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Household Indigenous Drought Coping and Adaptation Strategies in Baringo County, Kenya

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Authors' contributions

This work was carried out in collaboration among all authors. Author MMP carried out the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors FN and EM read, strengthened and approved this final manuscript for publication.

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ABSTRACT

Coping and adaptation to the impacts of climate change such as drought is increasingly necessary. Due to the expanding global impacts of climate change coping and adaptation agenda among various agencies, it is of primary importance to understand the coping and adaptation strategies in order to generate the most appropriate and effective interventions. The study established drought coping and adaptation strategies employed by households in Baringo County and this was based on Pressure and Release (PAR) model which grounds the framework for understanding vulnerability to disasters and adaptation. The 224 household heads were selected by simple random sampling out of which 204 completed the questionnaire. The study adopted description research design. Data was analyzed by both descriptive and qualitative statistics where the SPSS package version 22 was used in the analysis where the chi – square and percentages were obtained. The study established that households had various drought coping and adaptation strategies where 77 (37.7%) informed the study that during drought season they normally shift to other ways or sources of livelihoods, herd splitting were 58 (28.4%) while 44 (21.6%) do herd and

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crop diversification. A calculated chi – square (χ^2 =79.186, p–value=0.000 df=4) of the main coping mechanisms indicated that the variation was statistically significant. The study provided baseline information for further research. However, there is need for outside intervention or strategies for effectiveness since the community does not have well laid down strategies for climate change coping and adaptation.

Keywords: Climate change; coping; adaptation; households; drought.

1. INTRODUCTION

According to this study, Climate Change referred to the change in the traditional mean climatic condition of the global environment. It can be detected from observed year to year changes in the space time characteristics of weather parameters while drought meant a prolonged period of time of abnormally low or no rainfall that leads to water shortage.

Humans have long been adapting to climate change and variability in diverse ways such as migrating from habitats experiencing harsh environmental conditions, altering agricultural patterns and changing livelihood strategies [1]. Historically they have seemingly been successful in adapting to changes in the climate. However, the records of collapsed communities reveal that coping and /or adapting to climate change has got its limits [2,3].

Common adaptation methods in agriculture include use of new crop varieties and livestock species that are better suited to drier conditions, irrigation, crop diversification, adoption of mixed crop and livestock farming systems, and changing planting dates [4]. Other studies have attempted to analyze the impact of climate change and factors affecting the choice of adaptation methods in crop, livestock and mixed crop livestock production systems in Africa at regional level [4]. However they have a limitation on drought coping and adaptation strategies employed at household level.

According to [5] Farmers continuously adapt to climate variability at the local level. They change crops or varieties, choose different harvest and sowing dates, alter land management and employ water efficiency techniques. [6] notes that national and international levels, governments and development agencies must play a fundamental role in building the capacity of farmers to cope with and adapt to a changing environment. This is limited to farmers only hence leaving out pastoralists and the communities in arid and semi – arid areas.

According to [7,8] communities that live remotely in dry lands are expected to have experience in dealing with uncertain, arid conditions and many have therefore developed beneficial practices that enable resilience and build adaptive capacity. However, the scholars only mentioned experience but did not address coping and adaptation some of the strategies employed that should be employed by communities affected by climate change. Baringo County being one of the counties in Kenya majorly affected by drought and the residents are mainly pastoralists, there was need to establish the drought coping and adaptation strategies embraced by the community.

2. METHODOLOGY

2.1 Study Area

Baringo County is one of the 47 Counties in Kenya. It is situated in the Rift Valley region. It borders Turkana and Samburu Counties to the north, Laikipia to the East, Nakuru and Kericho to the south, Uasin Gishu to the southwest, and Elgeyo-Marakwet and West Pokot to the west [9]. It is located between longitudes $35^0\ 30^l$ and $36^0\ 30^l$ east and between latitude $0^0\ 10^l$ and $1^0\ 40^l$ south. The Equator cuts across the County at the southern part. Baringo covers an area of 11,015.3 sq. km of which 165 sq km is covered by surface water; Lake Baringo, Lake Bogoria, and Lake Kamnarok [10]. The research mainly covered three sub – counties of Baringo County and these were; Mogotio, Eldama Ravine and Baringo South. Fig. 1 shows a map of Baringo County which was the study area.

The climate of Baringo County varies from humid highland to arid lowland. Overall, Baringo is classified as arid, as it receives an annual rainfall of 350mm to 600mm in the drier lowlands and 1,000mm to 1,500 mm in the highlands [9]. The rains fall twice annually, the long rains from March to May and the short rains from August to November. The rains are more unreliable in the arid areas, with an intra –year coefficient of variation of more than 50 percent throughout the county, and with peaks of more than 80 percent in the driest part.

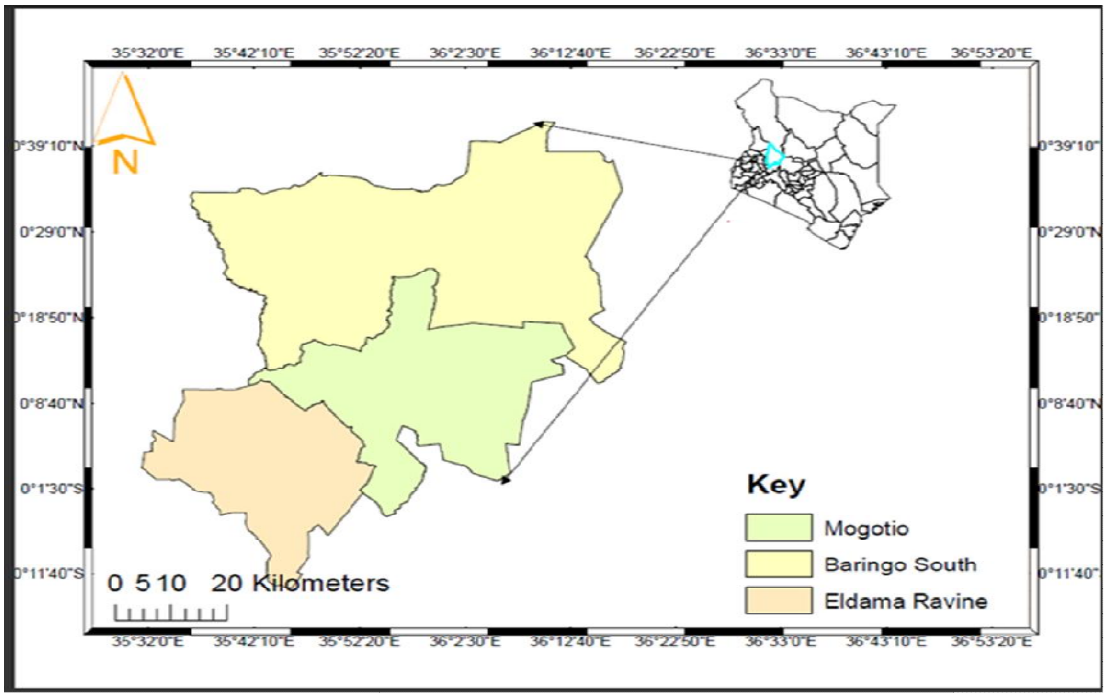

Fig. 1. Map of Mogotio, Eldama Ravine and Baringo South sub – counties

2.2 Research Design

The study adopted description research design. According to [11] descriptive research design allows the description of a given phenomenon "what exists" with respect to variables or conditions in a situation. This design relies on both primary and secondary sources of data. For the purpose of this study, descriptive research design was used to obtain a picture of the coping and adaptation strategies embraced by the residents during drought seasons.

2.3 Sampling Methods and Data Collection

The sample size determination was as shown in Equation 1. This is according to [12] who asserts that in most surveys or experiments, a coefficient of variation in the range of 21% to 30% and a standard error in the range 2% to 5% is usually acceptable. Therefore a coefficient of variation of 30% and a standard error of 2% was used. The higher limit for coefficient of variation and standard error was selected so as to ensure low variability in the sample and minimize the degree or error.

$$S = \frac{N(Cv)^2}{(Cv)^2 + (N-1)e^2} \quad (1)$$

where,

S = the sample size
N = the population size
Cv = the Coefficient of Variation
e = standard error

Therefore, the sample size was determined using the formula:

$$S \text{ (From73, 747 HHs)} = \frac{73{,}747\,(0.30^2)}{0.3^2 + (73747-1)0.02^2} = 222.$$

73 = 223 households

The data collection methods for this research included both the quantitative and qualitative methods. In qualitative data collection, observations and field notes were chronologically recorded to draw a single conclusion. The qualitative data collection methods that were used in this research included; questionnaires, observation, in-depth interviews, key informant schedules and focus group discussions. Since each method is particularly suited for obtaining a specific type of primary data. During data collection 204 questionnaires were completed and returned out of 223 questionnaires. The deficit was addressed through the focus group discussions and the interview schedules making the data reliable.

3. RESULTS AND DISCUSSION

3.1 Pattern of Extreme Climatic Events in Baringo County

The study sought to find out the views of the household heads on the pattern of the extreme climatic events in Baringo County. The household respondents were asked to state the rainfall, diseases and drought pattern of Baringo County for the past 30 years. The findings were recorded in the Table 1.

The findings in Table 1 from household heads show that majority of the respondents 121 (59.3%) informed the study that droughts have been frequent in Baringo in the past two decades. 23 (11.3%) of the household heads informed the study that droughts have been less frequent while 9 (4.4%) indicated that the pattern had remained unchanged. A Chi Square test of($\chi^2_{3,0.01} = 146.039$) carried out on the views of the household heads on the pattern of drought in the study area revealed that it was highly significant (P<0.01).

This was in agreement with the focus group discussants who informed the study that droughts in Baringo County have been frequent as compared to 30 years ago. The participants of one of the focus group discussions (FGD) were in agreement with the following statement made by one of them;

When I was young the rains were quite predictable and we all knew the time for the long and short raining season but now the rain comes earlier or late or even some times fails to come completely. We now experience failed raining seasons (droughts) at least once every two years in this area that has affected the farmers and livestock keepers system (Field Data, 2018)

This was in agreement with [13] who reported that there is increase in the frequency of drought in Arid and Semi – Arid Lands (ASALs) in Kenya and its impact on the livelihood of pastoralist living in the area.

Table 1 further indicates the views of the household heads on the pattern of rainfall in Baringo County. The respondents were asked to state how the lengths of the rain seasons have changed in the past three decades. The findings in Table 1 indicates that majority of the respondents 149 (73.0%) stated that the lengths of the rains seasons have decreased which means an increase in the drought seasons. 14 (6.9%) of the respondents informed the study that the length of the rain seasons have increased while 6 (2.9%) of the household heads indicated that the length of the rain seasons have rained the same. This was in agreement with most of the focus group discussions which revealed that indeed there has been a decrease in the length of the rain season. The National Drought Management Authority (NDMA) Director Baringo County during the interview schedule said:-

The shortening of the rain season was a result of climate change and this has made most parts of Baringo County to be food insecure (Field Data, 2018).

Table 1. Household views on the pattern of climate events in Baringo County

Climatic event	Pattern	N =204	Percentage	χ^2	P - Value
Drought	Frequent	121	59.3	146.039	0.000***
	Less frequent	23	11.3		
	Unchanged	9	4.4		
	Not sure	51	25.0		
Floods	Frequent	116	56.9	112.706	0.000***
	Less frequent	26	12.7		
	Unchanged	24	11.8		
	Not sure	38	18.6		
Temperature	Increase	112	54.9	110.824	0.000***
	Constant	22	10.9		
	Decrease	18	8.8		
	Not sure	52	25.5		
Rainfall	Increase	14	6.9	259.882	0.000***
	Constant	6	2.9		
	Decrease	149	73.0		
	Not sure	35	17.2		

(Field Data, 2018)

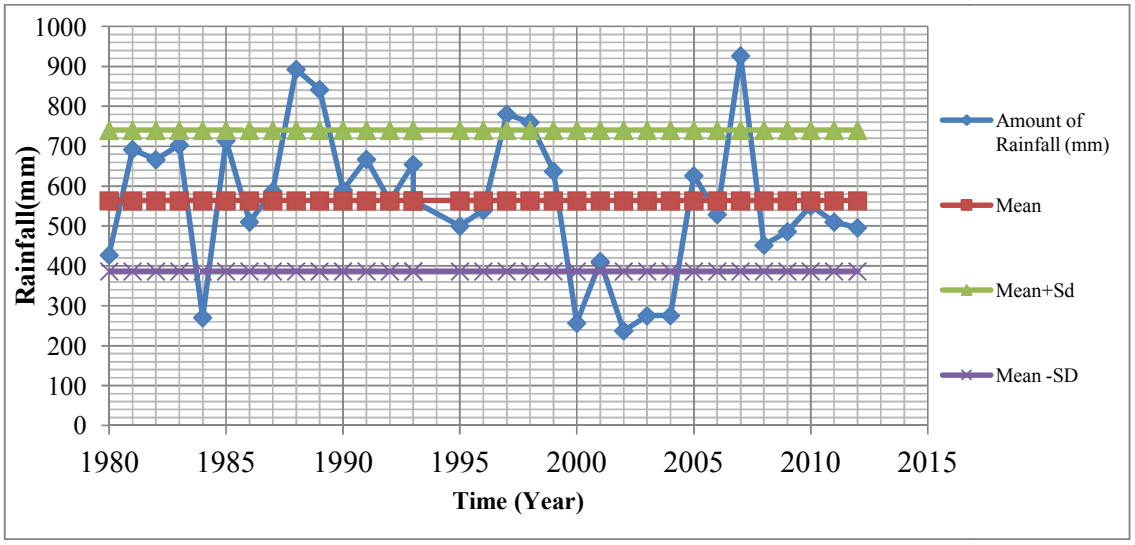

Fig. 2. Average amount of rainfall in Baringo county for the period of 1980 to 2012 (Kenya Meteorological Department (KMD), Field Data, 2018)

Fig. 2 shows the average amount of rainfall in Baringo County for the period between January 1980 and December 2012. The data was obtained from Kenya Meteorological Department (KMD) Baringo County office.

Fig. 2 indicates mean rainfall which shows the normal dry season in Baringo County. The County being an ASAL receives moderately low rainfall. The (Mean + SD) shows the amount of rainfall received in Baringo County that is above the mean rainfall which signifies wet periods of Baringo County. Fig. 2 also indicates (mean – SD) which shows the dry seasons (drought) and this is the region below the mean rainfall which as per the figure has been more frequent in the recent past. This reveals a decrease in the amount of rainfall which has been attributed to by climate change in Baringo County.

3.2 Effects of Drought on Households in Baringo County

The study sought to establish the effects of drought in Baringo County. The household heads were asked to state if they have ever experienced the impact of drought. Several respondents recounted to have experienced drought impacts as shown in Fig. 3.

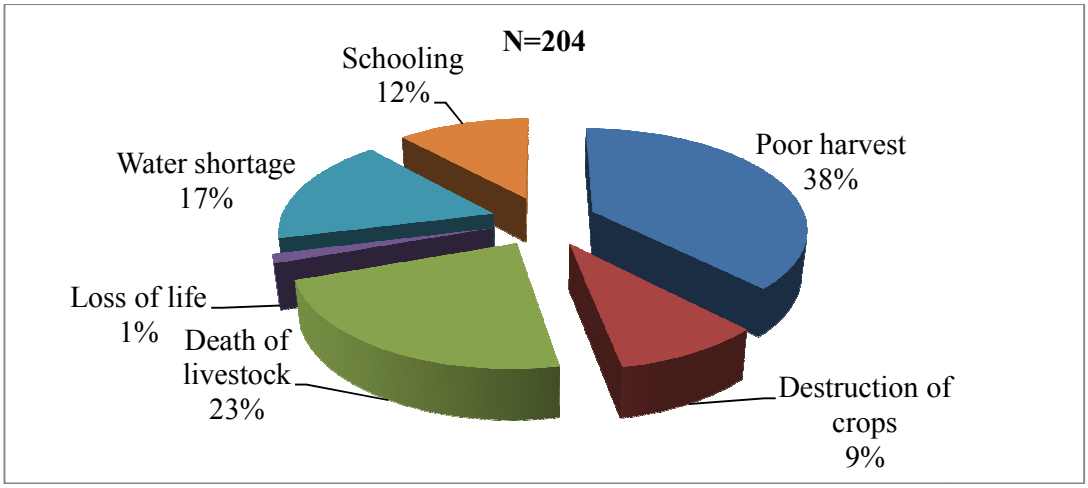

Fig. 3. Effect of drought on households in Baringo County (Field Data, 2018)

From the findings in Fig. 3, majority of the household respondents 77 (37.75%) reported to have experienced poor harvest while 47 (22.55%) reported to have lost their livestock. When asked further to specify the type of livestock they have been losing during drought the respondents indicated that most of the animals affected by drought were domestic animals like cattle, goats and sheep. The affected domestic animals form the livelihood of the majority of the inhabitants of Baringo County as they rely heavily on the livestock for their daily living. This is because majority of the inhabitants are pastoralists while others practice mixed farming. About 35 (17.16%) of the respondents informed the study that they have experienced water shortage due to drought and they are forced always to walk for a long distance to get water for domestic use. A number of the household heads informed the study that drought has been affecting the schooling of their children 24 (11.76%) due to migration looking for pasture. About 19 (9.31%) indicated destruction of crops while 3 (1.47%) households informed the study that drought in Baringo County has led to loss of their family members. Most Focus group discussants agreed with this statement from one of the FGDs.

The occurrence of drought in this region has had a lot of destruction to farms and death to animals and even people; it is now becoming a 'common/normal' phenomenon due to climatic pattern (Field Data, 2018).

This was in agreement with the interview schedule with the Team Leaders of Kenya Red – Cross and World Vision Baringo County who informed the study that drought has been very common in the County at least every year they have to offer relief food aid. However, the intensity of the drought periods differs yearly.

3.3 The Main Drought Coping Strategies Employed by Households in Baringo County

The study also established the main coping mechanisms that respondents adopt during drought seasons in Baringo County. The household heads were then asked to indicate their main indigenous drought coping strategies employed. Table 2 indicates the coping strategies.

Majority of the household respondents 77 (37.7%) informed the study that during drought season they normally shift to other ways or sources of livelihoods. A calculated chi – square (χ^2 = 79.186, p – value=0.000 df=4) of the main coping mechanisms for drought by the household respondents indicated that the variation was statistically significant. This is agreement with [14] observed that various pastoral groups have for decades explored a wide range of income-earning opportunities, and are taken up on a more intense basis to adapt with drought effects. Fishing, fuel wood and charcoal trading activities were highly preferred as sources of income by households during drought season.

Table 2. Main indigenous coping mechanisms for drought in Baringo County

	Frequency	Percent
Mobility	15	7.4
Herd and Crop Diversification	44	21.6
Herd Splitting	58	28.4
Livelihood Diversification	77	37.7
No Coping Strategy	10	4.9
Total	204	100.0

Chi Square value is statistically significant if p<0.01
(Field data, 2018)

Those household heads that indicated that their main drought coping strategy was herd splitting were 58 (28.4%). This is a strategy where herds are split among the family members and other kinsmen. Sharing of livestock among family, clans and friends is highly practiced by the many households in the study area an indication of strong social capital. This in tandem with [15] who asserts that sharing of livestock within kinship networks, where animals are borrowed for subsistence purposes and reproduction is common in many pastoral societies and acts as a form of insurance for poorer households, as well as a way for wealthier households to spread risks and ensure a supply of herding labour. This is in agreement with most of the FGDs where the respondents informed the study that the main purpose of this strategy is to enhance accumulation and survival of livestock through breeding and reproduction. It also allows the members of the poor households to engage in other productive and income generating activities. In the long run, even though the poor households engage in other livelihood activities, this strategy ensures that they do not drop out of pastoral livelihood.

According to [16] diversification of livelihood activities into off-farm activities is increasingly employed to reduce dependence on subsistence agriculture and increase resilience to uncertain

rainfall regimes. This corroborates with [17] that notes likewise, the diversification of crops and animals has been undertaken to increase adaptive capacity in agricultural production.

Table 2 illustrate that 44 (21.6%) of the household respondents informed the study their main indigenous drought coping strategy is herd and crop diversification. By observation the study established that most household had more than one type of crop and livestock. This corroborates with [18] who noted that pastoralists have for decades diversified livestock species in their herd taking into account that there are species well suited in arid environments and are more resilient to drought.

Those households that had adopted mobility or migration as their main drought coping mechanism were 15 (7.4%). This is a strategy that has been in practice for a long time, alluded the chiefs and sub - chiefs. The focus group discussants informed the study that migration or mobility looking for pasture and water for animals has been a major source of conflict in the Baringo County which was alluded to by all the key informants. The focus group discussants informed the study that in some cases the pastoralists are forced to have herds concentrated in one small area leaving large tracks of land unused and not occupied just for the safety of their herds. This was also alluded to by [19] who noted that in some parts of eastern and north eastern Provinces of Kenya which were not used due to conflicts.

[20] found that in the dry lands the government has focused on peace building from below'; involving communities in maintaining and negotiating peace, but not addressing the real cause of conflict; the resources by developing climate change adaptation and coping strategies. Similarly, [18] noted that mobility is a prominent livelihood strategy employed by pastoralists in anticipation of seasonal or annual changes of pasture and water availability.

The study also sought to establish if there was change in terms of food diversity because of drought. The household respondents were asked to indicate if they have had any diversity in food and the findings are as shown in Fig. 4.

The finding in Fig. 4 indicates that majority of the households, 103 (50.5%) had no change in food diversity, 53 (26%) indicated that they had more food diversity while 33 (16.2%) had less food diversity. This was in agreement with the interview schedule of the Team Leaders of Kenya Red – Cross and World Vision Baringo County branches who informed the study that most households do not have food diversity and this has led to food related diseases. However this was in disagreement with the focus group discussants in Eldama Ravine Sub – County who informed the study that their food diversity have not changed, in fact other discussants indicated that for them there have had more food diversity. Most focus group discussions in Eldama Ravine Sub – County ended with an agreement on food diversity. But the focus group discussants in Mogotio and Baringo South Sub – Counties were in agreement that the change in food diversity was very minimal if any. They cited poverty and lack of proper education being the main contributing factor.

Plate 1. Showing one of the focus group discussion carried out by the researcher (Field Data, 2018)

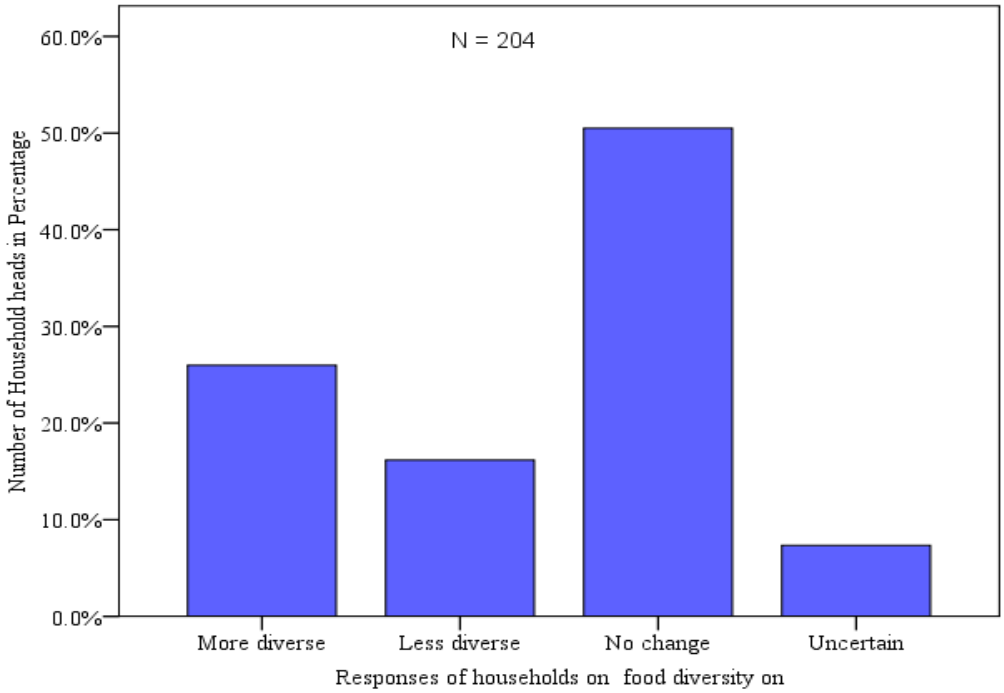

Fig. 4. Showing household responses on food diversity (Field Data, 2018)

4. CONCLUSION

Further, the study established that communities have indigenous climate change coping and adaptation strategies. For instance in Baringo County, during drought or reduced precipitation the community normally shift to other ways or sources of livelihoods, split the herd, move from place to place looking for pasture while other have no coping strategy. However, some of the coping and adaptation strategies have not been effective. This clearly shows that with changes in the climate every household or community is striving to cope or / and adapt to drought. However, the drought coping and adaptation strategies require support.

5. RECOMMENDATION

Despite of the community coping and adaptation strategies, there is need for outside intervention from humanitarian agencies, the County and National governments or rather all stakeholders in the field of emergency management and climate change advocacy. This will enhance effectiveness in addressing climate change since the community does not have well laid down strategies for climate change coping and adaptation. The community coping and adaptation strategies should be evaluated and those that are environment friendly should be upheld while those that that exacerbate climate change should be discouraged.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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