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Impact of Re-Current Droughts and Climate Change on Goats Farming in Horn of Africa Somalia

Study Case at Afgoye District Southern Somalia

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Abstract Drought events have claimed the lives of over 0.5 million people and affected more than 253 million people throughout Africa during the previous four decades (1981–2020), according to the International Disaster database of the Centre for Research on the Epidemiology of Disasters (CRED) (EM-DAT, 2010-2020). The main droughts that have occurred on the continent during the previous four decades are summarized in Table 3 Drought-prone areas must be identified, and the likelihood of drought must be estimated, before programs aimed at increasing food security may be implemented knowing the likelihood of drought recurrence is critical for risk management programs and effective food-aid distribution A total 200 community goat-owning households were chosen and questioned, with 140 from entire region. Farmers with 10 or more livestock were given consideration. Extension personnel aided the researchers in identifying and interviewing significant animal farmers. The snowball sampling approach was then utilized to find more potential interview participants. Farmers were questioned at their homes using a pre-tested systematic questionnaire. The interviews were conducted in Somali by trained enumerators. The head of household's age and gender, the livestock species and breeds kept, the frequency of drought, and the effect of drought on cattle output were all obtained. Each farmer was asked to rank the causes of any goat losses. All of the data was analyzed using SAS (2008). Chi-square tests were done to see if there was a link between the production environment and the head of household's gender, age, and location. The effect of the production environment on herd size and rank scores for breed preferences, reasons for animal loss, severity of drought components, severity of drought components' effects on cattle production, types of parasite prevalent during droughts, and breed susceptibility to drought were determined using SAS' PROC GLM (2008). Binomial logistic regression (PROC LOGISTIC) software was used to estimate the chances of a goat class being malnourished during a drought in both semi-desert and wet areas conditions, diseases and parasites cause higher cow losses than drought. Drought, on the other hand, increases the frequency of illnesses and parasites. During droughts, goats output is significantly impacted by water scarcity, heat stress, and a lack of feed. Droughts in sub-humid areas usually result in deaths and heat discomfort. Although semi-desert malnourished during droughts, mortality is lower than in sub-Saharan Africa.

Key Words: Droughts, rainfall diseases, dry lands, humid, health, implications, milk productions, food security.

1. INTRODUCTION

Droughts may have disastrous consequences for water supplies, agriculture output, and animal husbandry. Famine, hunger, diseases, and the relocation of huge people from one area to another are all possible outcomes. The agricultural droughts that ravaged Africa in the 1980s and early up to current dates (2020) afflicted a wide range of countries and people, and were among the most terrible famine disasters in recent history (Gommes & Petrassi, 1994). Drought events have claimed the lives of over 0.5 million people and affected more than 253 million people throughout Africa during the previous four decades (1981–2020), according to the International Disaster database of the Centre for Research on the Epidemiology of Disasters (CRED) (EM-DAT, 2010-2020). The main droughts that have occurred on the continent during the previous four decades are summarized in Table 3 Drought-prone areas must be identified, and the likelihood of drought must be estimated, before programs aimed at increasing food security may be implemented knowing the likelihood of drought recurrence is critical for risk management programs and effective food-aid distribution. Furthermore, drought data at the administrative level is critical for a better understanding of climate change's possible consequences in Africa. The lack of dependable rainfall data currently limits the estimate of drought risk at the continental scale. Most African nations' operational weather station coverage has considerable geographical gaps, and individual stations frequently offer inconsistent data. For these reasons, rainfall measurements are often replaced with data generated from atmospheric circulation models and/or satellite observations. Rainfall estimations (RFE) from the National Oceanic and Atmospheric Administration's Climate Prediction Centre (CPC) and forecasts from the European Centre for Medium-Range Weather Forecasts (ECMWF) are two widely used rainfall datasets for monitoring food security (NOAA) Other choices include the Tropical Rainfall Measuring Mission (TRMM), Reading University's Tropical Applications of Meteorology using Satellite (TAMSAT), and FAO rainfall estimates

(http://geonetwork3.fao.org/climpag/FAO-RFE.php). However, all of the aforementioned rainfall estimates have problems and show differences throughout Africa (Dinku et al., 2007; Lim & Ho, 2000; Rojas et al., in press). At the same time, the lack of ground (rain gauge) measurements makes validating and improving these rainfall estimates challenging. This makes determining the quality or trustworthiness of any dataset extremely difficult, which has important implications for food security applications (Verdin et al., 2005). The country's economy is dependent on goat and animal product exports, as well as strong local consumption. Furthermore, there is a significant

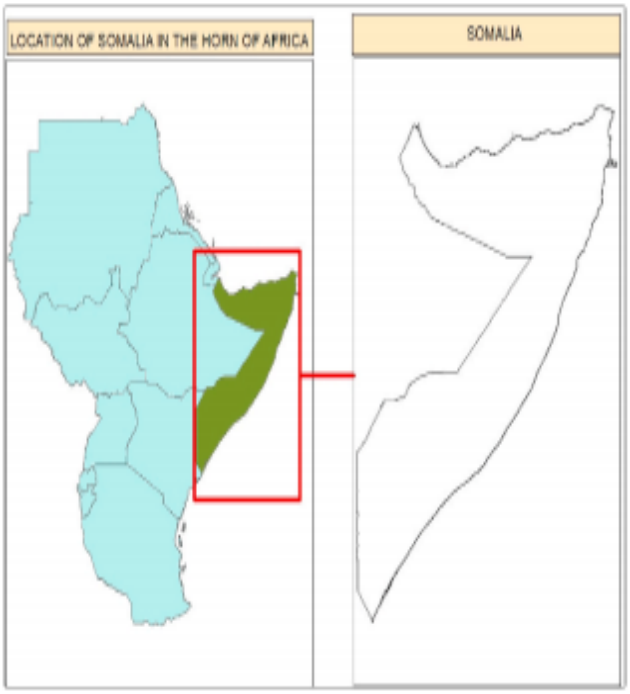
Cross border commerce with golf countries, Somalia sends two to three million animals each year to nations such as Oman, Saudi Arabia, the United Arab Emirates, and Kuwait. Livestock is estimated to account for around 40% of Somalia's GDP and employs up to 60% of the workforce, both directly and indirectly. To safeguard and develop Somalia's livestock sector and food security, annual national treatment and immunization efforts are essential. FAO also assists the government and local people in improving animal health surveillance, animal production, and the creation of a robust and resilient value chain, which includes beekeeping, fodder production, and marketing capacity development.

Somalia is the nation in East Africa that is most prone to drought. Since the 1970s, Somalia has struggled with persistent food shortages and severe malnutrition (Fitzpatrick, et al, 2012). For decades, international food aid and humanitarian aid have played an important role in supporting livelihoods (FEWSN, 2011; Funk et al., 2013). The country had been in a condition of civil conflict and drought shocks for some years (Maxwell et al., 2017). So far, Somalia has not been spared the consequences of drought and ongoing warfare. The UN declared famine in southern Somalia on July 20, 2011 (Fitzpatrick et al., 2012). was the toughest droughts of the last decades so far remembered Somali pastoralists. Approximately 3.1 million people were afflicted by the famine, half a million children were malnourished, and 1.46 million Somalis were uprooted from their homes (Hillbruner et al 2012 ;).

One of the most pressing concerns facing humanity and natural ecosystems is climate change (IPCC, 2007, 2013). Climate change is expected to exacerbate food and water shortages unless more effective early adaptation strategies and development activities are undertaken (AghaKouchak, 2015b; Brown & Funk, 2008; Lobell et al., 2008). Climate or weather-related disasters including droughts and floods have displaced an average of 22.5 million people per year since 2008. (Bower et al., 2015). According to the Intergovernmental Panel on Climate Change (IPCC), rising temperatures and less precipitation have resulted in more intense and longer droughts throughout a wider territory during the twentieth century (IPCC, 2007). Human influences, according to Marvel et al., have been increasing since the turn of the century. (2019), Drought has been worsened as a result of this. However, the previously reported growth in worldwide drought throughout the twentieth century is inflated due to the use of the Palmer Drought Severity Index and the data sets used to compute the evapotranspiration component (Trenberth et al., 2014). Drought trends throughout the twentieth century are hazy as a result of these disparities, and there is no consensus on drought patterns owing to climate change (Schwalm et al., 2017). Drought is predicted to arrive sooner, be more severe, and last longer, given projected global warming in the twenty-first century and climate change as a driving factor. (Cook et al., 2015; Dai, 2011, 2013; Sheffield & Wood, 2008; Trenberth et al., 2014; Trenberth et al., 2014) In the twenty-first century, droughts are expected to grow more common and severe in many regions of the world (Cook et al., 2015; Schwalm et al., 2017; Touma et al., 2015). Furthermore, climate models suggest that drought zones will extend across many areas in the twenty-first century, meaning that droughts would grow more severe and pervasive globally (Cook et al., 2014a; Sheffield & Wood, 2008). As a result, growing concern over climate change's impact on droughts has raised it to the position of "the most far-reaching of all natural disasters" on the globe (United Nations, 2014).

1.1 STUDY AREA

The research was carried out in Somalia, a country in eastern Africa with a total size of 637,660 km2 (Fig. 1). It has the longest coastline in Africa at 3025 kilometers (Alwesabi, 2012). The World Bank projected in July 2017 that Somalia had a population of 14.74 million people. Pastoralism, which is reliant on the timing and amount of rainfall, employs half of the population (Alwesabi, 2012). However, during the last three decades, there have been significant changes in the socio-economic elements of pastoralism, mostly as a result of periodic droughts, which drastically effect fodder supply and, as a result, cattle productivity. In general, hot weather prevails in Somalia throughout the year. The average yearly daytime temperature is 27 degrees Celsius. This is one of the hottest average yearly temperatures on the planet. The coastline region is generally 5–10 degrees colder than the interior areas due to the chilly offshore currents (Hadden and Lee, 2007). Somalia is divided into two climate zones: semi-arid and arid (Menkhaus, 2014). The semiarid zone receives moderate rainfall and is ideal for rain-fed farming. This zone encompasses the northern mountains, as well as the southwest and northwest regions. Pastoralism is practiced in the dry zone, which gets little precipitation. It includes the country's southern and river shabelle areas. Somalia has two seasons, one wet and the other dry. The wet season lasts from April to June, followed by a dry season from July to September (Alwesabi, 2012). Between October and November, a brief rainy season occurs. From December through March, the second and primary dry season begins.



2. METHODS

2.1 SAMPLING PROCEDURES

A total 200 community goat-owning households were chosen and questioned, with 140 from entire region. Farmers with 10 or more livestock were given consideration. Extension personnel aided the researchers in identifying and interviewing significant cattle farmers. The snowball sampling approach was then utilized to find more potential interview participants

2.2 DATA COLLECTION

Farmers were questioned at their homes using a pre-tested systematic questionnaire. The interviews were conducted in Somali by trained enumerators. The head of household's age and gender, the livestock species and breeds kept, the frequency of drought, and the effect of drought on cattle output were all obtained. Each farmer was asked to rank the causes of any goat losses.

2.3 STATISTICAL DATA ANALYSIS

All of the data was analyzed using SAS (2008). Chi-square tests were done to see if there was a link between the production environment and the head of household's gender, age, and location. The effect of the production environment on herd size and rank scores for breed preferences, reasons for animal loss, severity of drought components, severity of drought components' effects on cattle production, types of parasite prevalent during droughts, and breed susceptibility to drought were determined using SAS' PROC GLM (2008). Binomial logistic regression (PROC LOGISTIC) software was used to estimate the chances of a goat class being malnourished during a drought.

3. RESULTS

Table 1: Demographic characteristics of goat owners (N = 140) surveyed communities district of Afgoye southern Somalia

Demographic Characteristic	*Number (%)*
sex	
men	*135(96.4)*
women	*5(3.6)*

Age in (years)	
15-34	*47(33.6)*
35-54	*68(48.57)*
55- 74	*23(16.4)*
Above 75	*2(1.43)*
Education	
None	*73(52.1)*
Primary	*64(45.9)*
High school	*3(2.14)*
Livelihood	
Livestock dependents	*100(71.1)*
Others	
Crop dependents	*20(14.3)*
business	*6(4.2)*
employment	*4(2.85)*

variable	*Category*	*Number*	*Percentage (%)*
Ages	*20-30*	*25*	*26.3%*
	31-50	*50*	*52.6%*
	51-80	*18*	*20%*
	>81	*2*	*2.1%*
Gender	*Male*	*82*	*86.3%*
	Female	*13*	*13.7%*
Level of education	*No formal school*	*11*	*11.6%*
	Elementary	*57*	*60%*
	High school	*18*	*19%*
	College level	*9*	*9.5%*
Designation	*Chairpersons of the villages*	*5*	*5.3%*
	Executive officers village	*10*	*10.6%*
	Deputy village leaders	*12*	*12.6%*
	Chiefs of sub-villages	*14*	*14.7%*
	Members of the village council	*20*	*21%*
	Elders in the village	*9*	*9.5%*
	Officers in charge of livestock health	*8*	*8.4%*
Goat owners	*Yes*	*89*	*93.7%*
	no	*6*	*6.3*

Table# 02 demographic characteristics of FGD farmers of goats where (N=95) in seven villages of afgoye southern Somalia

Tables 1 and 2 shows the demographic features of goat owners' survey and FGD respondents, respectively the majority of the 140 respondents who responded to the survey claimed that keeping goat was their primary source of income regardless the harsh circumstances The herd sizes reported by these pastoralists approximately ranged from 10 to 300 animals (no breeding goats so far reported all are Somali goats or Arabian goats). A total of 95 persons took part in the discussions, with the number of members in each focus grouping discussion (FGD) varying from 4 to 11. The whole FGD group was made up of men. The majority of participants (60 %; 57/95) had only earned an elementary education, while 9.5% (9/95) had a college diploma and around 19% (18/95) had attainted the high school diploma, the bulk of the latter were ward livestock officers, who were

government employees who worked with pastoralists in their communities. Goats were owned by almost all of the participants (93.7 percent; 89/95) while the remaining increments contained health officers and those didn't owned goats but other livestock such as cows and sheep

4. Results

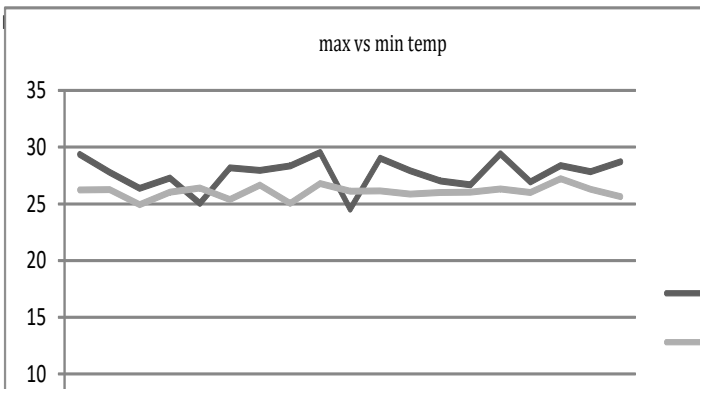


Figure #03 maximum and minimum temperatures recorded

Figure #01 and figure 02 shows the average temperatures of Somalia in the last two decades

In above figures demonstrates how climate change temperatures variation was changing for a long period of time (2001-2020) showed that the environmental condition of the horn was fluctuating in the year of 2013 marked the year of least temperature averages while the years of 2005 and 2018 marked the highest recorded temperatures in the last twenty years the temperature recording is obtained from Global precipitation measurements of national aeronautics and space agency (NASA) and department of irrigation of Somalia under ministry of agriculture and livestock

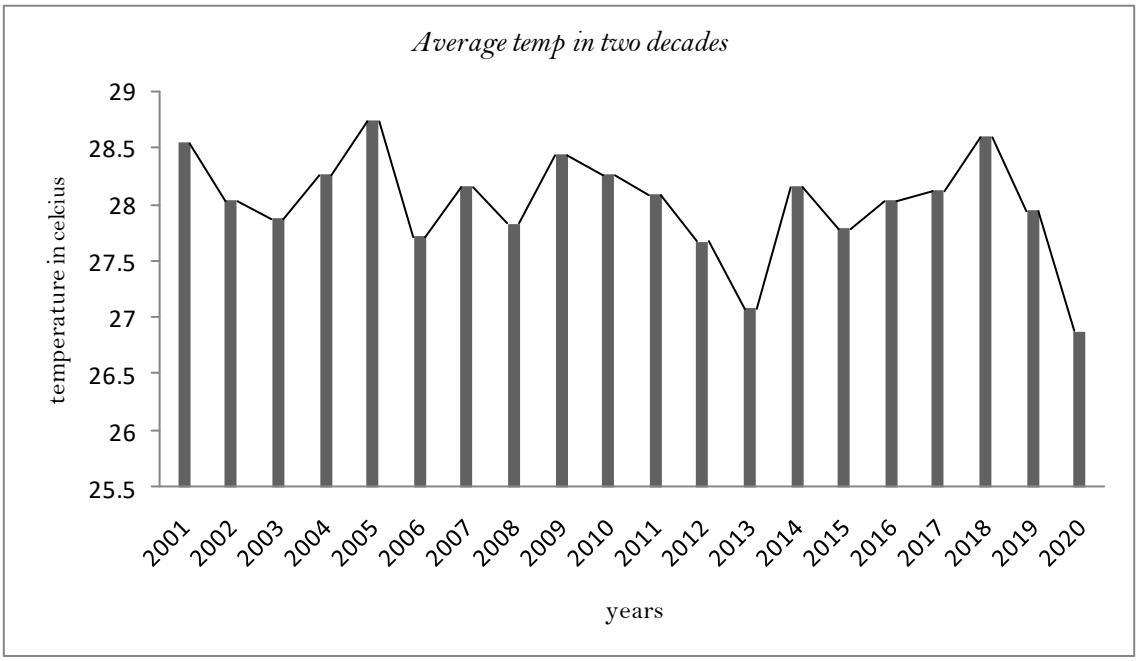


Figure #02 average temperatures of Somalia in the last two decades

4.1 Goat owners' survey and meteorological observations of climate and extreme weather events

Annual precipitation variations may be seen in meteorological data, with several troughs indicating low rainfall years and an overall decline in precipitation over a thirty-year period (Figure 2). The length of spells of moderate, dry weather has increased since 2007, according to the SPI (1.29 SPI 0.80). According to livestock owners, more villages have experienced severe water and pasture shortages in recent years.

Over the previous 40 years, the majority of goat owners (98 %; 134/140) claimed that rainfall in their areas had decreased. Approximately three-quarters of livestock (goat) owners (75.4 percent; 98/140) experienced irregular and unpredictable rainfall. Over the same time period, the majority (98.5 percent; 138/140) also reported a rise in temperature. The majority of goat owners (92.3 percent; 130/140) could recall and describe particular years in which their villages had acute water and pasture shortages (Table 3).

Table 3 goat owners (N = 140) reported years with severe water and pasture shortage for cattle over the last four decades years 1984-2021 at afgoye District, southern of Somalia

Study village	***Years of severe droughts according goat owners***
Afgoye	*1993,1995,,2000,2001, 2005,2009,2011,2017 and 2021*
Awdhegle	*1984,1989,1993,1995,2000,2005,2009,2011, 2017 and 2021*
qoryoley	*1984,1993,1995,2000,2005,2009,2011,2017,2021*
barawe	*1984,1993,2000,2001,2003,2005,2009,2011,2017,2021*
bullo	*1985,1990,1993,1995,1997,2000,2001,2003,2005,2009,2011,2014,2017, 2021*
golweyn	*1993,1997,2000,2001,2009,2011,2017,2021*

4.2 Character traits of the household and the size of the livestock

In both riverside and semi-desert (dry) zones, males accounted for more than 75% of household heads (P > 0.05). Less than 3% of family heads would be under the age of 35 in both industrial environments (P > 0.05). Cattle herds in semi-arid regions (33.10) were substantially greater than in sub-humid conditions (15.1).Table 2: Mean rank scores (SE) for reasons of frequent livestock losses in semi-arid and sub-humid climates.

The reason for the loss	***semi-desert***	***Humid (near river)***	***Significance***
Droughts	*1.7± 0.025 (3)*	*1.994 ± 0.027 (6)*	**
Predation	*1.91 ± 0.024 (4)*	*1.890 ± 0.025 (3)*	*ns*
Disease and parasites	*1.93 ± 0.007 (6)*	*2.000 ± 0.006 (7)*	*ns*
Theft	*1.63± 0.036 (1)*	*1.755 ± 0.037 (2)*	*
Malnutrition	*1.65 ± 0.038 (2)*	*1.710 ± 0.038 (1)*	*ns*
Thirst	*1.95 ± 0.012 (5)*	*1.994 ± 0.012 (5)*	*ns*
Overflows of the rivers	*1.98 ± 0.006 (7)*	*1.994 ± 0.006 (4)*	*ns*

The rank of each task is indicated by the figures in parentheses. The lower the attribute's mean rank score, the greater the risk of cattle loss. *P 0.05; **P 0.01; Ns P > 0.05;

4. 3 Reasons for loss of goats

The reasons of frequent livestock losses are listed in Table 2. Farmers in semi-arid environments identified diseases and parasites as the most common cause of cow loss (P 0.05), whereas farmers in sub-humid situations ranked starvation first (P 0.05). Drought was highly ranked in semi-desert environments (ranked third), but not so much in humid regions (near rivers) (ranked sixth; P 0.05). Dehydration was placed sixth in both locations (P > 0.05).

4.4 Drought frequency and influence on goat productivity

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4.5 Drought's impact on illness and parasite prevalence

Table 3: Mean rank scores SE for the severity of drought's influence on cow output in semi-desert and wet regions settings.

Drought attribute	*Semi-desert(dry regions)*	*Humid regions*	*Significance*
feed shortage	*2.114 ± 0.140 (2)*	*2.920 ± 0.144 (4)*	**
Heat and stress	*2.142 ± 0.067 (3)*	*1866 ± 0.068 (1)*	**
poor feed quality	*3.378 ± 0.137 (6)*	*3.667 ± 0.145 (5*	*ns*
Shortage of water	*2.093 ± 0.114 (1)*	*2.272 ± 0.222 (2)*	*ns*
Diseases	*2.708 ± 0.116 (4)*	*2.330 ± 0.115 (3)*	*
External parasites	*2.845 ± 0.139 (5)*	*3.957 ± 0.145 (6)*	**
Internal parasites	*3.765 ± 0.193 (7)*	*3.961 ± 0.198 (7)*	*ns*

The values in parentheses indicate the rank of each challenge. The lower the rating, the more severe the characteristic, *P 0.05; **P 0.01; ns P > 0.05; *P 0.05; **P 0.01; ns P > 0.05 Table 4: Mean rank scores SE for drought impacts on goats in semi-arid and wetland environments.

Impact of droughts	Semi-desert (dry regions)	Humid regions	Significance
Heat stress	2.070 ± 0.162 (2)	2.778 ± 0.150 (5	**
Mortalities	1.908 ± 0.094 (1)	2.492 ± 0.094 (3)	**
Increased disease	4.080 ± 0.195 (8)	2.603 ± 0.207 (4	**
Parasite incidence	3.027 ± 0.158 (4)	2.375 ± 0.177 (2)	**
Cow infertility	3.051 ± 0.142 (5)	3.066 ± 0.179 (6)	ns
Stillbirths	4.947 ± 0.396 (9)	3.739 ± 0.255 (7)	*
Abortions	3.813 ± 0.136 (7)	3.889 ± 0.235 (8	ns
Emaciation	2.554 ± 0.197 (3)	1.933 ± 0.196 (1)	*
Dehydration	3.300 ± 0.206 (6	4.712 ± 0.239 (9)	**

Each challenge's rank is indicated by the values in parentheses. The larger the influence of an effect, the lower the mean rank score *P 0.05; **P 0.01, ns P > 0.05 Environments (P > 0.05) During droughts, farmers in wet and dry conditions regions ranked heart water as the most common ailment (P > 0.01) ,(P 0.05) surroundings. During droughts, farmers in semi-arid and sub-humid regions ranked heart water as the most common ailment (P > 0.01). Malnourished as those in dry regions situations (P 0.05; Table 5),Farmers who stayed on the farm had more than twice as many pregnant goats, nursing goats, and heifers who were malnourished than those who walked away from the farm (P 0.05).

4.6 during droughts, goat's health and mortality are highly affected.

Figure 1 depicts the number of animals killed in droughts by different goats' classes. Animal mortalities were higher (P 0.05) in both dry and wet regions conditions. During droughts in sub-humid conditions, more goat and offspring died (P 0.05) than in desert areas environments. Lactating and pregnant goats in wet areas conditions were more than twice as likely as those in semi-arid environments to be malnourished during droughts (P 0.05; Table 5Farmers who stayed on the farm had more than twice as many malnourished pregnant goats, breast-feeding goats, and heifers as those who left the property (P 0.05).

5. Discussions

In the recent decade, droughts have been widespread in sub-tropical areas (Masih et al. 2014). Droughts are wreaking havoc on milk and meat production, resulting in a scarcity of natural resources, low feed quantity and quality, a high incidence of livestock diseases and parasites, and heat stress (Rojas-Downing et al. 2017). Farmers' opinions of afgoye goats as the most popular breed may be related to the breed's capacity to adapt to harsh environments (Nkala 2016). The popularity of large-framed exotic breeds, like as the Brahman, may be owing to the misconception that large-framed dogs are more intelligent.

Table 4: Mean rank scores SE for grazing management issues, parasite prevalence, and illness prevalence in semi-arid and wet land environments during droughts.

Parasites	**Semi-desert (dry regions)**	**Humid regions**	**Significance**
Ticks	1.135 ± 0.075 (1)	1.180 ± 0.037 (1)	ns
Tsetse flies	1.986 ± 0.009 (3)	2.000 ± 0.009 (3)	ns
Intestinal parasites	1.548 ± 0.041 (2)	1.402 ± 0.050 (2)	**

diseases	-	-	-
Heart water	*1.545 ± 0.109 (1)*	*1.605 ± 0.055 (1)*	*ns*
Brucellosis	*1.680 ± 0.056 (2)*	*1.615 ± 0.174 (2)*	*ns*
Mouth and feet	*1.796 ± 0.044 (3)*	*1.645 ± 0.050 (3)*	*

Table 4 Mean rank scores SE for grazing management problems, parasite prevalence, and illness prevalence during droughts in dry and sub-humid settings

Farmers say that afgoye district goats are the most popular variety because they are more tolerant to harsh weather than small-framed varieties. This notion is based on their performance in situations where large-framed breeds are preferred (Zindove and Chimonyo 2015). In comparison to the robust of many locations in Somalia, these goats produce a large quantity of milk and also have good meat when transported to foreign nations, but they are unable to withstand harsh climatic conditions (Nkala 2016). Governments, livestock organizations, and academic institutions must collaborate in drought-stricken areas to rebuild depleted local genetic resources. Illnesses and parasites are the primary causes of goat deaths, according to Sungirai et al (2016).

The low pasture quality and quantity found in semi-arid environments can be attributed to the fact that diseases and parasites were identified as a reason goat in semi-desert situations (Mlambo and Mapiye 2015). Malnutrition and a drop in the immune status of malnourished animals come from low pasture quality and quantity, leading in an increase in disease incidence. Starvation was cited as a cause of goat losses more frequently in sub-humid climates, probably because goats in these places are less frequently exposed to poor-quality pastures and hence are less adapted. The same argument might explain why feed has such a strong affect.

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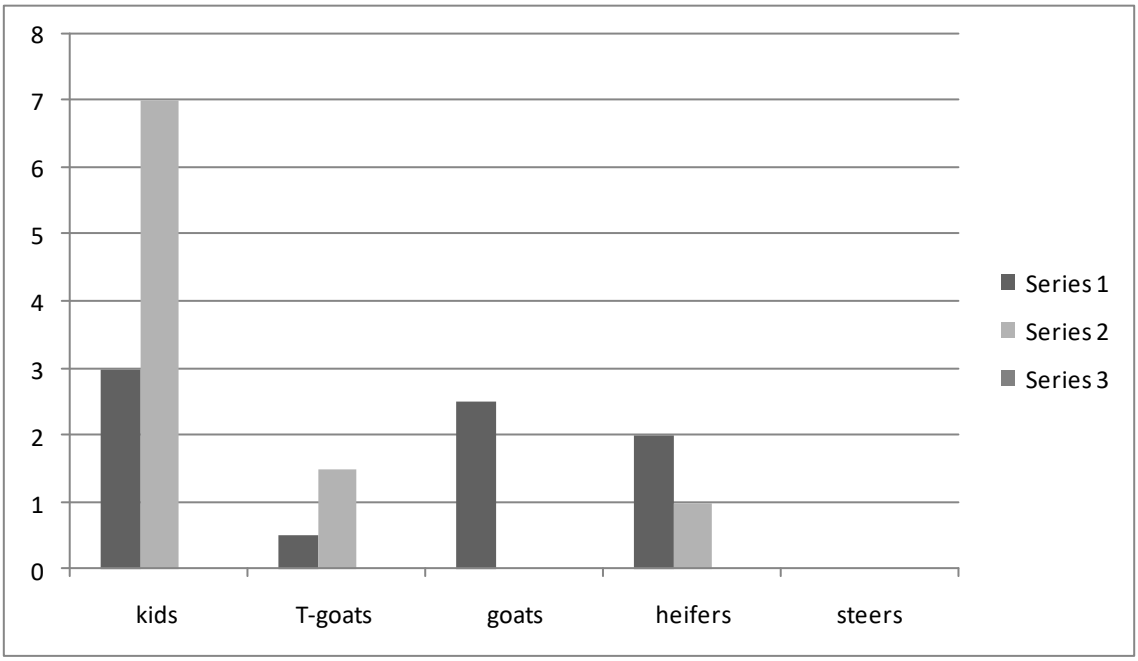

Figure #04 shows the average number of goats died during droughts in semi-desert and wet (near river) regions.

Goat output is being threatened. Dehydration in goats is hard to see, but it may be fatal (Nkondze et al. 2013) the result, as proven here, that water constraint had the biggest impact on goat productivity during drought in dry regions locations was expected. Goats with a regular body temperature benefit from water consumption (Golheret al. 2014). High temperatures are common in semi-desert environments, as evidenced by the fact that they were ranked second in terms of severity on cow production in this study. Heat stress in goats is caused by high temperatures mixed with a shortage of water, which can limit feed intake and cause mortality.

Goat productivity, reproduction, adaptability, and feed intake are all reliant on water consumption (Rojas-Downing et al. 2017). As a result, finding long-term solutions to drought-related water shortages is crucial. One strategy may be to use and promote breeds that are well-suited to water scarcity. Despite widespread notion that ticks prefer hot, wet, and humid settings, ticks were the most frequent parasite in both semi-desert and moist ecosystems during the drought (Sungirai et al. 2016). Ticks in subtropical locations appear to be able to adapt to harsh weather, hiding in burrows during droughts and waiting for hosts (Arnaudov 2017).

Heart water was thought to be the most prominent disease due to the high incidence of ticks during dry years. During droughts, goats have the highest death rates, most likely due to their higher nutritional demands than other goat species. During droughts, when water is scarce and feed quantity and quality are compromised, it is difficult to achieve these requirements. The differences between nursing and pregnant goats might be explained by the same causes.

Table 5: Estimates of lower (LCI) and higher (UCI) confidence intervals for malnourished cows, heifers, and calves during the drought.

[1] **predictor**	[2] **Lactating cows**			[3] **Pregnant cows**			[4] **Heifers**			[5] **Dry cow**		
[6]	[7] ODS	[8] LCI	[9] UCI	[10] ODS	[11] LCI	[12] UCI	[13] ODS	[14] LCI	[15] UCI	[16] ODS	[17] LCI	[18] UCI
[19] (wet vs dry)	[20] 6.4	[21] 2.2	[22] 18.93	[23] 1.5*	[24] 1.54	[25] 4.08	[26] 0.7^{ns}	[27] 0.35	[28] 1.31	[29] 0.23^{ns}	[30] 0.37	[31] 9.11
[32] Gender	[33] 0.9^{ns}	[34] 0.27	[35] 2.8	[36] 1.3^{ns}	[37] 0.34	[38] 4.45	[39] 1.2^{ns}	[40] 0.51	[41] 2.65	[42] 1.81^{ns}	[43] 0.21	[44] 7.12
[45] Farmers ages	[46] 0.2^{ns}	[47] 0.010	[48] 3.71	[49] 1.4^{ns}	[50] 0.11	[51] 21.45	[52] 0.2^{ns}	[53] 0.02	[54] 2.65	[55] 0.2^{ns}	[56] 0.081	[57] 2.34
[58] Employment	[59] 1.9*	[60] 0.011	[61] 0.67	[62] 0.2^{ns}	[63] 0.041	[64] 1.30	[65] 0.3^{ns}	[66] 0.11	[67] 1.12	[68] 0.03^{ns}	[69] 0.70	[70] 1.87
[71] Residence	[72] 2.3*	[73] 1.11	[74] 48.87	[75] 32.0*	[76] 1.93	[77] 99	[78] 13.7	[79] 7.24	[80] 26.09	[81] 1.1^{ns}	[82] 0.011	[83] 1.78

Higher odds ratio values imply a greater difference in the risk of cattle malnutrition under drought between levels of predictors. ns P > 0.05, *P 0.05

Workers were more likely to be malnourished in both production situations. During dry seasons, governments and/or livestock insurance providers should prioritize farmers in wet humid locations with a large number of pregnant and nursing goats to get money for feed, water, and/or veterinary services to keep their animals healthy. Workers were more likely to be malnourished in both production situations. During drought seasons, governments and/or livestock insurance providers should prioritize farmers in wet (humid) regions with a large number of pregnant and nursing goats in order to pay money for feed, water, and/or veterinary services to keep their goats healthy.

Lactating goats in semi-arid environments were expected to be malnourished. Wet places are more prone to drought, and rangeland regeneration after droughts is limited (Rojas-Downing et al. 2017). Farmers' predilection for large-framed breeds in damp humid climates, as well as these goats' inability to adjust to drought-related difficulties, might explain the study's inconsistent results (Zindove and Chimonyo 2015). During droughts, kids and t-goats in semi-arid locations were more likely to be malnourished, probably due to differences in tolerance to heat stress, water, and feed scarcity among animals of the same species of different genders and ages (Nardone et al. 2010). The reason that goats owned by farmers who live on the farm were more likely to be malnourished might be attributed to the fact that farmers who live on the farm are more likely to be jobless (Kabiti et al. 2016), and hence do not have easy access to money to buy supplements during droughts. Stay-at-home goat owners should be encouraged to get low-cost livestock insurance to safeguard their herds during droughts.

6. CONCLUSION AND RECOMMENDATIONS

In both semi-desert and wet areas conditions, diseases and parasites cause higher cow losses than drought. Drought, on the other hand, increases the frequency of illnesses and parasites. During droughts, goats output is significantly impacted by water scarcity, heat stress, and a lack of feed. Droughts in sub-humid areas usually result in deaths and heat discomfort. Although semi-desert malnourished during droughts, mortality is lower than in sub-Saharan Africa. Surroundings that are humid goats and kids in wet (humid) conditions are more susceptible to emaciation during droughts than those desert (dry) situations This study suggests that policymakers should help farmers during droughts by freezing interest rates on loans for drought-related purposes and providing feed loans (to keep the core herd going until the rain comes and the loan can be paid back). In addition, the government should assist the private sector in developing and implementing climate-risk insurance. When droughts hit, commercial farmers should develop long-term drought coping methods. The findings of this research add to the ongoing policy discourse among many stakeholders.

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