

Assessing Barriers to Effective Climate Change Adaptation Strategies in the Teltele Districts, Oromia Region, Southern Ethiopia

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ABSTRACT

Climate change is one of the biggest environmental issues the world is now dealing with and pastoral groups are at risk from it. Consequently, this research aimed to evaluate barriers to practical climate change adaptation strategies in Southern Ethiopia. Through proportionate probability sampling, 349 pastoralists were chosen at random. Quantitative and qualitative data were gathered. Descriptive statistics were utilized to analyze the gathered quantitative data. While Thematic analysis was employed for the qualitative data. The result shows even with a range of coping mechanisms, pastoralists continue to face substantial challenges in adjusting to climate change. Significant barriers include the following: lack of real-time climate and market information, livestock disease, lack of veterinarian services, and decline in livestock price throughout drought season. Thus, to make effective climate change adaptation strategies, development interventions, future policies, and research should take into account the identified barricades.

INTRODUCTION

One of the most significant environmental problems the world is currently confronting is climate change. According to the Intergovernmental Panel on Climate Change's (IPCC) sixth assessment report, surface temperatures between 2011 and 2020 would be 1.09°C higher than they were between 1850 and 1990. Climate change is global, fast, and escalating. (IPCC, 2021a). The majority of African countries are expected to see an increase in the frequency and severity of heavy rains over the next several decades, according to the research, which also shows with high confidence that the continent's mean sea level and surface temperature have risen faster than the world average (IPCC, 2021b). The severe effects of climate change on Africa's ecosystem and population are further described in the most recent Working Group II assessment of the IPCC report. These effects include the extinction of species, the loss of human life, increased poverty and food insecurity, increased water scarcity, and the depletion of natural resources (Trisos et al., 2022).

The second-most populous nation in Africa, Ethiopia, is extremely susceptible to the effects of climate change. Since a large portion of its people depend on agriculture and other natural resources, both of which are highly vulnerable to climate change (Cochrane and Singh, 2017; Alemayehu and Bewket, 2017; Gezie, 2019; Marie et al., 2020). Between 1980 and 2015, the nation saw eight significant droughts, five of which resulted in famine (World Bank, 2010; FEWS NET, 2015). These hypothetical situations present a fresh angle on the systems and procedures involved in climate change adaptation (Ecklund et al., 2017). Furthermore, Deressa et al. (2011) state that adaptation to climate change is a two-step process that starts with acknowledging that the climate is changing and ends with responding to the changes through adaptation.

Although Ethiopia has already started implementing adaption techniques, work is still in its infancy (Getahun et al., 2021). From national to local scales, there is a complex web of interconnected obstacles to local-level adaptations. These barriers include political, institutional, cultural, social, behavioral, biophysical, cognitive, and gender-related factors (Barros et al., 2014). Furthermore, Rosenzweig et al. (2020) stated that people are aware that a community's ability to adapt to climatic variability and change is influenced by institutional, socioeconomic, and demographic aspects.

Pastoral cultures moved and momentarily adapted to hunting and gathering when the land was large, the human population was low, and droughts occurred infrequently (McCabe, 2010). Pastoral groups are at risk from climate change as a result of declining practices in the face of land shortages, rapidly growing human populations, and frequent droughts (Angassa and Oba, 2008). Moreover, the lack of fodder and soil degradation in the Borana zone emerged as the main issues. Rotational grazing, migration, lowering food intake, bleeding, calf slaughtering, and more recently destocking, livestock diversification, and livelihood diversification due to peripheral inspirations were the traditional practices used by pastoralists (Riche et al., 2009). Nonetheless, in many aspects, today's circumstances make the majority of coping techniques less effective (Morton, 2006; Notenbaert et al., 2010).

According to Tolera and Fayera (2020), 40% of Ethiopia's cattle population is owned by Oromo-Borana pastoralists, who are the group most exposed to the effects of climate change in Ethiopia because of their frequent and severe droughts. Because of this, even though the Borana pastoral area supplies a significant portion of Ethiopia's exported cattle and beef meat, livestock mortality has increased and density and reproductive performance have decreased (Angassa and Oba, 2008; Herrero et al., 2010; Gezahegn et al., 2015). Similarly, pastoralists in the Teltele district usually employ traditional management techniques to utilize and oversee their rangeland's resources for an extended duration (Bikila et al., 2014). However, rangeland resource degradation poses a significant threat to pastoral ecosystems, livestock production, and human livelihoods (Tsegaye et al., 2010). Since pastoralism is a way of life for the Borana pastoralists, they must become adaptive to the negative effects of climate change by identifying barriers to adaptation strategies.

Numerous research has attempted to determine the factors that influence the adaptation techniques used by Borana pastoralists (Dirriba and Jema, 2015; Berhanu and Fekadu, 2015; Doyo et al., 2018; Tolera and Fayera, 2020; Gelgelo et al., 2021; Kemal et al., 2022). However, they overlooked the barriers to climate change adaptation measures that prevent pastoralists from implementing effective strategies. Consequently, identifying and addressing barriers that prevent pastoralists from putting climate change adaptation techniques into practice. Thus, identifying barriers to strategies for climate change adaptation is the objective of this research.

LITERATURE REVIEW

Challenges of Climate Variability and Change

For both developed and developing nations, the global climate shift and the resulting weather extremes presented significant challenges (IPCC, 2007a). On seasonal time scales, several parts of Africa are known to have among of the most changeable climates in the world, which negatively impacts the continent's capacity to adapt to climate change and variability (Filho et al., 2020; UNFCCC, 2010). Ethiopia's agricultural food production and economic development are seriously threatened by climate variability (IFPRI and UNDP, 2019; Dercon, 2004). The nation's heavy reliance on climate-sensitive industries and shifting weather patterns put farmers' livelihoods and food security at risk (IFPRI and UNDP, 2019; Haile, 2005). These demonstrated that the nation's low degree of socioeconomic development, poor infrastructure, lack of institutional capacity, and increased reliance on natural resources make it more susceptible to climate unpredictability and change.

Climate Change Adaptation and Adaptive Capacity

Adapting farming systems to climate change and improving farmers' and pastoralists' ability to adapt to changes in climate variability and extremes are the main ways to lessen the potentially negative effects of climate change (Bradshaw et al., 2004). The process by which farmers and pastoralists adjust their climatic expectations in response to anomalous weather patterns is known

as adaptation to climate change (Gbetibouo, 2009). The process is multifaceted, multi-scale, and complex (Bryant et al., 2000). Adapting to natural or human systems in response to real or anticipated climate stimuli or their impacts that mitigate, damage, or take advantage of advantageous chances is known as climate change adaptation (IPCC, 2001). Conversely, adaptive capacity refers to a system's ability to adapt to climate change, including climate variability and extremes, in order to mitigate possible harm, seize opportunities, or deal with the fallout (IPCC, 2007d). Short-term coping skills and behavioral or economic structural modifications are what lessen society's susceptibility to climatic system changes (Malik et al., 2010). According to IPCC (2001), societies encounter four types of adaptive capacities: localized or widespread adaptation responses; autonomous or planned adaptation; proactive or reactive adaptation; and short- or long-term adaptation. Additionally, adaptation techniques can be categorized according to their form, temporal scope, and spatial scope. According to temporal scope, adaptation can be classified as either long-term, when the decision maker can modify the capital stock in response to climate change, or short-term, when the response to climate change is limited by a fixed capital (Stern, 2008). According to the form, adaptation can be classified as technological, behavioral, financial, institutional, or informational, and based on the spatial scope, it can be classified as local or widespread (Smit et al., 2000).

METHODOLOGY

Description of the Study Area

The study was carried out in the Borana zone of the Oromia Regional State in Southern Ethiopia, specifically in the Teltele district. The district's town is called Milami. The country's capital, Addis Ababa, is 668 kilometers to the south of it. Additionally, it is 100 kilometers away from Yabelo, the Zone's capital. The Republic of Kenya borders it on the south; South Omo borders it on the west; Southern Nations, Nationalities, and People's Region (SNNP), Konso Zone borders it on the north; Dillo district borders it on the northeast; and El-weye district borders it on the southeast. Since the region is among the driest in the Borana zone, pastoral populations there are particularly vulnerable to drought due to a combination of meteorological and human causes (TDAO, 2022).

The district is located between 496 and 1500 meters above sea level, roughly between 04° 56' 23" N latitude and 37° 41' 51" E longitude. Rainfall in the area varied from 400 to 650 mm per year. We refer to that as bi-modal. In other words, 60% of the rainfall falls between March and May, while 27% falls between September and November. The average yearly temperature varied between 28 and 32 0C. Out of the district's total land area of 10,627.82 square kilometers, 25% is arable, 2.5% is under cultivation, 48% is pasture, 5% is woodland, 20% is shrub and brush, and the remaining 2% is deemed to be marshy, degraded, or otherwise useless (Fenetahun et al., 2020; TDAO, 2022). The area included two small towns and twenty-three rural Kebeles, of which thirteen were dominated by agro-pastoralists and the other twelve by pure pastoralists (TDAO, 2022).

The national census, which was completed in 2015, revealed that 128,760 people, or 7.5% of the district's small population, live in urban areas. Of these, 66,499 are men and 62,261 are women. There were 18,300 households in the district overall, with 3,562 headed by women and 14,738 headed by men. The majority of the area's residents are Oromo, who make up the Borana people. There are also other ethnic groups in the area, like the Konso and Burji. 96.23% of people speak Afaan Oromo as their primary language, 3.0% speak Konsegna, 0.77% speak Burjegna, and others. Their primary sources of income are the care of cattle and, to a lesser extent, crop farming. The district and adjacent areas have frequent droughts, which makes it difficult for animals to traverse the border between Kenya and the Southern People Nation Nationality (SPNN). As a result, there is a great deal of anxiety around animal migration. The district's primary livestock composition consists of cattle, goats, sheep, camels, mules, donkeys, and chickens (TDAO, 2022).

Senegalia mellifera, Vachellia reficiens, and Vachellia oerfota are among the encroaching woody species that predominate in the study area's vegetation. The soil type in the area is composed of 53% red sandy loam soil, 30% black clay, volcanic light-colored silt clay, and 17% silt (Fenetahun et al., 2020).

Procedures for Sampling and Determining Sample Size

The purposeful selection of the Teltele district was based on the district's dependence on precarious livelihoods and the intensity of the drought. A multiphase cluster sampling process was used to choose the respondents and kebeles that represented the representative sample. The district's 25 kebeles were divided into two homogeneous groups in the first stage according to their respective livelihood systems pastoral and agro-pastoral. Finally, 349 pastoralists were randomly picked from the designated kebeles using proportionate probability sampling depending on each kebele's size. The second stage involved the random selection of three kebeles from the stratum of 13 pastoralists. wherein key informants were deliberately chosen. The procedure created by Yamane (1967) was used to calculate the sample size at a 5% level of precision and a 95% confidence range.

$$n = \frac{N}{1 + N(e)^2} \quad (1)$$

Where: N= total number of the target population, n= sample size, e = margin of error

$$n = \frac{2712}{1 + 2712(0.0025)} = 349$$

As a result, the study's sample size is 349.

Consequently, the researcher calculated the sample size using the above formula, and the total sample size was then allocated to each sample kebele according to the percentage of all households in each chosen kebele, as shown in the table below (Table 1).

Table 1. Sample size distribution

Sampled Kebeles	Total number of households head	Sample PPS (Probability proportionate to size)
Dibe Gaya	1043	$1043/2712*349 = 134$
Gandhile	903	$903/2712*349 = 116$
El-kune	766	$766/2712*349 = 99$
Subtotal	2712	349

Source: Based on secondary data computation (TDAO, 2022).

Data Type, Sources, and Collection Methods

The study included two distinct data collection methods: semi-structured questionnaires were used to obtain quantitative data from the sampled households, while focus group discussions (FGDs) and key informant interviews (KIIs) were used to gather qualitative data. Primary and secondary sources of data were both used in the study. For the primary data, checklists were used to gather information from FGDs and KIIs, while semi-structured questionnaires were used to gather information from sampled respondents about institutional, socioeconomic, and demographic characteristics that affect their choice of adaptation strategies. Secondary data sources included published publications, climate data, and documentation from the district pastoral development office.

Methods of Data Analysis

Descriptive statistics like mean, standard deviation, minimum, maximum, percentage, and frequency distribution were used to analyze the quantitative data from the questionnaire to summarize, present, and interpret the survey results, which included information on demographics, socioeconomic status, pastoralists' adaptation options, institutional factors, and barriers to adaptation. Version 17 of the STATA program was utilized for the analyses.

RESULT AND DISCUSSION

Descriptive statistics for category and dummy variables

The sample of respondents included both male and female heads of households. The majority of the sampled respondents were men, based on the descriptive data. Table 2 reveals that 82% of the selected pastoralists had a male head, whereas 18% of the respondents had a female head. Having access to financing helps pastoralists adopt methods that minimize the adverse effects of climate change and moderate their financial constraints. Table 2 showed that, of all the selected households polled, 59% said they got credit, and 41% said they didn't have access to credit throughout the survey period.

An 80.23% of the sampled households as a whole had access to climate information, compared to 19.77% who did not. (Table 2). Information on climate change is essential because it broadens people's understanding of its detrimental effects. Even if 80.23% of the households in the sample have access to climate information, the source is obsolete; instead, 45.85% of sampled households get their climate information from pastoralists' associations, while 17.19% of sampled

households get their climate information from Qaalluu, the indigenous climate forecasters (Table 4).

It is imperative to pick appropriate techniques for climate change adaptation and to raise awareness through climate-related training. Nevertheless, 98.85% of the tested pastoralists do not have access to training on climate-related issues, while just only 1.5% of them did (Table 2). Only local government structures could receive training on climate related issue.

Joining a social group offers pastoralists access to credit, coordinated product marketing, labor, superior inputs, and information. Table 2 shows that 89% of the households that responded are members of a rural community-based institution, whereas 11% are not. It was confirmed that the pastoralists of Borana have strong cultural and social significance, close family ties, and a complex political and cultural system of traditional behaviors known as the Gada system. If available, this system can even be used to alter climate information.

Most respondents accepted that they saw and believed that climate change was occurring. Table 2 indicates that 85% of pastoralists believed there was climate change. Most of the households in the sample think that natural processes and God's act are the causes of climate change, even if they acknowledge that the climate is changing (Table 5). As a result, they still require attentiveness.

Table 2. Statistics that describe dummy variables (n = 349)

Provide some conclusions and implementation of research results.

Variables	Dummy	Frequency	Percent (%)
Sex of HH	Female	62	17.77
	Male	287	82.23
Access to credit	Yes	206	59.03
	No	143	40.97
Receive climate information	Yes	280	80.23
	No	69	19.77
Training on climate-related issues	Yes	4	1.15
	No	345	98.85
Membership in social groups	Yes	310	88.83
	No	39	11.17
Perception of climate change	Perceived	296	84.81
	Not perceived	53	15.19

Source: Own survey data, 2022

Access to Basic infrastructures

Table 3 shows that the pastoralists lacked access to electricity and livestock health posts. Furthermore, 91%, 72%, and 67% of them lack access to clean drinking water for cattle, and clean drinking water for humans and roads, respectively. In contrast, 100% and 93% of sampled respondents had access to primary schools and human health posts respectively. Even still, the majority of the pastoralists in the sample did not have easy access to a school or a health facility since they lived too far away to use them.

Table 3. Basic infrastructures household head can access (n = 349)

Infrastructures	Yes (%)	No (%)
Access to Human Health Post	93.1	6.9
Access to Livestock Health Post	0	100
Access to Road	33.24	66.76
Access to Clean drinking water for Human	28.37	71.63
Access to Clean drinking water for Livestock	10	90
Access to School (Primary)	100	0
Access to Electricity	0	100

Source: Own survey data, 2022

Information Sources on the Climate

According to Table 4, Qaalluu, or Indigenous climate forecasters, provide climatic information to most tested families (45.85%). 2.87% of the tested households got climate information from the radio, compared to 18.91% from no source. The outcome showed that the usual approach which is inaccurate is the only source of climate information in the research area.

Table 4. Source of climate information for sampled households (n = 349)

Sources	Frequency	Percentage (%)
Indigenous climate forecasters'	160	45.85
Not received	66	18.91
Pastoralists association	60	17.19
Development Agent	30	8.60
Non-governmental Organization	23	6.59
Radio	10	2.87

Source: Own survey data, 2022

Descriptive statistics for variables in categories

According to the results, 75% of selected families are illiterate and do not need to attend formal education, whereas 21%, 6%, and 6% of sampled households have attended adult education, elementary school, and religious education, respectively (Table 5). This demonstrated that a higher proportion of the sampled households are still illiterate. According to FAO (2020), expanding adult education programs is crucial since knowledge is a weapon against food insecurity and climate change. The household head's livelihood strategies are shown in (Table 5). The results showed that 62% of respondents were involved in subsistence activities centered around cattle, or pastoralism.

Furthermore, this survey found that 34% of them participated in both pastoral and non-pastoral activities. Dinku (2018) reports that the Borena pastoralist groups of Ethiopia's Oromia regional state include approximately 64.1% of the total population, with a focus on pastoral livelihoods. This supports this outcome. The land in the pastoral community is fragile due to ongoing communal grazing for extended periods and recurring climate change, so it is less productive to continue pastoral livelihood practices as usual, according to qualitative analysis gathered from (F GD in El-kune and Dibe Gaya).

In the study area, publicly accessible natural pasture serves as the main source of feed for animals. It is abundant during the rainy season and in short supply during the dry one. The findings showed that whereas 19% and 1% of pastoralists used communal and private enclosure, respectively, 80% of sampled households used natural pasture, freely accessible rangeland for all groups (Table 5). Mekuriaw and Harris (2021) contend that natural grass, which is plentiful during the rainy season, serves as cattle's main source of feed. This natural pasture's drawback is that it is inaccessible during the dry season. Furthermore, unrestricted access to resources and their ownership by no one cause resource damage and heightened vulnerability. Similarly, Takele et al. (2014) report that dairy cattle in the lowlands of the Borana Zone primarily used natural pastures as a source of feed. But natural pasture is insufficient to provide the animals' nutritional needs on its own, especially in the dry season when its quality and availability are already compromised.

Pastoralists use their worries to forecast what their future selves may hold. Table 5 shows that 78%, 19%, and 3% of the sampled households believe that God, human actions, and natural processes alone are the causes of climate change. 90% of the sampled households predicted that as drought and famine worsen, their standard of living will also worsen, whereas only 10% believed their livelihood would remain the same. Participants in all FGDs and KIIs who participated in qualitative analysis agreed with the following person's idea:

"We already lost every animal we had, and now that we are worried about surviving, there is no hope for us if climate change keeps on this way. We therefore require extra assistance, which ought to encompass long-term planning and emergency response".

Table 5. Descriptive statistics of categorical variables (n = 349)

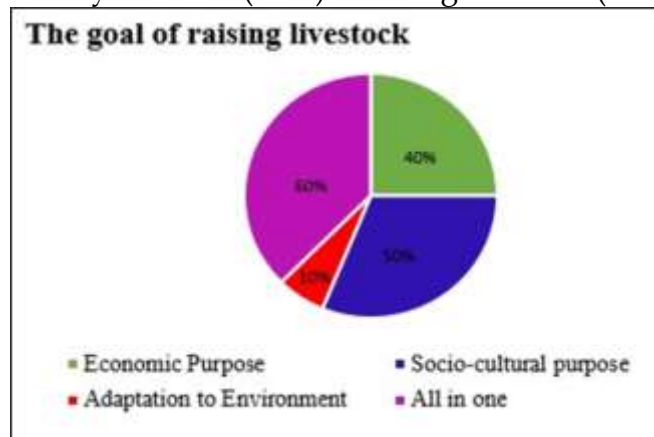
Variables	Categories	Frequency	Percent (%)
Education level	Unable to read and write	263	75.36
	Adult education	74	21.20
	Religious education	6	1.72
	Primary school	6	1.72
Livelihood strategies	Livestock based	215	61.60
	Non-pastoral activities based	14	4.01
	Both pastoral and non-pastoral	120	34.38
Main feed source	Open access rangelands	280	80.23
	Enclosure communal	67	19.20
	Enclosure-private	2	0.57
Their future expectation	Worse-off life	314	89.97
	The same life	35	10.03
Causes of climate change	The act of God	271	77.65
	Natural process	68	19.48
	A human and natural process	10	2.87

Source: Own survey data, 2022

Goals of pastoralists in raising livestock

Raising livestock is the mainstay of pastoralism, a subsistence livelihood approach used mostly for survival and financial sustenance. Pastoralists were rearing livestock for multiple purposes. The results demonstrate that 40% of pastoralists raise various livestock species for economic purposes, such as subsistence, revenue production, trading, and risk management. For socio-cultural (social prestige, cultural identity, social cohesiveness, and insurance) reasons, 50% of the sampled pastoralists raised various livestock species. At least 10% of pastoralists also raise livestock to adapt to their changing environment. Although 60% of the pastoralists in the sample raised livestock for all of the aforementioned purposes simultaneously (Figure 1)

This implies that pastoralism is everything to pastoralists. Pastoralism is the sole and primary source of income for the expanding human population in the region under the dry and semi-arid agro-climatic characteristics of the Borana, as confirmed by Berhanu (2011) and Megersa et al. (2014).



Source: Own survey data, 2022

Figure 1. Goals of rearing livestock

Climate Change Adaptation Strategies

The result indicates that to mitigate the effects of climate change, pastoralists in the district mainly use destocking, herd mobility, and livestock diversification. These strategies demonstrate the resilience of the community, making up 78.80%, 73.93%, and 66.48% of documented adaption methods, respectively. Even while herd splitting and drought-tolerant livestock are also used, their adoption rates are 4.01% and 4.30%, respectively, making them less popular adaptation strategies (Table 6).

The Borana pastoralists have thus had to adapt through herd mobility, or moving their cows so that they alternate between the rangelands and deal with limited nutrient availability as well as climate change. That is, they made this strategy work through an understanding of how forage availability varies over time and space. Destocking was by contrast the course of action with which there was the least agreement because cattle were too important in culture. While mobility served as the foundation of their adaptation, pastoralists frequently engaged in a variety of practices to mitigate the effects of drought. Nevertheless,

despite the extent to which different coping mechanisms were tried out and experimented with by participants prayer emerged as a solution in its own right when it came to experiences of climate change.

Table 6. An overview of the main adaption strategies that pastoralists employ

Adaptation Strategies	Frequency	Percent (%)
Herd mobility	275	78.80
Livestock diversification	258	73.93
Destocking (livestock selling)	232	66.48
Drought-tolerant livestock species	15	4.30
Herd split and exchange	14	4.01

Source: Own survey data, 2022

Barriers to Climate Change Adaptation

Despite different coping mechanisms in place, pastoralists still face major barriers to adapting to climate change. Major constraints include limited access to weather information, lack of veterinary services, prevalence of livestock diseases in high-rainfall zones, inadequate market access, and information resource conflicts over water critical shortage for domestic use in some areas' poor prices during droughts a scarce technical adaptation knowledge. As a result, posed to it are factors that in combination prevent pastoralists from effectively dealing with the impacts of climate change.

A major barrier to pastoralist climate adaptation remains the lack of real-time and on-demand reliable information about markets as well as weather/climate (Figure 2). Pastoralists are unable to make well-informed judgments on when to sell livestock due to a lack of meteorological knowledge, which may result in selling during drought-induced price declines (which are made worse by limited market access). Related work: Yimam and Yimer (2016), Birhanu et al. (2017), and Zhang et al. 2019 corroborated, which specified the importance of such information to help adaptive strategies. As a result, institutional fragility and the vagaries of climate exacerbate the dissemination of indispensable knowledge. Strengthen the institutional capacity for providing climate and market information promptly to improve pastoral resilience.

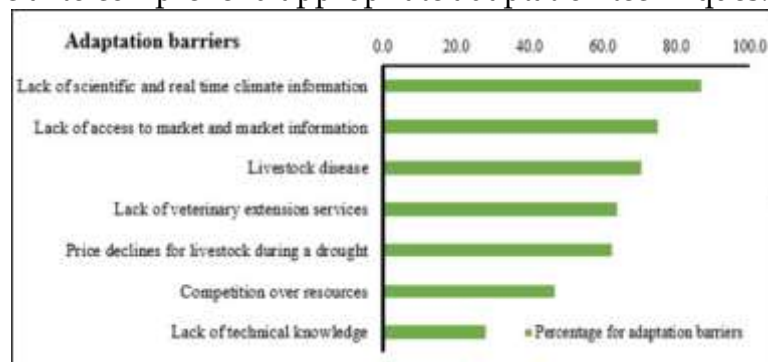
Livestock diseases present an obstacle, for pastoralist communities adjusting to changes in the climate. According to data in Figure 2 these illnesses are ranked as the significant challenge showing an increase, in both occurrence and spread. When their condition worsens during droughts, diseased livestock are likely to sell for much less. As a result, there is less money available to buy necessities. This upward trend, possibly linked to climate shifts worsens the situations faced by pastoralists. Research conducted by Jilo et al. (2016), Birhanu et al. (2017) and Debela et al. (2019) support these conclusions. Considering the role that livestock plays in pastoralist livelihoods the high prevalence of animal diseases greatly hampers their ability to carry out adaptation measures.

Moreover, the research revealed that an additional crucial barrier to successful adaptation was the absence of veterinary extension services (Figure 2). Pastoralists are unable to learn about best practices in water management, animal

husbandry, and other adaptation methods if they do not have access to trustworthy information and extension services. This keeps them vulnerable. According to Dinku (2018), pastoralists' abilities and decision-making when looking for and utilizing a variety of livelihood possibilities may be influenced by the knowledge, expertise, and information received from veterinary extension service providers. For pastoralists in the Borana Zone, maintaining a healthy and productive livestock population is still severely hampered by the lack of or inadequate access to animal healthcare services (Birhanu et al., 2017). Animals may gather at fewer watering locations due to competition for limited water supplies, which raises the possibility of disease transmission. A shortage of veterinary services to control epidemics may make this worse. According to Lelamo et al. (2022) and Jilo et al. (2016), inadequate veterinary care is a significant obstacle in Ethiopia's pastoral regions. This suggests that pastoralists are finding it difficult to maintain the health of their cattle and enhance their output due to a lack of restricted veterinary extension services.

The drop in cattle prices during droughts and the intense competition for resources present another barrier to climate change adaptation. (Figure 2). Conflicts over water can disrupt customary grazing patterns and access to markets, further reducing economic potential. According to Lelamo et al. (2022), pastoralists compete with one another for water and pasture, and low livestock prices offered during drought years are cited as a barrier to desired adaptation and coping techniques. Only the pastoralists residing in the surrounding areas have free access to pasture and water resources, meaning that competition for these resources arises from the mobility of pastoralists from other places. The results of the FGDs and KIIs also showed that, because the livestock is already weak and there is a surplus of supply compared to demand, prices for livestock typically drop during droughts.

Lastly, the sampled pastoralists indicate that one barrier preventing them from utilizing various adaptation measures is a lack of technical knowledge (Figure 2). The respondents believed that one of the obstacles preventing pastoralists from adopting effective adaptation techniques is their ignorance of suitable options for adaptation. Jilo et al. (2016), Marie et al. (2020), and Lelamo et al. (2022) all reported findings that were comparable to this one. To live and avoid suffering significant losses, pastoralists must adjust to climate change. Thus, it's crucial to comprehend appropriate adaptation techniques.



Source: Own survey data, 2022

Figure 2. Barriers to climate change adaptation

CONCLUSIONS AND RECOMMENDATIONS

Ethiopia is particularly vulnerable to the consequences of climate change. Since a sizable section of the population is dependent on natural resources and agriculture, both of which are extremely vulnerable to climate change. Pastoralists face challenges in adapting to climate change due to their restricted options for subsistence and lack of capability. Policymakers, researchers, and other stakeholders can benefit from the study's findings, which provide pertinent information on barriers to climate change adaptation strategies that hinder pastoralists and the best places to begin efforts.

To help pastoralists adapt to change, future policies and strategies, and stakeholders at the district and zonal pastoral development offices, disaster risk management offices, development agents, and pastoralists associations should provide them with access to real-time and scientific climate information. Since numerous barriers are interconnected, adaptation planning should occur at multiple scales.

ADVANCED RESEARCH

The study's limitations were that it only examined pastoral groups; agro-pastoralists was not taken into account, and a survey was only conducted with 349 sampled households.

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