



The Impact of Climate Change and Climate Variability on the Pastoralist Communities in Moyle District, Somali Regional State, Ethiopia

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Abstract

The study examines the impacts of climate change and climate variability on pastoralist communities in the Moyle District of the Somali Regional State in Ethiopia. Using a mixed-methods approach that includes qualitative and quantitative data. A total of 154 households were surveyed, participated in focus groups, and key informant interviews were interviewed in order to collect data. The findings indicated that climate change resulted in periodic droughts, floods, elevated temperatures, and alterations in precipitation patterns. These factors had an impact on the productivity of animals, the frequency of diseases, the patterns of breeding, the yields of crops, the patterns of rainfall, and the appropriateness of crops. The study also evaluated the effects on susceptible demographics, such as women, children, the elderly, and those with disabilities. Climate change disproportionately affects children and women in pastoral communities, making them especially vulnerable to its negative impacts. This study highlights the necessity for proactive actions, enhanced research, and efficient solutions to address climate change threats and their effects on pastoralist communities. Policymakers and stakeholders should create thorough plans to improve the ability of these communities to withstand and adapt to challenges. Promote diversified livelihood strategies, strengthen early warning systems and promote collaboration and partnerships.

Subject Areas

Environmental Sciences

Keywords

Climate Change, Pastoral Communities, Vulnerability, Drought Livelihoods

1. Introduction

Climate change, a worldwide issue, is already impacting many regions and posing a threat to humanity in both in the present and future future. [1] The consequences of these effects pose significant threats to human welfare, ecological equilibrium, and the susceptibility of livelihoods. [2] The consequences of increasing global temperatures and extreme weather occurrences pose significant and formidable problems in the 21st century. However, the effects and dangers related to climate change can vary significantly among various countries. [3] Climate change is causing immediate and visible impacts such as heat waves, hurricanes, floods, forest fires, and droughts. Slower changes in average temperature, sea level, and rainfall patterns will have far-reaching consequences for larger populations in the future. [4]. It is widely acknowledged that Africa is exceptionally vulnerable to the consequences of climate change. Pastoralist communities across the globe, including those in Africa, have long been confronted with a range of social, economic, and climate-related hurdles. [5] Due to their dependence on livestock-based livelihoods and their susceptibility to droughts and unpredictable rainfall, these communities are especially prone to the detrimental impacts of climate change [6]. In recent decades, pastoralism has undergone changes that have reduced its ability to withstand shocks and adapt to new circumstances, leading to increased poverty, social differentiation, and inequality within pastoralist communities [7]. Africa is a region heavily impacted by climate change [8]. The limited economic, developmental, and institutional capacities of African countries render them highly vulnerable to these impacts. Consequently, the progress achieved in enhancing the socio-economic welfare of Africans, including those in East Africa, is at risk of being undermined or reversed. [9] Pastoralist communities in Ethiopia are threatened by climate change, which has a direct impact on the availability of natural resources and livestock yields in grazing regions. [10] The livelihoods of these communities are greatly impacted by climate change, as evidenced by an observable rise in the frequency of extreme events like droughts and floods. These events disrupt the delicate equilibrium between land availability for grazing, the presence of cattle, and the impact caused by the human population. [11] These challenges have resulted in a shift in pastoral practices and a greater dependence on non-pastoral livelihoods. [12] Although pastoralist communities in Ethiopia face many challenges such as their high vulnerability to climate change, there is a dearth of adequate study and comprehension of their specific vulnerabilities and long-term consequences. Further investigation is required to examine the enduring consequences of climate change and get a more profound comprehension of the distinctive difficulties faced by pastoralists in the area. [13] In the Moyle Dis-

tract of the Somali Regional State, Ethiopia, there is a significant research gap pertaining to the prevention and management strategies for climate change risks. Although some studies have examined the vulnerability of pastoralist communities to climate change in the country, further research is necessary to enhance our understanding of this issue. This study aims to bridge this research gap by specifically assessing the vulnerability of pastoralist communities to climate change. Through a comprehensive examination, valuable insights can be gained regarding the specific challenges and risks faced by these communities, enabling the development of targeted interventions to support their resilience. The study area confronts challenges such as water scarcity, shifting rainfall patterns, and limited access to natural resources due to climate change. However, there is an insufficient level of research and understanding regarding the specific vulnerabilities and long-term impacts encountered by these communities. To address these knowledge gaps, additional research is required to examine the enduring impacts of climate change and gain a better understanding of the specific challenges faced by pastoralists in the region. By addressing these gaps, policymakers and practitioners can formulate targeted interventions to enhance the resilience of pastoralist communities in eastern Ethiopia, particularly in the Moyle District.

2. Methodology of the Study

2.1. Study Area

Dawo Zone, which is a Somali regional state located in Ethiopia covers an area of 21875.93 square kilometers, and the zone has a diverse landscape (**Figure 1**). The traditional landscape comprises higher and lower parts, each with distinct suitability for different agricultural activities. The higher areas are characterized by favourable conditions for grazing animals, while the lower areas are suitable for farming practices.

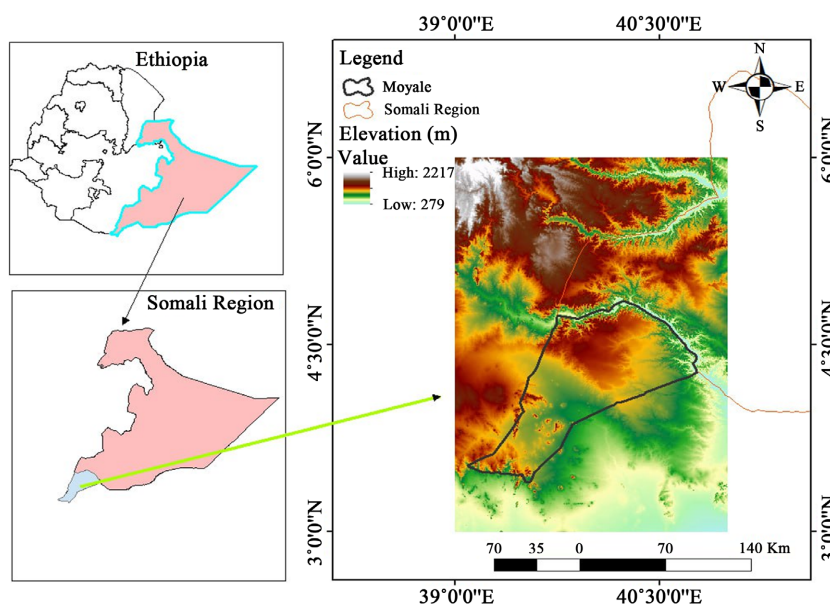


Figure 1. Study area map.

2.2. Sample Selection and Target Kebeles and HH Size

The sampling design and procedure for this study involved determining a representative sample of participants from the Moyle District in the Somali Regional State of Ethiopia. To ensure a representative sample, the study employed a random selection method to choose three Kebeles (administrative subdivisions) from the total of 27 Kebeles in the Moyle District. These specific Kebeles were predicated on their significant exposure to climate impacts and variability. To determine the sample size the study adopted Slovin's formula.
$$n = \frac{N}{1 + N(e)^2}$$

Where n represents the required sample size, N is the total population size, and e is the desired level of precision. Using this formula, the researchers calculated the appropriate sample size to be 154 respondents.

2.3. Data Collection Tools of the Study

The method of data collection included both qualitative and quantitative. The qualitative method was a key informant interview, focus group discussion while the quantitative method was like structured household survey.

2.4. Sources of Data

The sources of data for the study included both primary and secondary data. Primary data was collected using semi-structured questionnaires. These questionnaires were designed to explore the respondents' perceptions, opinions, and experiences regarding climate change. The survey process involved discussing the points listed in the questionnaires and capturing the participants' perspectives on climate change.

Secondary data was gathered from various sources, including published reports, articles, websites, and unpublished materials obtained from the Woreda Agricultural and Rural Development Office, disaster risk management agencies, and representatives from NGOs. Previous research documents, relevant literature, the internet, books, and electronic journals were also utilized to provide additional depth and context for the analysis. To gain a comprehensive understanding of the climate change scenario and its impacts on pastoralist communities, interviews were conducted with key informants. These interviews involved engaging with individuals who possessed expertise or a comprehensive understanding of the subject matter.

2.5. Data Analysis

The data analysis process involved thorough organization and coding of the collected data. Qualitative techniques were used for interviews, document reviews, and observations, while quantitative techniques were employed for the questionnaire data. The findings were presented using descriptive statistics and interpreted in the context of climate variability and community challenges, drawing from published and unpublished materials.

2.6. Data Presentation

The data obtained by using different data collection methods were analysed and presented differently. The data that has been analysed and interpreted is displayed in the report using tables, figures, pie charts, plates, and narratives. The data obtained from the quantitative analysis are presented in tables, figures, pie charts and plates. Qualitative data were presented in the form of narratives/descriptions.

3. Results

This section presents the study's findings, which were collected directly from primary data sources. It also includes an analysis and explanation of these findings.

3.1. Demographic Data

According to **Table 1**, 86 (55.8%) of the household respondents were males, while the remainder 68 (44.2%) were females. This suggests that there is a slightly higher number of male respondents compared to female respondents, indicating that the questionnaire was primarily completed by males. However, this difference is not expected to have any impact on the conclusions of the research.

Concerning the age composition of the respondents, 80 (51.9%) of the respondents were aged 33 - 45 years, approximately 36 (23.4%) and 22 (14.3%) were aged 24 - 32 and 46 - 50 years, respectively, and the remaining 16 (10.4%) respondents were aged 16 years and older.

This indicates that respondents aged 25 to 44 constitute the majority and are therefore qualified to provide adequate information for this investigation. The educational status of the respondents revealed that 46 individuals (29.9%) were illiterate, 68 (44.2%) had completed grades 1 - 8, and 19 (12.3%) had completed high school. Additionally, 21 respondents (13.6%) had attained a certificate or higher. This implies that the educational status of the respondents demonstrates that a considerable number of individuals possess a level of education that equips them with the necessary understanding to comprehend the problem and provide adequate information regarding the existing situation of climate change, its variability, and its effects in the study area.

Table 1. Demographic profile of household respondents.

Sex	Frequency	%	Age	Frequency	%	Educational level	Frequency	%
Male	86	55.8	24 - 32	36	23.4	illiterate	46	29.9
Female	68	44.2	33 - 45	80	51.9	Grade 1-8	68	44.2
Total	154	100	46 - 50	22	14.3	High school	19	12.3
			51 above	16	10.4	Certificate and above	21	13.6
			Total	154	100.0	Total	154	100.0

Source: Field Survey, 2023.

3.2. Perception of Climate Change, and Climate Variability among Pastoralists and Agro-Pastoralist

As seen in **Table 2** below, pastoralists and agro-pastoralists' perceptions and awareness of the effects of climate change presents the perception and awareness of the effects of climate change among pastoralists and agro-pastoralists. The study's findings indicated varying levels of perception among the respondents regarding climate variability. Among the surveyed respondents, 31 individuals (20.1%) reported a perception of very low impact from climate change, Moderate impact perception was expressed by 44 respondents (28.6%) and the majority of the respondents, 79 individuals (51.3%), indicated a perception of very high impact from climate change.

3.3. Impacts of Climate Change Observed in the Study Area

As the majority of respondents indicated in **Table 3**, accounting for 57.1%, cited recurring droughts as a major consequence of climate change. Furthermore, 22.1% of respondents highlighted the occurrence of floods as a notable impact, emphasizing the variability in precipitation patterns and the associated risks of property damage, displacement, and disruption of daily life. Additionally, 11.7% of respondents mentioned increased temperatures as a significant climate change impact, and 9.1% of the respondents identified changes in precipitation patterns. Recurrent droughts and variable precipitation were regarded as being the most significant consequences of climate change in the region under investigation.

Table 2. Perception and awareness of climate change, and climate variability among pastoralists and agro-pastoralists.

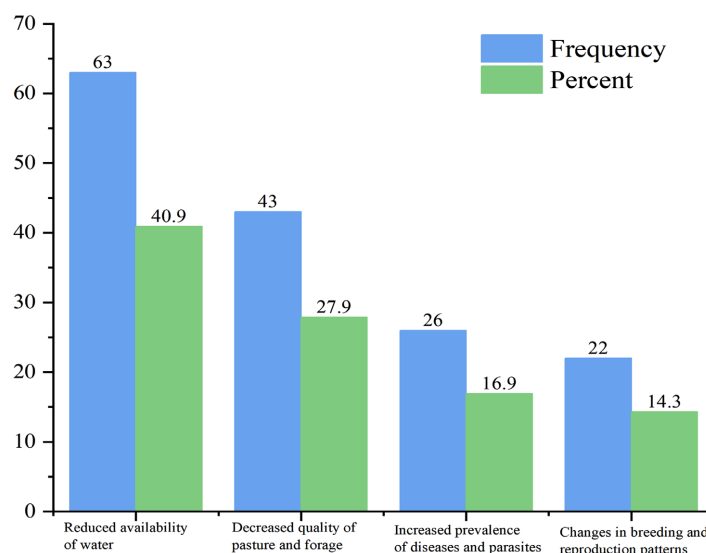
Respondents	Frequency	Percent
Low	31	20.1
Moderate	44	28.6
High	79	51.3
Total	154	100

Source: Field Survey, 2023.

Table 3. Impacts of climate change observed.

Respondents	Frequency	Percent
Drought	88	57.1
Floods	34	22.1
Increased temperatures	18	11.7
Changes in precipitation patterns	14	9.1

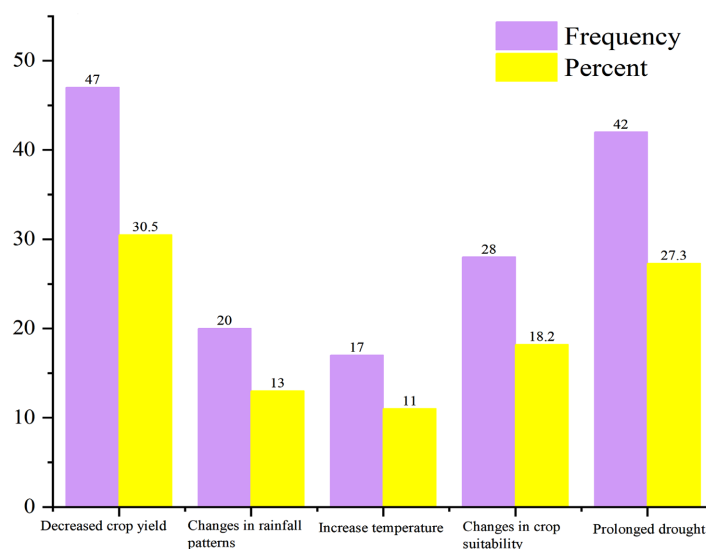
Source: Field Survey, 2023.



Source: Field Survey, 2023.

Figure 2. Impacts of climate change on livestock productivity.

As illustrated in **Figure 2**, 40.9% decrease in the availability of water, a 27.9% decrease in the quality of pasture and forage, an increase in the prevalence of diseases and parasites of 16.9% and changes in breeding and reproduction patterns 14.3%. However, these findings revealed multifaceted challenges posed by climate change to livestock productivity.



Source: Field Survey, 2023.

Figure 3. Impacts of climate change and climate variability on crop yield.

The Results obtained from households survey reveal that out of the total 154 respondents said that impacts of climate change crop production Decreased crop yield 30.5%, Changes in rainfall patterns 13.%, and increase temperature 11.% Changes in crop suitability 18.2% and Prolonged drought 27.3% This implies that climate change has diverse and significant effects on crop production (See **Figure 3**).

3.4. Vulnerable Groups Affected by Climate Change

Of the 154 individuals surveyed, 31.8% replied to women and children, 20.8% to elderly people, 16.9% to people with disabilities and 30.5% to pastoralist respondents. (See **Table 4**)

Table 4. Vulnerable groups affected by climate change.

Respondents	Frequency	Percent
Women and children	49	31.8
Elderly	32	20.8
People with disabilities	26	16.9
Pastoralist	47	30.5

Source: Field Survey, 2023.

3.5. Key Informant Interview and Focus Group Discussion

The focus group discussions and interview discussions with pastoralist communities, government agencies and authorities communities confirm the negative impacts of climate change on both crop and livestock production. The participants reported Climate change has significantly impacted crop and livestock production in pastoralist communities, leading to decreased rainfall, increased temperature, and extended droughts. These changes have become more noticeable in recent years, causing crop failure and livestock mortality. Water scarcity has increased susceptibility to waterborne illnesses, particularly among children and women. Lower agricultural yields, increased crop losses, and potential changes in traditional crops for pastoral farming are among the consequences.

4. Discussions

The study reveals that pastoralists are aware of climate impacts, but knowledge gaps need to be addressed to improve their understanding. This aligns with a Pakistani study that found a lack of knowledge is a significant obstacle to poor nations' ability to adapt to climate change. [14] Similarly, [15] has shown that addressing climate change in poor countries is challenging owing to a lack of community awareness.

This study also identified perceived impacts of climate change and climate variability on pastoral households in moyale district. Accordingly, majority of households experienced recurring droughts, occurrence of floods, increased temperatures, and changes in precipitation patterns. In line with other studies, the livelihoods of pastoralists and the production of livestock are strongly correlated with rangeland productivity. Consequently, the severe consequences of climate change, such as frequent droughts and animal mortality, have had a significant impact on the lowlands in the study area [16] [17] [18]. Pastoralists in the region perceive more erratic and reduced rainfall, rising temperatures, and prolonged

drought. These factors have led to challenges such as cattle starvation, malnutrition, and reduced milk production [19] [20]. The livelihood of pastoral people in Ethiopia is threatened by repeated droughts, high livestock mortality, and famine, which ultimately results in human fatalities and famine [10]. The climate change affected livestock productivity due the decrease in water availability and pasture quality, along with increased disease prevalence and changes in breeding patterns. This finding is further supported by research done in Ethiopia's southern lowlands, which showed that the rate of livestock productivity and reproduction has been periodically dropping in pastoral communities as a result of the detrimental effects of climate-related shocks, especially drought. [21] A study by Megersa et al. [20] revealed the production of livestock is greatly impacted by climate change, which results in reduced productivity due to increasing disease incidence, decreased availability of water, fodder, and pasture, as well as heat and cold stress. "In line with these findings, Kimaro et al.'s study [19] showed that in pastoralist and agro-pastoralist communities, climate change significantly reduces livestock yield, worsens health, and lowers agricultural productivity. Additionally, the findings of this study are consistent with those of Mengistu's research [22], which investigated the effects of extreme drought circumstances on livestock." during drought situations, a significant percentage of cattle mortality (68%), compared to lesser losses in goats (5%) and camels (2%). Pastoralists and agro-pastoralists face climate-related challenges such as inadequate rainfall, water availability, poor feed quality, animal disease risk, and heat stress, resulting in reduced livestock performance. [23] In addition to the impacts of climate change, which include reduced crop yields, altered rainfall patterns, increased temperatures, changes in crop suitability, and prolonged drought, these factors have had a negative effect on the productivity and sustainability of crop cultivation among pastoralist communities. Furthermore, this study specifically assessed the impact of climate change on vulnerable populations in pastoral communities, including women and children, the elderly, and individuals with disabilities. Among these groups, children and women in pastoral communities are particularly susceptible to the adverse effects of climate change.

5. Conclusion

In conclusion, the study revealed several significant findings concerning the consequences of climate change in the study area. It was evident that there was a considerable knowledge gap and low levels of awareness among the respondents regarding climate change and its potential consequences. The most prominent impacts identified were recurring droughts, followed by floods and variability in precipitation patterns. Livestock productivity was severely affected by reduced water availability, poor pasture quality, increased disease prevalence, and disrupted breeding and reproduction patterns. Crop yield was also impacted by decreased productivity, changes in rainfall patterns, increased temperatures, and shifts in crop suitability. Vulnerable groups, such as women, children, elderly

people, people with disabilities, and pastoralists, were particularly affected. To address these findings, raising awareness and implementing adaptive measures are crucial. Promoting knowledge about climate change and its consequences among the affected communities can empower them to take proactive measures. Additionally, implementing adaptive strategies, such as water conservation techniques, improved livestock management practices, and climate-resilient agricultural techniques, can help mitigate the adverse effects of climate change on livelihoods, agriculture, and livestock productivity.

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Conflicts of Interest

The authors declare no conflicts of interest.

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