizations or systems or social networks programmes

### Recommendations

To solicit funds for addressing vulnerability due to climate change : The community should use the (CMDRR)

report to solicit assistance from national, county government and other stake holders to help address climate change impacts in the pastoral forested ecosystem.

To address future climate change impacts: The community, governments and other stakeholders need have vulnerability maps, to help in targeting the most vulnerable when distributing relieve resources to communities.

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