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Impact of Climate Change on Pastoralists Access to Forage and Water in Kajiado South Sub County

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Abstract

Though an important way of life for several ethnic groups living in arid and semi-arid areas of Kenya, pastoralism now faces immense challenges emanating from variability in climate. Different climate issues such as prolonged droughts have resulted to reduced precipitation which has equally led to water shortages and reduced quantities of pasture adversely impacting on pastoralism. Specifically this study investigated the influence of; pastoralists' access to forage and pastoralists' access to water in Kajiado South Sub County. The study picked upon descriptive survey research design. Research target population was; Staff at Agriculture, Livestock and Fisheries Department, County Assembly of Kajiado Staff and Managers working for Civil Society Organizations (CSOs). The sample size was of 23 Staff at Agriculture, Livestock and Fisheries Department, 42 County Assembly of Kajiado Staff and 40 Managers working for CSOs that were singled out to participate in the study. Stratified and simple random sampling techniques were applied to single out sampled subjects. Questionnaires were employed in the gathering of data from all the study's sampled subjects in the study area. Data was analyzed qualitatively and quantitatively making use of SPSS version 20.0. Based on study findings, a substantive number of the respondents as shown by a mean of 53.9% (Mean= 4.12) agreed climate change has an impact on pastoral access to forage in the form of shortage of pasture in Kajiado South Sub County. Further, the results of the research demonstrated climate change has an impact on pastoral access to water in the form of increased

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demand for water and mobility distances in Kajiado South Sub County as illustrated by a mean of 50.7% (Mean=3.99). The study concluded climate had presented an adverse impact on the quantity and quality of pasture and water accessible to pastoralists. From the research findings the study recommended that there was need to develop partnerships between county governments and civil society organizations (CSOs) in addressing pasture and water shortages experienced by pastoral communities through the drilling of boreholes and construction of water pans.

Keywords: *Climate Change, Pastoralists, Access, Forage, Water, Impact, Kajiado South*

1.1 Background to the Study

Though not a universally agreed upon definition, climate change refers to long-term variations in the statistical circulation of weather patterns for instance rainfall and temperatures over a duration of decades to million years (Werndl, 2016). Pastoralism is defined as the way of life that entails movement of persons and their livestock in search of forage and water (Mounet &Turquin, 2014). Scholars in South America have reported on different impact levels brought about by climate change on pastoralism. In Peru, López-i-Gelats *et al.,* (2015) reported on dissimilar negative impacts on access to forage and water resulting from variability in climate that had presented an adverse impact on pastoralism. In Bolivia, Valdivia, Gilles and Turin (2013) reported that climate change had presented an adverse impact on pastoralists' access to forage and water and had also subsequently intensified their socio-economic vulnerabilities.

Further, Angón *et al.,* (2015) observed local pastoral communities had successfully employed adaptation strategies that minimized the negative impact of climate change on pastoralism in Argentina. In Asia, several scholars have also found evidence on divergent impact of climate change on pastoral communities in rural areas of various countries. In Pakistan, Joshi *et al.,* (2013) reported that climate change has had a significant adverse impact on pastoralists' access to forage and water thereby impact on pastoralism negatively. In Mongolia, Batsuuri and Wang (2017) reported that climate change had presented a significant adverse impact on pastoralists' access to forage and water. Different scholars in Africa have reported on the dissimilar impact of climate change on pastoralism in major rural areas of several countries. In Mali, Oyekale (2014) similarly reported climate change had adversely impacted on pastoralists' access to water and forage greatly impacting on pastoralism.

In South Africa, Browning (2011) reported that climate change had a negative impact on pastoralism in terms of access to forage and water forcing most of them to reconsider its viability. In Sudan, Maalla, Abakar, Hamdi and Maruod (2015) observed climate change had negatively impacted on pastoralists' access to forage and water resulting to an adverse effect on pastoralism. In Kenya, Lelenguyah (2013) reported on variability of climate on the livelihoods of pastoralists in Baringo County and extended the scope of his study to the pastoralists' perception of climate change. Kajiado South Sub- County has a cool dry climate with mean annual temperatures over most of the Sub-county being around 21°C; although the northwestern corner near has higher mean annual temperatures of 23°C to 25°C. Annual average rainfall ranges from as low as 300mm, although most of the county receives an average of between 500mm and 750mm annually. It is

therefore a drought prone county and this is the main hazard to agriculture as it causes crop loses, livestock emaciation and their eventual death.

1.2 Statement of the Problem

Despite its substantive contribution to food security goals in Kenya, pastoralism still faces a myriad of unaddressed challenges. Key among these challenges is variability in climate that makes it extremely difficult for pastoralists to access key resources such as water and forage that are vital for the survival of their livestock. Pastoralists in Kajiado County are not exempted from these challenges. According to a report by the Center for Minority Rights Development (CEMIRIDE), the 2017 drought led to the death of 232,400 cows in Kajiado County with an estimated 23.5% of this owned by pastoralists in Kajiado South. Further, according to a report by the Kenya Agricultural and Livestock Research Organization (KALRO), over 47% of pastoralists' livestock died in Kajiado County due to emaciation caused by the 2016/2017 drought (KALRO, 2017).

Similarly, the National Drought Management Authority (NDMA) observed within the same period an estimated 70% to 80% of livestock had been moved by pastoralists to Chyulu Hills National Park in search of water and forage emanating from shortages experienced in Kajiado South sub-county as a result of drought (National Drought Early Warning Bulletin, 2017). Specifically, according to 2017 reports by the NDMA Kajiado South sub-county was due to fluctuating precipitation during the long rains of the same year under severe vegetation. The current research therefore sought to investigate the ramifications of climate change on pastoralism in Kajiado South sub-county. The focus of the research was however to investigate impact of climate variability on; pastoralists access to forage and water in Kajiado South Sub County.

1.3 Objectives of the Study

i. To examine the impact of climate change on pastoralists access to forage in Kajiado South Sub County
ii. To determine the impact of climate change on pastoralists access to water in Kajiado South Sub County

1.4 Research Questions

i. What is the impact of climate change on pastoralists' access to forage in Kajiado South Sub County?
ii. What extent does climate change impact on pastoralists' access to water in Kajiado South Sub County?

2.0 Literature Review

2.1 Theoretical Literature Review

Cultural Theory of Risk (CTR)

Formally composed by Douglas (1966), the Cultural Theory of Risk (CTR) is anchored on the premise that culture guides individuals' understanding of hazards, resolution and actions taken.

Further, Douglas and Wildavsky (1982) asserts CTR maintains that there exists four (4) rival perspectives including; hierarchist, fatalist, egalitarian and individualists which work as culturally guided categorization networks enabling individuals select perceptions of specific hazards to familiarize with a particular way of life. The fatalist interpret climate as basically erratic and capricious in which humans have no significant task in mitigating climate variability, the egalitarian are worried and attentive to issues to do with climate change their perspective been that of a connection between human beings and nature operating on a fragile balance, the hierarchist believe the environment is yielding dealt with care while the individualists believe the environment is hardy and flexible, climate is therefore naturally capricious (O'Riordan & Jordan, 1999).

Additionally, with respect to climate change, culture is viewed as the complete scope of cultivated convictions and behaviour rituals that are embraced, communalized, and reorganized by individuals as members of a community, is ever present, directing and granting significance to awareness of climate hazards, resolutions about whether to tackle climate variability, and if arriving at a conclusion to take action, the steps that will be implemented (Douglas & Wildavsky 1982). In using this theory for the study, the researcher attempted to assert that pastoralists' cultural frames of reference (categorized under egalitarian and individualists) play a substantive role in formulating their responses of, their appreciation of and advocacy for policies, whose goal is to address the challenges associated with climate variability (Wolf & Mosser, 2011). As such, adopting the CTR strategy contributes to evaluating impediments to individual obligations among pastoralists in addressing climate variability risk to their access to forage and water for their herds. In the same vein, CTR helps in elucidating the measures (adaptation strategies) individuals among pastoralists regard important and which among the measures or adaptation strategies are socially admissible among them so as to de-escalate risks to their social and economic aspirations (McNeeley & Lazrus 2014). The theory is therefore pertinent to all the research questions.

2.2 Empirical Literature Review

2.2.1 Climate Change and Pastoralists' Access to Forage

Wang, Wang and Qin (2014) found evidence indicating climate change resulted to a significant negative impact on pastoralism in terms of pastoralists' access to forage in the Tibetan Plateau of China. Additionally, they note variability in climate characterized by unpredictable rainfall led to reduce quantities of pasture thereby negatively impact on pastoralists' access to forage for their livestock (Wang, *et al.,* 2014). Further, in a study Hossain *et al.,* (2016) found evidence on the adverse impact of climate change on pastoralists' access to forage in Bangladesh. Specifically, they assert that climate change resulted to a negative impact on forage quantities and quality thereby negatively impacting on pastoralism (Hossain *et al.,* 2016). Similarly, in their study Wangchuk and Wangdi, (2018) also established climate change had presented a significant negative impact on pastoralists access to forage in Bhutan. In particular they contend variability in climate characterized by fluctuations in rainfall and prolonged droughts had resulted to severe pasture availability and had equally affected its quality in a negative way adversely impacting on pastoralism (Wangchuk & Wangdi, 2018).

In their study, Kima *et al.,* (2015) found evidence indicating climate change led to a significant negative impact on pastoralists' access to forage in Burkina Faso. Additionally, they assert variability in climate predominantly characterized by unreliable rainfall and prolonged drought resulted to shortages in pasture and also affected its quality thereby presenting a negative impact on pastoralism (Kima *et al.,* 2015). Further, Amusan, Abegunde and Akinyemi (2017) observed climate change had presented an adverse impact on pastoralists' access to forage in Nigeria. This they also assert that as a result of prolonged droughts emanating from climate change forced pastoralists to drive their herds to farms leading to pasture induced conflicts which negatively impacted on pastoralism (Amusan, *et al.,* 2017). Similarly Moritz et al., (2010) also found climate change had presented an adverse impact on pastoralists' access to forage in Cameroon. They further observed that this was predominantly as a result of unreliable precipitation quantities which led to shortages in pasture subsequently having a negative impact on pastoralism (Moritz et al., 2010). However, Dongmo, *et al.,* (2012) established minimal evidence on the impact of climate change on pastoralists' access to forage in Cameroon. They only observed that reduced precipitation had increased pastoral communities' mobility in search of pasture driving them to some regions of Burkina Faso (Dongmo, *et al.,* 2012).

In a study, Nkondze, Masuku and Manyatsi (2013) established climate changed had presented a negative impact on pastoralism in Swaziland. They also did note that this impact emanated from fluctuations in precipitation that negatively affected on quantities and quality of pasture thereby adversely impacting on pastoralists access to forage (Nkondze *et al.,* 2013). Further, Maluleke and Mokwena (2017) also found evidence indicating climate change had presented a negative impact on pastoralists' access to forage in South Africa. Additionally, they observed climate change had resulted to fluctuations in rainfall which reduced quantities of pasture that can be fed to livestock subsequently having an adverse impact on pastoralism (Maluleke & Mokwena, 2017). However, Kgosikoma and Batisani (2014) found limited evidence on the impact of climate change on pastoralists' access to forage in Botswana. Specifically, they focused on the impact of rainfall variability on pastoralists' livestock populations but did not provide its clear impact on pasture quantities and quality (Kgosikoma & Batisani, 2014).

In a study, Sulieman and Elagib (2012) observed that climate change had presented an adverse significant impact on pastoralists' access to forage in The Sudan. Specifically, they assert that fluctuations in precipitation and subsequent prolonged droughts had resulted to decrease in quantities of forage available and increase in distances for pastoralists in search of forage leading to a negative impact on pastoralism (Sulieman & Elagib, 2012). Similarly, Magita and Sangeda, (2017) established climate change had presented a negative impact on pastoralists access to forage in Tanzania. They also did specifically note unreliable rainfall had resulted into shortages in pasture subsequently presenting a negative impact on pastoralism (Magita & Sangeda, 2017). In a study, Egeru (2014) found evidence indicating climate change resulted to an adverse impact on pastoralists' access to forage in Uganda. Further, he notes variability in climate negatively affected quantities of rainfall which not only adversely impacted on forage production and availability but

also on its quality and increased movement distance for pastoralists in search of pasture (Egeru, 2014).

2.2.2 Climate Change and Pastoralists' Access to Water

Aryal, Maraseni and Cockfield (2014) established climate change had presented a substantive negative impact on pastoralists' access to water for their herds in Nepal. Specifically, they observed extended droughts coupled with fluctuated rainfall resulted to rivers and streams drying up leading to decreased number of litres accessible for herds' consumption presenting a negative impact on pastoralism (Aryal, et al., 2014). Additionally, Chuluun *et al.*, (2014) found evidence demonstrating climate change had an adverse impact on pastoralists' access to water both for human consumption and for herds in Mongolia. In particular, they argued reduced precipitation had resulted to drying water sources consequently leading to increased demands for water and mobility distances in its search which presented a negative impact on pastoralism (Chuluun *et al.*, 2014).

In their study, Djohy *et al.*, (2014) found evidence demonstrating climate change had presented a negative impact on pastoralists' access to water for their herds in Benin. Specifically, they assert prolonged droughts characterized by fluctuations in rainfall resulted to local pastoral communities guided by field officers from the Intergovernmental Panel on Climate Change (IPCC) to construct water pans which had also dried up. This they argued led to increased mobility in search of water which had a significant negative impact on pastoralism (Djohy *et al.*, 2014). Further, Xiao et al., (2015) observed climate change had a significant negative impact on pastoralists' access to water for their herds in Cameroon. They note decreased water supply emanating from reduced precipitation equally increased demand and mobility distances in search for it consequently negatively affecting pastoralism (Xiao et al., 2015). Similarly, Okpara, Stringer and Dougill (2016) established climate had presented immense negative impacts on pastoralists' access to water both for their consumption and for their herds in Chad. In particular, they argued prolonged droughts had resulted to the drying of Lake Chad which had an adverse impact on; number of litres of water accessible for livestock and quality of available water for herds resulting to increased mobility distances in search of it consequently affecting pastoralism (Okpara, *et al.*, 2016).

In a study, Archer van Garderen (2011) found the impact of climate change had significantly affected pastoralists' access to water for their herds in South Africa. Specifically, he asserts prolonged droughts resulted to reduced water quantities thereby limiting number of litres accessible for herds leading to its increased demand which negatively impacted on number of people engaging in pastoralism (Archer van Garderen, 2011). Further, Akinyemi (2017) also found evidence indicating climate change had presented a significant negative impact on pastoralists' access to water for their herds in Botswana. He in addition contends reduced precipitation led to inadequate water supply which also had a negative impact on quality of water available for livestock resulting to an adverse impact on pastoralism (Akinyemi, 2017). Additionally, Zeidler, Kandjinga and David (2010) established the negative impact emanating from climate change worsened pastoralists' access to water for their herds in Namibia. In particular, they assert reduced

precipitation coupled with extended droughts resulted to dried rivers which affected water supply and quality of water available. This they further argued led to the drilling of water wells by Non-governmental Organizations (NGOs) through which pastoral communities adopted an Integrated Water Resource Management (IWRM) to enhance water access for their herds (Zeidler, *et al.,* 2010).

Egemi (2013) observed climate change had led to a negative impact on pastoralists' access to water both for their consumption and that of their herds in Sudan. Additionally, he argued this mainly emanated from prolonged droughts which led to the drilling of water wells by Non-governmental Organizations (NGOs) and Faith Based Organizations (FBOs) to enhance access (Egemi, 2013). Similarly, Niyonzima, Stage and Uwera (2013) found evidence implying climate change had a negative impact on pastoralists' access to water for their herds in Rwanda. In particular, they note reduced precipitation coupled with extended droughts had an adverse impact on water supply resulting to the drilling of water wells by NGOs to improve access of pastoral animals (Niyonzima, *et al.*, 2013). In a study, Lovell (2011) also found evidence demonstrating climate change had presented a negative impact on pastoralists' access to water for their herds in Tanzania. Specifically, she observed prolonged droughts resulted to dried rivers which affected water supply and quality leading to increased mobility distances for pastoral communities in search of water consequently presenting a negative impact on pastoralism (Lovell, 2011).

2.3 Conceptual Framework

According to Orodho (2009) a conceptual framework is a model of presentation where a researcher represents the association between variables in the investigation and portrays the relationship making use of a diagram.

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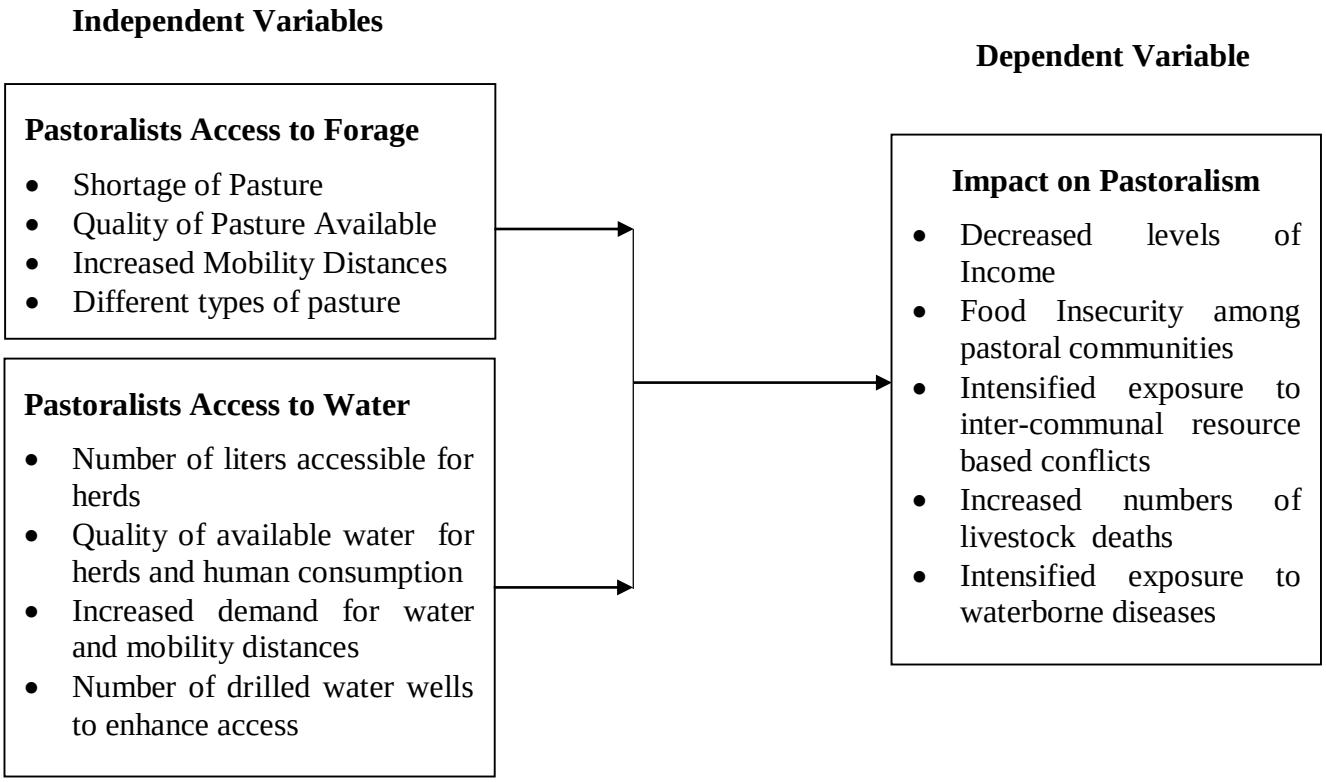

Figure 1: Conceptual Framework

3.0 Research Methodology

This research employed a descriptive survey research design to carry out an investigation into the impact of climate change on pastoralism in Kajiado South Sub County. Descriptive survey design was the optimal design for this study in that it facilitated the gathering of both qualitative and quantitative data establishing the link between study variables and study problem (Christensen, Johnson & Turner 2011). The target population of the study was 207 respondents and included; Staff at Agriculture, Livestock and Fisheries Department, County Assembly of Kajiado Staff and Managers working for Civil Society Organizations (CSOs) in the location in which research was carried out. The sample size for this study was 105 respondents. Primary data was gathered by employing the administration of questionnaires. Data obtained from open ended questions was analyzed by applying content analysis with entailed both the elucidating and presenting of data in themes guided by their respective objectives under investigation (Bernard & Ryan,2010).

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4.0 Research Findings and Discussions

4.1 Descriptive Statistics

Table 1: Impact of Climate Change on Pastoralists Access to Forage

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Std Deviation
Climate change has an impact on pastoral access to forage in the form of shortage of pasture which impacts on pastoralism.	1.6%	4.7%	7.9%	53.9%	31.9%	4.12	0.86
Climate change does not have impact on the quality of pasture accessible to pastoralists for their herds.	46.6%	29.8%	14.7%	6.3%	2.6%	2.05	0.97
Climate change has an impact on pastoral access to forage in the form of increased mobility distances in search of it.	0%	3.1%	11.0%	34.0%	51.8%	4.15	0.73
Climate change does not have impact on pastoral access to forage in the form of access to different types of pasture.	2.6%	50.8%	12.0%	3.7%	30.9%	4.04	0.90
Average Mean						**3.60**	**0.86**

Results obtained on impact of climate change on pastoralists access to forage, showed that a substantive number of the research's sampled subjects as shown by 53.9% (Mean= 4.12), agreed climate change has an impact on pastoral access to forage in the form of shortage of pasture which impacts on pastoralism in Kajiado South Sub-county. From this finding, it was deduced that most sampled subjects acknowledged climate change had resulted to the drying of pasture that pastoralists rely on for feeding their herds. The results are comparable to those of the investigation by Moritz et al., (2010) who reported the impact of climate change had resulted to shortage in pasture available to pastoralists for their herds. Findings are however contrary to those by Kgosikoma and Batisani (2014) who did not establish impact of climate change on quantities of pasture in Botswana. 51.8% (Mean= 4.15) of study respondents strongly agreed that climate

change has an impact on pastoral access to forage in the form of increased mobility distances in search of it. This could be because respondents had witnessed local pastoral communities moving to larger distances than before in search of pasture for their herds emanating from climate change.

The finding is comparable to that of Sulieman and Elagib (2012) who established impact of climate change on pasture has increased distances travelled by pastoralists in search of forage in Sudan. 50.8% (Mean=4.04) disagreed that climate change does not have impact on pastoral access to forage in the form of access to different types of pasture. This could be because majority of sampled subjects have witnessed the extinction of dissimilar plants as a result of climate change that provide pasture for pastoralists herds. Wang, Wang and Qin (2014) observed comparable results in China. 46.6% (Mean =2.05) strongly disagreed that climate change does not have impact on the quality of pasture accessible to pastoralists for their herds. From this study finding, it was deduced that study respondents were of the view that the quality of pasture accessible to pastoralists was adversely affected by climate change. The results are comparable to those by Wangchuk and Wangdi (2018) who assert climate change had presented an adverse impact on quality of accessible forage for pastoralists in Bhutan.

Table 2: Responses to Impact of Climate Change on Pastoralists' Access to Water

	Frequency	**Percentage**
No	7	8.4
Yes	76	91.6
Total	**83**	**100**

Hinged on the results in Table 2, 91.6% of the study's respondents indicated that climate change has had an adverse impact on pastoralists access to water while 8.4% disagreed indicating it didn't. From this result, it was deduced that a substantial number of sampled subjects attributed the inaccessibility of water among pastoralists to impact of climate change.

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Table 3: Impact of Climate Change on Pastoralists Access to Water

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Std Deviation
Climate change has an impact on pastoral access to water in the form of number of liters accessible for herds which impacts on pastoralism.	8.9%	15.2%	3.7%	48.2%	24.1%	2.37	1.23
Climate change does not have impact on quality of available water for herds and human consumption and this does not have an impact on pastoralism.	2.6%	15.7%	8.9%	27.2%	45.5%	3.79	1.09
Climate change has an impact on pastoral access to water in the form of increased demand for water and mobility distances which impacts on pastoralism.	6.3%	17.1%	2.1%	50.7%	23.8%	3.99	1.31
Climate change does not have impact on pastoral access to water due to the high number of drilled water wells to enhance access.	32.3%	47.5%	5.2%	11.6%	3.4%	2.20	1.10
Average mean						**3.10**	**1.20**

Results obtained on impact of climate change on pastoralists access to water, demonstrated that a substantive number of the researches sampled subjects as shown by 50.7% (Mean= 3.99), agreed climate change has an impact on pastoral access to water in the form of increased demand for water and mobility distances which impacts on pastoralism. From this finding, it was deduced that a predominant percentage of study sampled subjects acknowledged climate change had resulted to the drying of rivers and seasonal wells adversely affecting pastoralists' access to water for their herds subsequently increasing distances they had to travel in search of it. Results are comparable to those by Chuluun *et al.,* (2014) who found evidence illustrating the impact of climate change in the form of drying water sources which consequently led to increased demands for water and mobility distances in its search negatively affecting pastoralism in Mongolia. 48.2% (Mean= 2.37) of study respondents agreed climate change has an impact on pastoral access to water in the form

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of number of liters accessible for herds which impacts on pastoralism. This could be because a significant percentage of them acknowledged the quantities of water in rivers were reducing as a result of warm temperatures.

This study finding is comparable to that in the research by Okpara, Stringer and Dougill (2016) who assert the adverse impact of climate change in the form of prolonged droughts had resulted to the drying of Lake Chad which had an adverse impact on number of liters of water accessible for pastoralists' livestock in Chad. 47.5% (Mean= 2.20) disagreed that climate change does not have impact on pastoral access to water due to the high number of drilled water wells to enhance access. From this study finding, it was deduced that the county government and Civil Society Organizations (CSOs) they were working for had not drilled enough water wells or boreholes to provide water for pastoralists in their area.

Results are contrary to those of the research by Zeidler, Kandjinga and David (2010) and Egemi (2013) who found Non-Governmental Organizations (NGOs) and Faith Based Organizations (FBOs) had drilled water wells to enhance access to water for pastoralists' herds in Namibia and Sudan. 45.5% (Mean =3.79) felt that climate change does not have impact on quality of available water for herds and human consumption and this does not have an impact on pastoralism. From this study finding, it was deduced that study respondents did not place great value on the impact of climate change with respect to water quality both for human and animal consumption and therefore did think climate change had presented an adverse impact on the quality of water. This investigation's results were comparable to those of the research by Aryal, Maraseni and Cockfield (2014) who extended the scope of their study to the impact of climate change on the number of liters accessible for herds' consumption and its negative impact on pastoralism in Nepal.

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Table 4: Measures of Climate Change Impact on Pastoralism

Statement	Very Low Extent	Low Extent	Moderate	Great Extent	Very Great Extent	Mean	Std Deviation
Decreased levels of income among pastoralists.	4.6%	9.8%	6.8%	50.3%	28.5%	3.91	1.04
Food insecurity among pastoral communities.	5.8%	12.2%	9.2%	42.3%	30.5%	2.6	0.97
Intensified exposure to inter-communal resource based conflicts.	10.4%	4.7%	9.0%	51.6%	24.3%	3.9	1.05
Increased numbers of livestock deaths	6.2%	8.0%	11.3%	48.5%	26.0%	2.27	1.18
Intensified exposure to waterborne diseases.	13.5%	15.0%	3.4%	23.6%	44.5%	4.11	1.34

The study sought to establish the depth to which the indicators stated are measures of the impact of climate change on pastoralism in Kajiado South Sub-County. Results of the study show, a substantive number of the investigation's sampled subjects as shown by 51.6% felt intensified exposure to inter-communal resource based conflict; decreased levels of income among pastoralist as shown by a 50.3% of sampled subjects, 48.5% of the sampled subjects felt that increased numbers of livestock deaths were significant measures of the impact of climate change on pastoralism. 44.5% of the study's sampled subjects were of the view that intensified exposure to waterborne diseases while 42.3% also food insecurity among pastoral communities were not significant measures of the impact of climate change on pastoralism in Kajiado South Sub County. These results means that a substantive number of sampled subjects placed greater significance on inter-communal resource based conflict and decreased levels of income among pastoralist as measures of the impact of climate change on pastoralism. Additionally, food insecurity according to the study's sampled subjects was the most insignificant measure of the impact of climate change on pastoralism.

5.0 Conclusions

The study concludes that climate change has had impact on pastoralists' access to forage for their herds. This is because variability in climate has resulted in shortage of pasture, different types of pasture, the quality of pasture and increased mobility distances in search of it. The study also concludes that climate change has had an adverse impact on pastoralists' access to water. This is

because variability in climate has increased demand for water and pastoralists' mobility distances in search of it and number of liters accessible for herds. Government authorities concern and non-profit organizations such as Faith Based Organizations (FBOs) and Non-governmental Organizations (NGOs) had not drilled enough wells to address the issue of water shortage caused by climate change that had presented an adverse impact on pastoralism.

6.0 Recommendations

Based on the research findings, the study recommends that there was need to improve on mitigation measures that would address the impact of climate variability on pastures. Government in partnership with civil society organizations (CSOs) should for instance engage communities in planting more trees. Farmers should also be engaged in measures targeting reduction of greenhouse gas emissions that affect grasslands and CSOs should also train them on how to reduce overgrazing in particular geographical zones.

Further, from the research findings the study recommends that there is need to develop partnerships between county governments, civil society organizations (CSOs) and faith based organizations (FBOs) in addressing water shortage experienced by pastoral communities caused by climate change through prolonged droughts. This could be done by drilling of boreholes, construction of water pans and wells which would do away with mobility distances done by pastoralists in search of water.

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