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Assessment of Water Shortage in Pastoralist Communities in Guriel District, Somalia

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ABSTRACT

The study sought to assess the impact of water shortage on pastoralist communities in the Guriel District of Somalia. The study used a cross-sectional survey methodology, gathering data using questionnaires from 318 participants and conducting interviews with 12 participants. The data obtained from the field were examined with a chi-square test. The results revealed that water shortage had a substantial influence on agricultural yield in Guriel District, Somalia ($X2 = -4.605$, $p = 0.040$). Furthermore, it had a very significant effect on crop production in general ($X2 = -5.432$, $p = 0.000$). This implies a significant association between the scarcity of water in the Guriel region and the productivity of crops. The study also examined the occurrence of water shortage in Guriel District, Somalia and its effects on domestic animal husbandry. This research used bivariate analysis. The statistical analysis reveals a strong correlation between the two variables, as shown by a chi-square value of -7.348 and a p-value of 0.000. The presence of water shortage in the Guriel area is closely linked to a decline in the use of domestic animal husbandry. In addition, a chi-square test was performed to analyse the influence of the incidence of water scarcity on income-generating activities in the Guriel area of Somalia. The study demonstrates that a continuous shortage of water significantly impedes agricultural output and production techniques. Sorghum, a prominent agricultural crop in the Guriel region, is continually exposed to potential hazards.

Keywords: Water shortage, Pastoralist, Crop production, Drought, Revenue generation, Somalia

INTRODUCTION

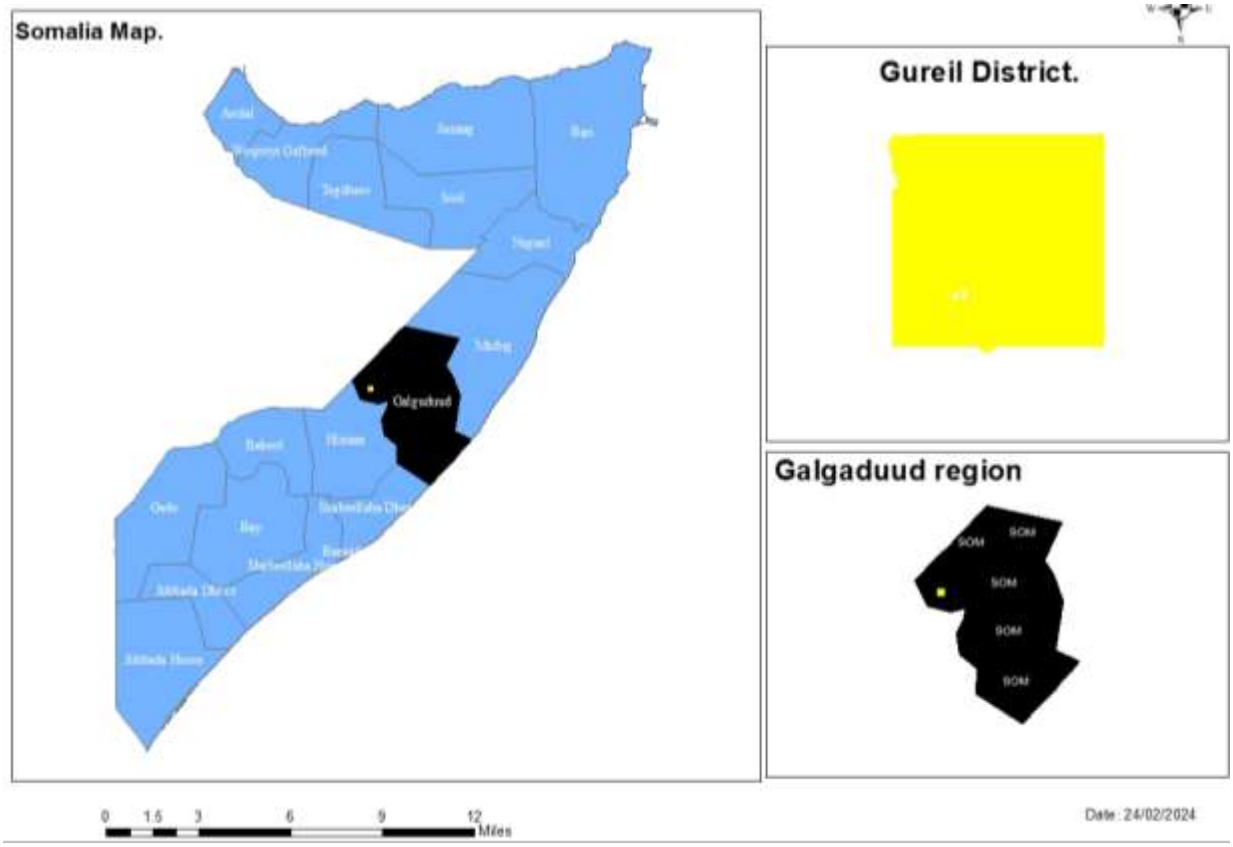
Water is a vital need for the life of humans on Earth. Water is necessary for the survival and optimal functioning of plants, animals, and people. Securing access to uncontaminated water and adequate sanitation is a crucial step towards achieving economic advancement and fostering optimal health [1]. Therefore, efficient allocation and use of its resources are crucial for the development of any nation. Water has a crucial function not only in supporting human life, but also in facilitating the growth of crops, raising animals, and producing fish. However, both natural factors such as climate change, lack of rainfall, and drought, as well as human factors such as rapid population growth, development of major cities, agriculture, and tourism, all contribute to the scarcity of water. Water scarcity, defined as an insufficient quantity of water or restricted access to uncontaminated water sources, is a global issue [2]. Pastoralism in the Horn of Africa is an essential economic pursuit that supports the livelihoods of millions of people. The industry employs a substantial proportion of the population in every country. The pastoralists in this region own a significant share of the livestock assets. Moreover, the livestock originating from the pastoral and agro-pastoral areas of these countries plays a vital role in generating foreign currency profits for them [3]. In Africa, more than 2.7 billion people face the problem of water shortage, while worldwide, over 663 million persons do not have access to clean water. Unfortunately, Africa is home to half of the population that relies on unsafe water sources, with a special focus on sub-Saharan Africa (SSA) where 319 million people are affected. The reasons of water shortages varies throughout various regions of the world owing to variations in climatic conditions and socio-cultural influences [4]. Water shortage often hampers poverty reduction initiatives and is associated with detrimental impacts on public health. Understanding the fundamental

factors that contribute to water scarcity in Sub-Saharan Africa (SSA) and evaluating its tangible impacts on the socio-economic progress and health of the African sub-continent are of utmost importance. Acquiring a thorough comprehension of the aforementioned features will assist in developing appropriate strategies and policies to address the issue of water shortage in Sub-Saharan Africa (SSA). The user's content is wrapped by tags. In Somalia, the continuous lack of rainfall for the sixth year in a row has led to persistent and severe scarcity of water. The lack of water and pasture has directly impacted the welfare of animals. According to the OCHA, Somalia has seen the death of almost 3 million livestock as a consequence. The lack of rainfall has caused a severe shortage of animal feed, resulting in a full halt in output, with a total drop of 100%. The lack of cattle also adversely impacts several sectors, including dairy, grocery, and other local businesses, resulting in the devastation of people's means of making a living. Water shortages are not only impacting livestock, but also crops, leading to continuous harvest failures. Multiple farmers have reported a decline in agricultural productivity since the year 2020. While water infrastructure exists in some areas, it is often disregarded, hazardous, and requires extensive travel to get water. This scenario presents a heightened likelihood of harm to females [5]. Guriel, Somalia is experiencing a severe water shortage, which poses a great danger to the lives of many people, especially those involved in pastoralism. The water scarcity in the region is a result of an extended period of aridity and the exhaustion of water reservoirs, such as wells and dams. Consequently, pastoral groups have been compelled to abandon their homes in pursuit of water. Furthermore, the price of the limited water supply in the Guriel district and adjacent regions has increased substantially, making it too expensive for the majority of the local residents to pay. The scarcity of water, resulting from the confluence of economic growth and population expansion, is generally seen as a substantial obstacle to human civilization and a hindrance to the attainment of sustainable development [6]. In the next decades, water has the potential to become the most vital resource, especially in arid and semi-arid regions of the world [10]. Historically, governments in these regions have endeavoured to tackle water scarcity problems by employing various strategies, including the construction of dams, replenishing groundwater, inducing rainfall through cloud seeding, converting saltwater into freshwater using desalination, recycling wastewater, and undertaking extensive water transfer projects, among other approaches [7]. However, there is increasing evidence indicating that making unsustainable decisions to meet the growing demand for water might result in the development or worsening of water shortages [8,9]. The susceptibility of a civilization to drought is in a constant state of flux, influenced by factors such as population increase, alterations in land use, advancements in technology, governmental regulations, and several other causes. Pastoral communities, such as those in Somalia, are very susceptible to natural disasters like drought, especially when they are faced with volatile political conditions [10]. The rural and pastoralist residents of the Guriel District have a substantial problem of water shortage, resulting in several social and environmental difficulties. This includes the effects on individuals' livelihoods and the insufficient availability of drinkable water. The aim of this study is to determine the main variables that are causing a lack of water in the Guriel District and assess how it is affecting pastoralist communities.

METHODOLOGY

Description of the Study Area

Guriel, situated in the Galgaduud region of Somalia, is the second biggest city in the central area. It is located inside the Galmudug state. Since the collapse of the old Somali government in 1991, this city has been embroiled in ongoing violence. In 2007, Al-Shabaab, an Islamic extremist organisation that originated in southern Somalia, launched an assault on Guriel. However, in 2010, the local paramilitary group Ahlu Sunna Waljama'a (ASWJ) emerged as a reaction and successfully gained control of Guriel [11, 12]. Nevertheless, the ongoing war between ASWJ and Al-Shabaab persisted. Furthermore, Galmudug, a regional administration established in central Somalia, has actively participated in the fight on behalf of the Somali government troops [13].



Source: Primary Data, 2023

Figure 1: map of Somalia showing location of Galgaduud region

Climate

Two recent natural catastrophes struck Somalia, which is racked by a lengthy war. More than half of the population of the nation now experiences food insecurity and 1.6 million people have been displaced as a result of the drought that started in 2016—the third catastrophic drought in as many decades. The drought was finally over in April 2018, however the rains also brought about widespread flash floods, riverine flooding, and cyclones near the northern shore.

Population

Galmudug, officially Galmudug State of Somalia is a Federal Member State in central Somalia, with its capital at Dhusamareeb. Around 400,000 people are said to live in the area, with 120,000 living in the Guriel district [11].

Research Design

An exploratory survey approach was used in this study to investigate and explain the peculiarities of the current water shortage circumstances in the Guriel District and their consequences on the pastoralist population. The investigation applied quantitative methodologies. The quantitative methods were utilized to analyze the quantifiable and measurable replies, particularly those from the questionnaire.

Research population

The target population of this study was 12,380, encompassing pastoralists, community leaders, Government officials, and environmental activists. These groups were targeted since they have substantial information about trends of water shortage in the area of study, the main water sources for homes, the factors contributing to the water deficit results in pastoralist communities, and the revenue generating activities of the water supply shortage in pastoralist communities.

Sample Size

The Slovene formula was used to choose the sample. By using the Slovene formula with a confidence level of 95% and a margin of error of 0.05, the research sample size was calculated.

Simple Random Sampling

Small-scale farmers were chosen at random, and simple random sampling was employed to choose responders from among them in order to ensure that each had an equal chance of being represented. Every candidate were given equal opportunity to be chosen. Each person in this situation was selected solely by random, and each person in the population has an equal possibility of being chosen.

Purposive sampling

Purposive sampling was employed to select high-profile respondents from government, pastoralists and environmental activists who could have eminent information on the research topic. They can only gather replies from the subgroups they uncover if they have a limited amount of time or access to conduct the systematic study. Purposive sampling expedites research, allowing you to do it more quickly and for less money.

Data Collection Methods

The techniques used to obtain the data for this study were questionnaire distribution and interviewing. Interview for structured interview and face-to-face interviews were conducted, questionnaires for quantitative data that were personally administered.

Self-administered Questionnaire and Interviews

Semi-structured questionnaires were selected because they may be utilized with large samples, making the results more trustworthy and accurate. The interviews were conducted with agricultural and environmental officers, who by virtue of their experience through purposefully identified and interviewed as key informants

Data Processing and Analysis

The data processing started by editing the schedules and coding the responses. Editing, coding, and tabulation techniques were used. SPSS (IBM 20) is a tool that is specifically used to process, code, and analyze data.

Ethical considerations

In order to uphold ethical standards in the study, the researcher obtained an introductory letter from the School of Natural and Applied Science (SONAS) at Kampala International University. Additionally, the researcher personally introduced themselves to pastoralists, environmental activists, community leaders, farmers, and other relevant entities, including law enforcement officers. The researcher sought input from scholars and law enforcement officials during the duration of this study. The researcher adhered to ethical guidelines in order to uphold and prevent any violations of the respondent's privacy. This included principles of respect, secrecy, and participant autonomy.

RESULTS

Table 1: Response Rate for the Respondents

Response	Sample	Response
Questionnaire	371	318(85.7%)
Interview	16	12 (75%)

Table 1 showing that 318 responses were attained out of the 371 questionnaires which were sent in the field representing 85.7% of the study while the interview responses had 12% responses presenting a 75% response rate

Table 2: Gender of Respondents

Responses	Frequency	Percent
Male	204	64.2
Female	114	35.8
Total	**318**	**100.0**

Table 2 showing that majority of the respondents were male with a total of 204 (64.24%) and female 114 (35.8%)

Table 3: Age of Respondents

Age	Frequency	Percent
20-29 Years	31	9.7
30-39 Years	53	16.7
40-49 Years	88	27.7
50-59 above	98	30.8
60 above	48	15.1
Total	**318**	**100.0**

Table 3 showing that majority respondents were in the age of 50-59 years who were 98(30.8%) of the study, those of 40-49 years were 88(27.7%) of the study, those of 30-39 years were 53(16.7%), those in the age of 20-29 years were 31(9.7%) of the study, those of 60+ were 48(15.1%).

Table 4: Education of Respondents

Responses	Frequency	Percent
Secondary	166	52.2
Certificate & Diploma	80	25.2
Bachelor	40	12.6
Post graduate	32	10.1
Total	**318**	**100.0**

Table 4 showing that majority of the respondents were secondary school leavers who were 166(52.2%), certificate and diploma holders who were 80(25.2%) of the respondents followed by degree holders who were 40(12.6%) and finally post graduate were 32(10.1%).

Table 4: Time of Living in Guriel district

Responses	Frequency	Percent
1-4 Years	5	1.6
5-9Years	6	1.9
10- 14 years	40	12.6
15 Years above	267	84.0
Total	**318**	**100.0**

Table 5 indicate that majority respondents had been in Guriel district for more than 15 years, these were 267(84%) of the respondents, this was followed by those in the age of 10-14 years who were 40(12.6%), then those who have been in Guriel district for 5-9 years were 6(1.9%) of the respondents and finally 1-4 years were 5(1.6%) respondents

Table 5: Marital Status of the Respondents

Responses	Frequency	Percent
Single	14	4.3
Monogamous	214	67.1
Polygamous	55	17.2
Divorced	0	0.0
Widowed	35	11.4
Separated	0	0.0
Total	**318**	**100.0**

Table 6 showing that the majority (66.1%) of the respondents were in polygamous marriages, 17.1% in monogamous marriages, the widowed were 11.4% and the singles being 4.3% (Table 6).

Table 6: Sources of water in the areas of study

Responses	Frequency	Percent
Borehole	182	57.3
Tap	66	20.8
Well	26	7.8
Rain	36	11.7
Spring	8	2.2
Total	**318**	**100.0**

Table 7 showing that Borehole is the most common sources of water in the area of study with 47% of the respondents drawing their water from boreholes. Other sources which are important include River, Tap water, wells, Rainwater and Oasis.

Figure 2: Whether water shortage Prevalence affect Crop production in Guriel district, Somalia

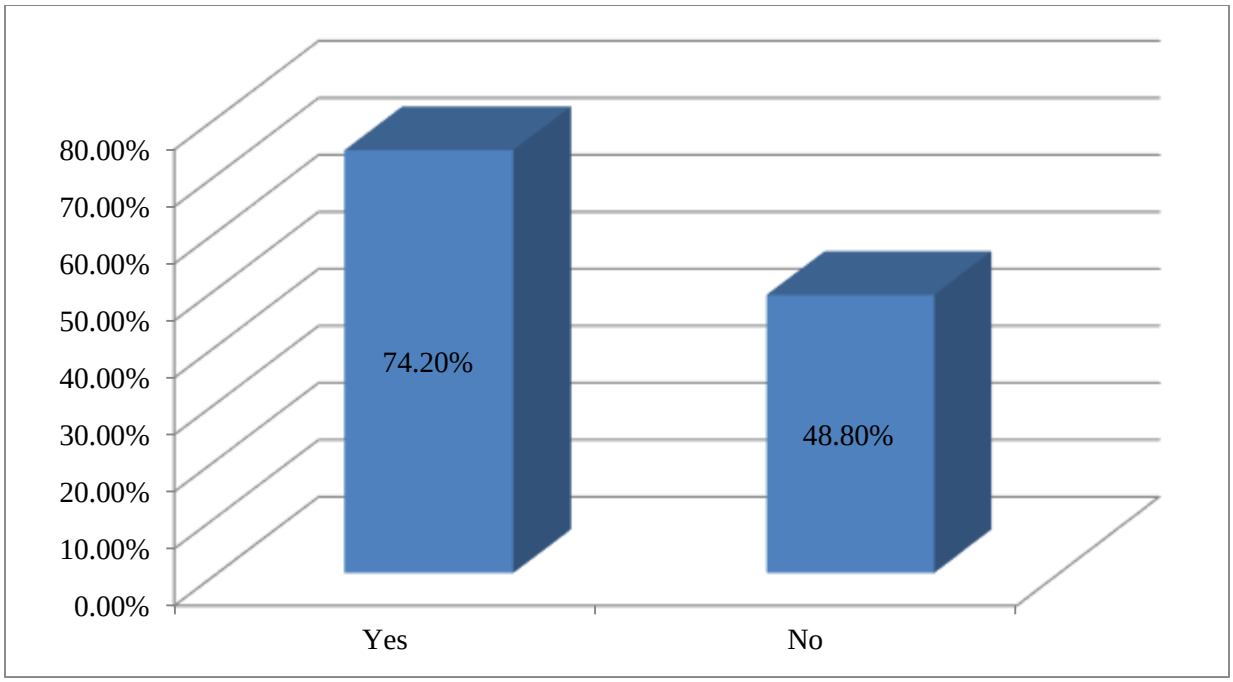


Figure 2 showing that majority of respondents 236 (74.2%) agree that water shortage affect Crop production while 82 (25.8%) respondents disagree

TABLE 7: FREQUENCY IN EXPERIENCING WATER SHORTAGE IN GURIEL DISTRICT, SOMALIA

Responses	Frequency	Percent
A month in year	60	18.9
At least 3 Months a year	144	45.3
6 Months a year	114	35.8
Total	**318**	**100.0**

Table 8 showing that 114(35.8%) respondents contend to experiencing water shortage 6 months in a year, those who contend for at least 3 months a year were 144(45.3%) respondents and those of at least a month in the years were 60(18.9%) respondents.

Table 8: State of water shortage prevalence in Guriel district, Somalia

Responses	Frequency	Percent
Very High	73	23.0
High	90	28.3
Low	70	22.0
Very Low	85	26.7
Total	**318**	**100.0**

Table 9 shows that 85 (26.7%) respondents content that the water shortage prevalence in the district were very low, 70 (22%) contend it was low, 90 (28.3%) and finally those of very high were 73(23%) responden

Table 9: Univariate analysis on effect of water shortage prevalence affects crop production in Guriel district, Somalia

Responses	Frequency	Percent
Seeds fail to germinate	112	35.2
Crops become stunted	55	17.3
Crops fail to yield grain	24	7.5
Crops yield poorly	56	17.6
Crops completely die	71	22.3
Total	**318**	**100.0**

Table 10 shows that 112 (35.2%) respondents agree that water shortage leads to seed failure to germinate, 55(17.3%) respondents argued that crops become stunted, 71(22.3%) respondents contend that crops completely die, crops poor yielding was by 56(17.6%) respondents and 24(7.5%) respondents contend that crops fail to yield grains.

Table 10: Bivariate analysis of association of water shortage prevalence affect crop production in Guriel district, Somalia

Variable	Responses	Yes	No	X^2	P-value
Water shortage Prevalence affect	Yes	119	93	4.605	0.040*
the domestic animal keeping	No	65	41		
Seeds fail to germinate		45	21	5.432	0.000
Crops become stunted		37	24		
Crops fail to yield grain		45	23		
Crops yield poorly		49	19		
Crops completely die		35	20		

Table 11shows that water shortage prevalence affect crop production in Guriel district, Somalia (X^2 = 4.605, p =0.040) and on the effects of water shortage prevalence on crop production (X^2 = 5.432, p =0.000). ** statistically significant at P< 0.05

Figure 3: Prevalence of approaches to ensuring crop production in Guriel district, Somalia

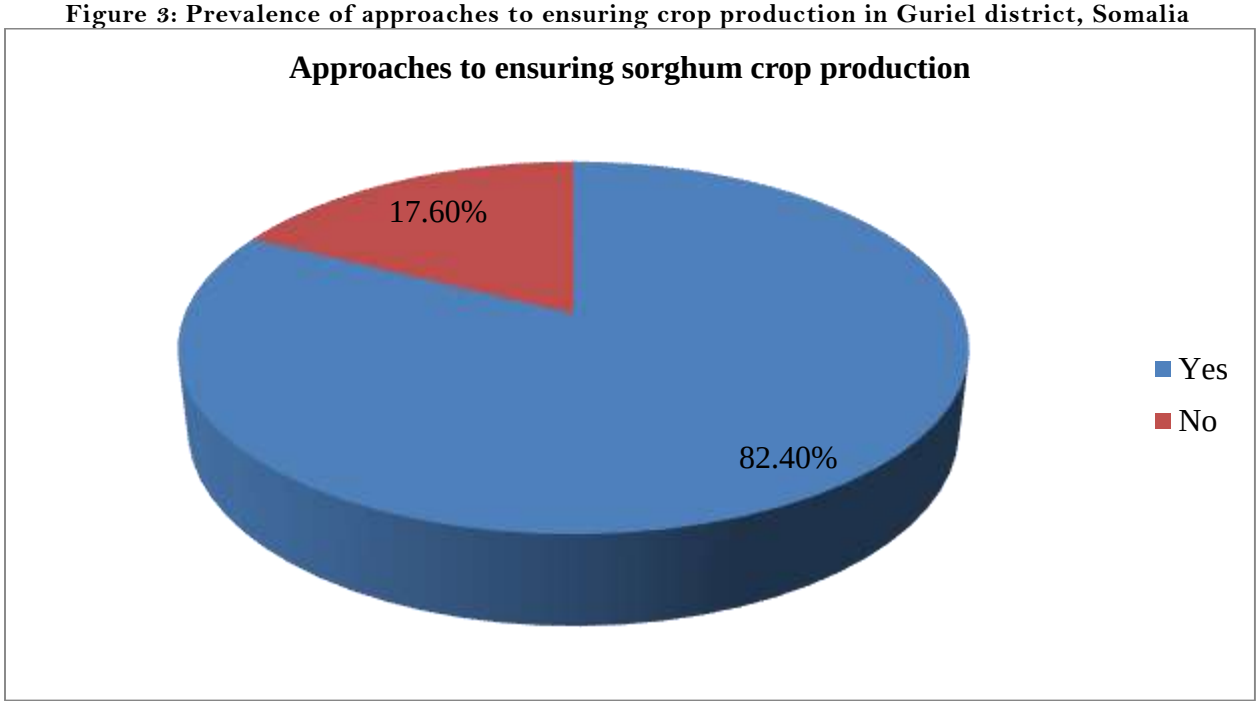


Figure 3 show responses on the prevalence of approaches to ensuring crop production in Guriel district, Somalia; 262(82.4%) respondents agree while 56(17.6%) respondents disagree.

Figure 4: Whether water shortage prevalence affect the domestic animal keeping in Guriel district, Somalia

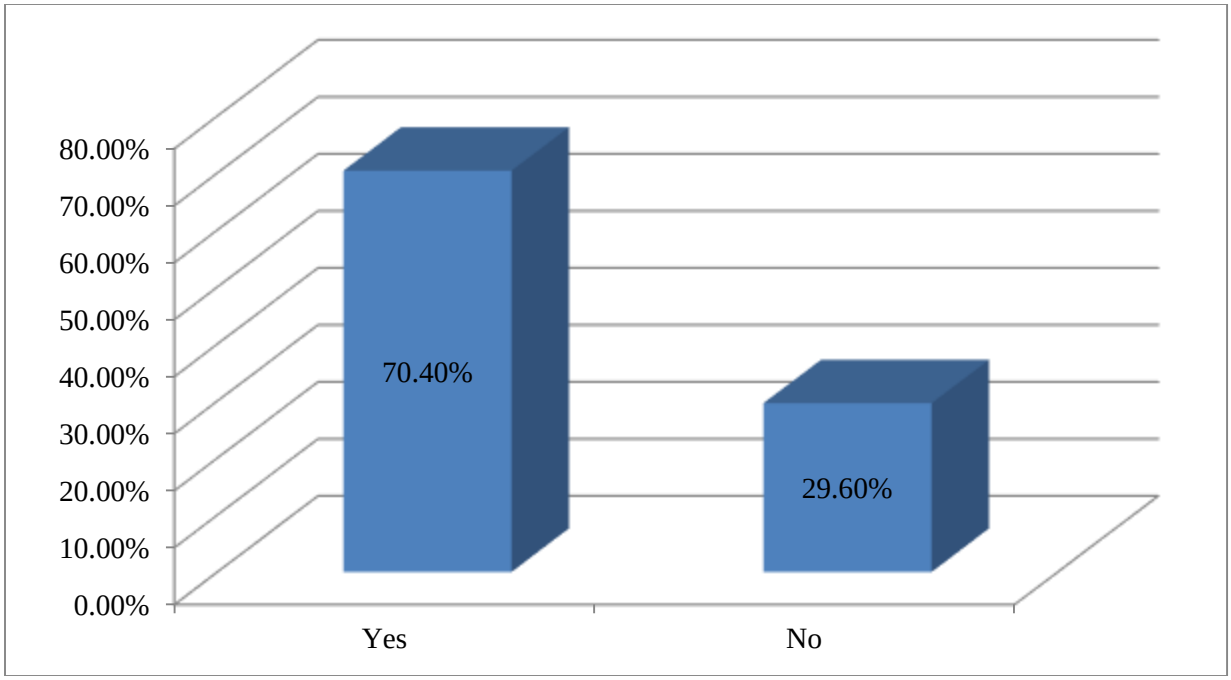


Figure 4 shows findings on whether water shortage prevalence affects the domestic animal keeping in

Guriel district, Somalia indicating that 224(70.4%) respondents agree while 94(29.6%) respondents disagree.

Table 11: How water shortage prevalence affects camel's in Guriel district, Somalia

Responses	Frequency	Percent
Reduction of camel weight	56	17.6
Reduction in milk production	45	14.2
Reduction in animal value	61	19.2
Reduction in animal price	106	33.3
Disease infestation to animals	50	15.7
Total	**318**	**100.0**

Table 12 show results on whether water shortage prevalence affects camel's in Guriel district, Somalia. It was found that water shortage prevalence reduced the prices of camel according to 106(33.3%) respondents with 61(19.2%) respondents who contend that there is reduction in animal value due to water shortage

TABLE 13: WATER SHORTAGE CONTINUITY MAY AFFECT THE DOMESTIC ANIMAL KEEPING IN GURIEL DISTRICT, SOMALIA

Responses	Frequency	Percent
Camels' population were reduce	91	28.6
There was a significant loss of revenue from camels	89	28.0
People was lose camel's revenue	61	19.2
Total poverty from camel farmers	77	24.2
Total	**318**	**100.0**

Table 13 results on whether water shortage continuity may affect the domestic animal keeping in Guriel district, Somalia, it was found that camel's population will reduce with 91(28.6%) respondents, there will be a significant loss of revenue from camel with 89(28%) respondents

FIGURE 5: WHETHER WATER SHORTAGE AFFECT REVENUE-GENERATING ACTIVITIES IN GURIEL DISTRICT, SOMALIA

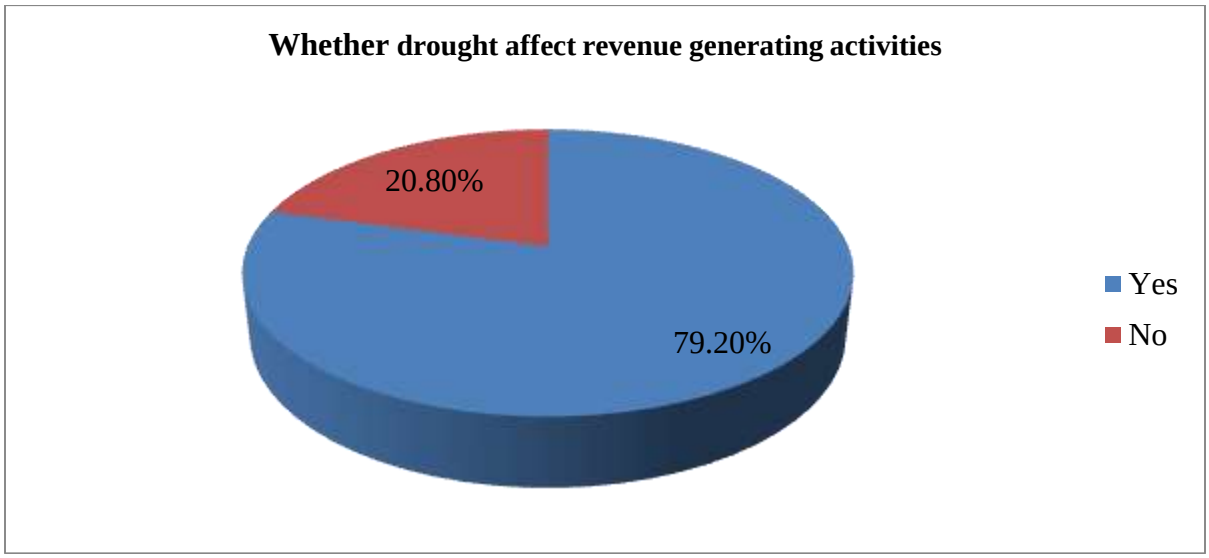


Figure 5 shows findings on whether water shortage affect revenue-generating activities in Guriel district, Somalia, which reveal that 252 (79.2%) respondents agree while 66(20.8%) respondents disagree.

TABLE 14: EFFECT OF WATER SHORTAGE ON REVENUE-GENERATING ACTIVITIES IN GURIEL DISTRICT, SOMALIA

Response	Frequency	Percent
Business activities are hampered	73	23.0
Business support services are affected	67	21.1
Water shortage reduce the capacity of business operations	69	21.7
Water shortage reduce the revenue activities functionality	109	34.3
Total	**318**	**100.0**

Table 14 findings on whether water shortage affects revenue-generating activities in Guriel district, Somalia, It was found that Water shortage reduce the revenue activities functionality had 109(34.3%) respondents, Water shortage reduce the capacity of business operations had 69(21.7%) respondents,

Table 15: Bivariate analysis of association of water shortage prevalence affects revenue-generating activities in Guriel district, Somalia

Variable	Responses	Yes	No	X^2	P-value
Water shortage Prevalence affect revenue generation	Yes	104	83	-4.12	0.030*
	No	75	56		
Business activities are hampered		65	35	-9.667	0.000
Business support services are affected		42	30		
Water shortage reduce the capacity of business operations		54	24		
Water shortage reduce the revenue activities functionality		48	30		

Table 15, present bivariate analysis of water shortage prevalence affects revenue-generating activities in Guriel district, Somalia (X^2 = -7.348, p =0.000) and on the effects of water shortage prevalence on domestic animal keeping (X^2 = -9.667, p =0.000) ** statistically significant at P< 0.05

Table 16: Degree at which water shortage affect revenue-generating activities in Guriel district of Somalia

Responses	Frequency	Percent
Large	241	75.8
Small	77	24.2
Total	**318**	**100.0**

Table 16 show that to large degree water shortage affect revenue-generating activities in Guriel district of Somalia with 241(75.8%) respondents who agreed

TABLE 17: MECHANISMS UNDERTAKEN IN IMPROVING REVENUE-GENERATING ACTIVITIES GURIEL DISTRICT OF SOMALIA

Responses	Frequency	Percent
Community awareness campaigns on forest value	48	15.1
Storage of water for future irrigation	55	17.3
Valley dams provide water	65	20.4
Seasonal timing before crop growth	100	31.4
Planting of water shortage resistant crops	50	15.7
Total	**318**	**100.0**

Table 17 shows findings on the mechanisms are undertaken in improving revenue-generating activities Guriel district of Somalia

FIGURE 6: PRESENCES OF LIVESTOCK FROM A DIFFERENT HERD

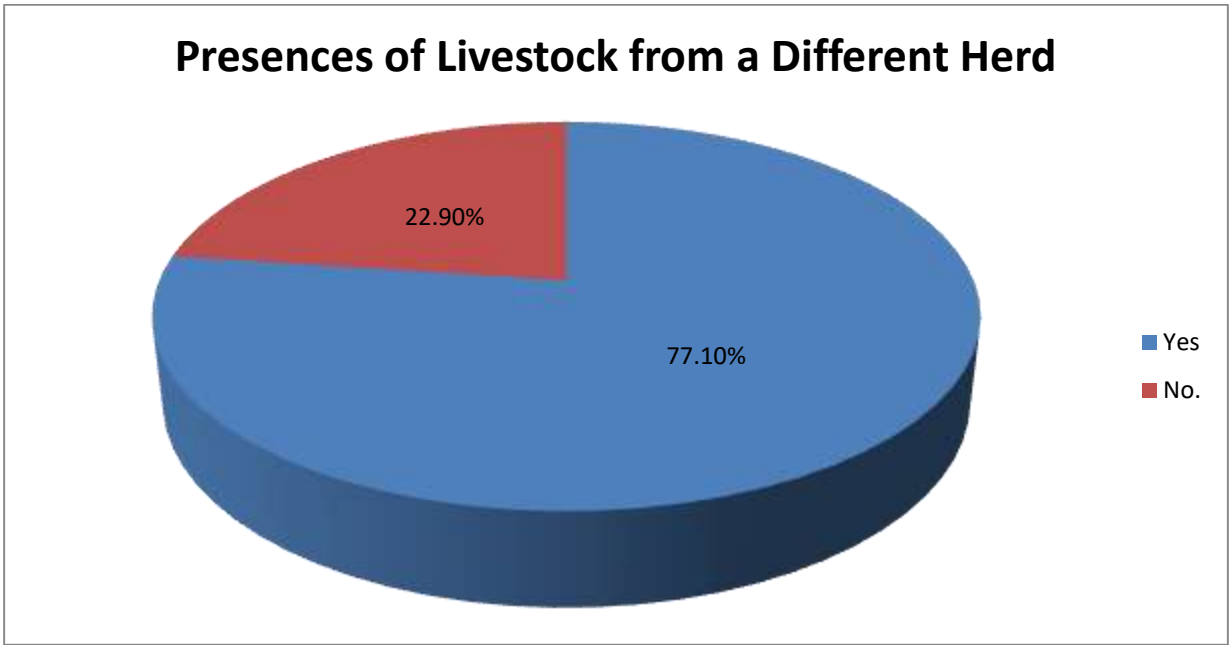


Figure 6 shows that majority (77.1%) of the respondents didn't have animals belonging to others in their herd, while 22.9% of the respondents had animals in their herds that belonged to others

FIGURE 7: PRESENCE OF ANIMALS BEING KEPT OUTSIDE THE HERD

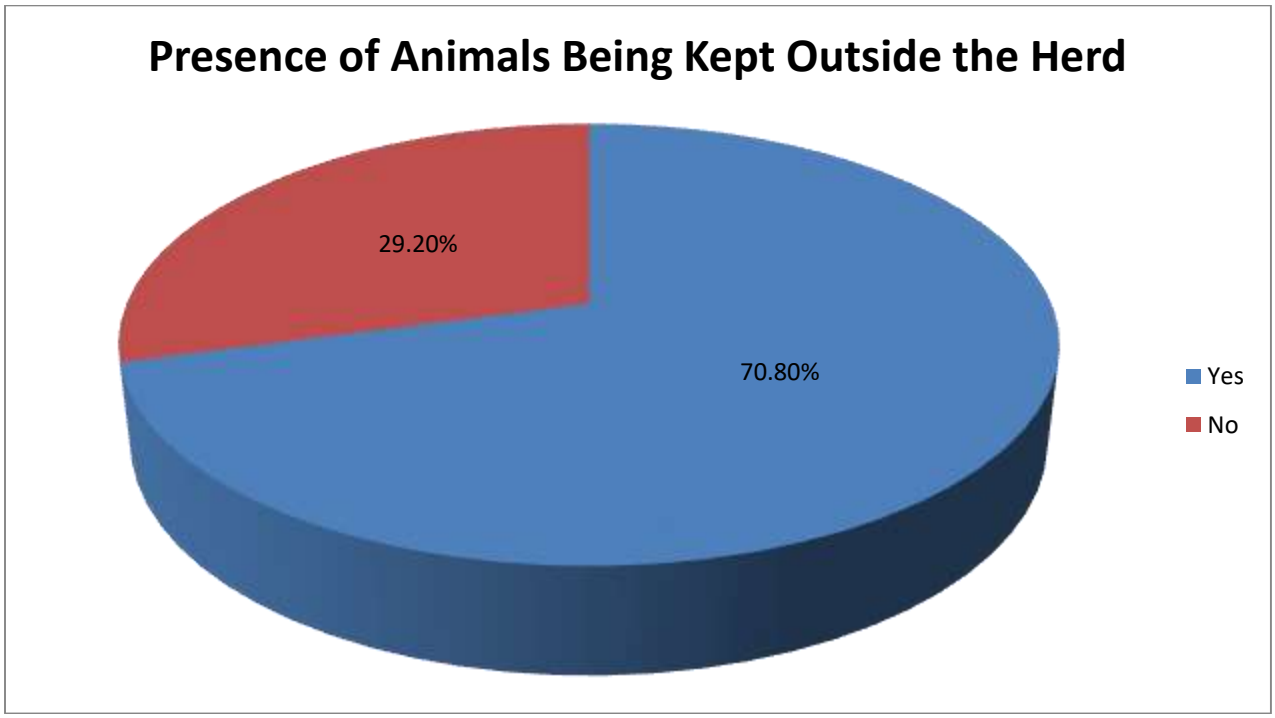


Figure 7 shows that majority (70.8%) of the respondents didn't have any animals belonging to them outside their herd, while 29.2% of the respondents had their animals being reared on their behalf by others (Figure 4.6).

Table 18: Migrated in Such of Water and Pasture

Responses	Frequency	Percent
Yes	300	94.3
No	18	5.7
Total	**318**	**100.0**

Table 19 shows that there was divided opinion on the success with 50% of the respondents indicating migration was a successful move for them while others it wasn't.

Table 19: Whether government intervene in improvement of revenue activities in Guriel district, Somalia

Responses	Frequency	Percent
Yes	155	48.7
No	163	51.3
Total	**318**	**100.0**

Table 19 shows findings on whether government intervenes in improvement of revenue activities in Guriel district, Somalia, 155(48.7%) respondents agree while 163(51.3%) respondents disagree.

DISCUSSION OF FINDINGS

Findings shown in Tables 10 and 11 suggests that there is a strong correlation between agricultural productivity and the Guriel district's water scarcity. The results demonstrate that the Guriel district of Somalia's agricultural productivity is significantly impacted negatively by water scarcity. Based on the results, the findings concur with those of Boukary et al., [14], who contended that the evaluation of water shortage adaptive genes on crops, like sorghum, in water-limited environments can only be done when the system as a whole is taken into account in terms of yield potential, resistance to water shortage, and efficiency of water use. The results corroborate the claims made by Mdungela et al., [15] that a lack of water has a detrimental impact on agricultural output. The study reveals a significant negative correlation between water scarcity and domestic animal husbandry in the Guriel district of Somalia (Tables 12 and 13). The water deficit significantly impacts domestic animal keeping, leading to a decrease in this sector. The study supports the argument that water scarcity affects small-scale farmers and rural communities, highlighting the need for improved preparation and mitigation measures. The study also reveals a negative correlation between water scarcity and revenue-generating activities in the Guriel district. An increase in water shortages decreases revenue-generating activities, affecting businesses that generate income. This is consistent with Mngumi's argument that poor households reduce food expenditure in response to shocks, while wealthier households find alternative ways to cope [16]. The study concludes that water scarcity significantly impacts agricultural output, particularly sorghum, the main crop in the Guriel area. Additionally, water scarcity negatively impacts domestic animal husbandry, stunting camel development, diminishing their market value, and negatively impacting the camel industry, particularly the meat industry. The study highlights the complex interconnections within the food system and the need for improved preparation and mitigation measures. The study highlights the impact of water shortage on income generation in Guriel district Somalia, highlighting the need for improved water conservation programs, range management, and environmental preservation. It also emphasizes the importance of fostering domestic animal husbandry to reduce the impact of drought on camel production. The government should support self-governing adaptive mechanisms and provide credit facilities for pastoralists to deal with droughts. This can help them save money for restocking animals during the post-drought phase. Additionally, rural Guriel regions should receive development initiatives, such as providing services like veterinary care, schools, and hospitals close to people's homes. Additionally, the study suggests understanding the losses experienced by pastoralists on a household level and whether individual families can mitigate these losses by selling animals. Further research is needed to understand the losses experienced during droughts due to forced sales and death, and to determine the correlation between forced sales and the degree to which individual families sell camels during periods with easy access to pasture and water supplies.

In conclusion, the study highlights the need for further research to better understand the household-level herd dynamics in pastoral areas affected by drought and to develop strategies to support livelihoods and improve the quality of life for the local communities.

The findings indicate a strong correlation between domestic animal husbandry and water scarcity in the Guriel area in the Galgaduud region of Somalia. The results are consistent with the argument made by Lottering et al., [17] that a methodical approach was used to look for published literature on the impact of water scarcity on small-scale farmers in Sub-Saharan Africa between 2008 and 2018. Reducing the susceptibility of small-scale farmers and rural communities to the effects of water shortages requires improving preparation and mitigation for water shortages. Even Vicario et al., [18] found that a variety of measures were adopted across institutional sizes and across the supply chain, demonstrating complex interconnections within the food system, and that the bulk of reported answers were from farms.

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