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Small-holder farmers knowledge and information on the impact of climate variability & extremes on livestock production in Limpopo & Mpumalanga Provinces

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Abstract. A study was carried out to investigate the level of awareness, knowledge and information of small-holder farmers (SHLF) on the impact of climatic change (CC) and extremes on livestock production in Limpopo and Mpumalanga Provinces. At least 366 small-holder farmers were interviewed using a semi-structured questionnaire to elicit responses on vulnerability. Almost all the farmers (96 %) have heard about CC only a few farmers (4 %) did not know CC. The medium for the conveyance of CC information was the main radio (94.32%). Newspapers and television were also efficient mediums in the conveyance of this information, each with the outreach of 16.76 and 32.67%, respectively. Central to the impact of CC was the fact that (90%) of the farmers confirmed that there was a change in grass availability; which contributed to major livestock fatalities of which over half of the farmers (55.19%) attested as the cause. The study found that 86.67% of SHLF who attended awareness meetings indicated that the discussions prioritized adapting to CC. However, SHLF (80.77%) did not have an early warning system. This was coupled with a lack of contingency plans by (84.36%) the farmers to deal with the impact of the said drought on their farms. SHLF (19%) who had facilitated contingency plans indicated that improved aspects of the plan should incorporate the support of their provision feeds, drilling of boreholes, and erection of dams. Based on SHLF perceptions there is a need for strategic shifts from grazing to small scale feed-lots.

Keywords. Climate Change, Early Warning, Natural Pastures

1. Definition of the problem

Climate Change (CC) refers to a long-term (over a decade) change in climate patterns that can be identified by changes in the mean and/or the variability of its properties whether due to natural variability or as a result of human activity. It may involve a gradual change in long-term average conditions of climate; greater variability in normal conditions; or changes in the frequency, magnitude, and distribution of extreme events (Smit *et al.*, 2000). The adverse effect

of CC and variability has become an environmental and socio-economic problem that is increasingly causing climate-driven hazards to people around the world (Scholze, Knorr, Arnell, and Prentice, 2006). Climate Change is also expected to alter pest and disease outbreaks, increase the frequency and severity of droughts and floods, and increase the likelihood of poor yields, crop failure and livestock mortality (Morton, 2007).

Across the tropics, small-holder farmers already face numerous risks to their agricultural production, including pest and disease outbreaks, extreme weather events and market shocks, among others, which often undermine their household food and income security (O'Brien *et al.*, 2004). Climate Change leads to an increase in the frequency of drought and a rise in temperatures, threatening the availability of freshwater for agricultural production and other uses (Kotir, 2010). Impacts facing the agricultural sector include a reduction for land that is suitable for arable and pastoral agriculture, a shortened growing season and a decrease in yields, particularly along the margins of semiarid areas (Turpie *et al.*, 2002). Notenbaert *et al.*, (2010) observed climatic trends that included reduced productivity of animal feed, higher disease prevalence, and reduced freshwater availability. This was due to the negative effects of lower rainfall and more droughts on crops and pasture growth, and the direct effects of high temperature and solar radiation on animals.

2. Material and Methods

3. Study Area

The study was conducted in both Limpopo and Mpumalanga provinces, respectively. Only Vhembe and Gert Sibanda District Municipalities were chosen based on the proximity and convenience of having Small Holder Livestock Farmers that are organized and within reach of the investigators. A map of the two provinces is attached as Figure 1.

4. Data Collection

Data was collected through a descriptive survey using structured questionnaires, observations, and interviews from individuals and focus groups. A structured questionnaire was developed where respondents were interviewed each being asked a standard set of questions posed in the same way each time. Also, spontaneous questions were developed for interaction with the interviewee (Schulze, 2002). The structured questionnaire contained both open and close-ended questions. Close-ended questions collected quantitative data which were structured with less flexibility.



Figure 1. Political Map of South Africa with provinces

At least 366 small-holder farmers were interviewed using a semi-structured questionnaire to elicit responses on vulnerability. The questionnaire included among others demographic and economic household characteristics; livestock and crop production; access to extension services; credit access; hazards occurrence; adaptations strategies pursued; coping strategies; the level of resilience and other information as indicated in the methodology. To determine livestock water use efficiencies focus was on the sensitivity attributes. The main water-related indicators were around the source, access, use and distance to water by small-holder farmers and their households. The main sources of water assessed were homestead well, borehole, wetland, dam, and or stream. The distance to access such water resources were also be elicited and quantified.

5. Sampling Procedure and Data Analysis.

5.1.1. Sampling

Systematic purposive sampling was used to select farmers within the five identified agro-ecological zones of Limpopo and about four in Mpumalanga. The effort was made to have a minimum of at least 10 farmers per village out of the randomly sampled household. We used stratified sampling to obtain a representative sample of villages and households for interview. A two-stage random sampling process was conducted using the *SURVEYSELECT* procedure of SAS. The *PROC SURVEYSELECT* allows the selection of probability-based random sampling where sampling in different categories or classes depends on the number of units within that class. It is appropriate for handling selection bias. The two-stage sampling was conducted as follows: (a) Stage 1: 10% of the villages from the four local municipalities were randomly sampled and (b) Stage 2: 10% of the households from villages sampled in Stage 1 were randomly sampled. Simple random sampling was used at each stage of sampling.

5.1.2. The population of small-holder farmers

In the two districts, all four local municipalities of Vhembe (Makhado, Musina, Collins Chabane and Thulamela) and seven of Gert Sibande (Chief Albert Luthuli, Msukaligwa, Mkhondo, Dr Pixley Ka Isaka Seme, Lekwa, Dispaleng and Govan Mbeki) were considered. The population of interest was 23 283 livestock households from 362 villages in Vhembe and 27 706 livestock households from 183 villages in Gert Sibande. The number of households

sampled for the interviews was 366 for Vhembe and Gert Sibande Local municipality, respectively.

5.1.3. Data analysis

Quantitative data were transcribed into MS Excel Package and analysed statistically using the SAS Package (SAS, 2009). The Procedure FREQ of SAS was used to generate simple frequency tables for variables of interest. Selected data were summarized in an Excel spreadsheet. Descriptive analysis techniques were used in the study to capture the perceptions of respondents mainly the qualitative data.

6. Results And Discussion

This section summarizes and synthesizes the results of the small-holder livestock farmers' exposure to impacts of CC. The exposure was expressed in terms of the following parameters; access to information, water resource availability and source, aridity index, precipitation, and temperature variability.

7. Access to Change Information

7.1.1. Farmers awareness of climate change

Table 1 shows the frequency and per cent of the farmers who are familiar with the concept of CC and different and the respective sources of such information.

Table 1. Frequencies and respective percentages of small-holder farmers and access to Climate Change information

Climate Change information		Frequency	Per cent
Have you heard of the Climate Change	No	14	3.83
	Yes	352	96.17
	Total	366	100
From what source of information			
Government Source	No	347	98.58
	Yes	5	1.42
	Total	352	100
Friend	No	328	93.18
	Yes	24	6.82
	Total	352	100
Radio	No	20	5.68
	Yes	332	94.32
	Total	352	100
Newspapers	No	293	83.24
	Yes	59	16.76
	Total	352	100
NGO's	No	351	99.72
	Yes	1	0.28
	Total	352	100
Church Group	No	345	98.01

	Yes	7	1.99
	Total	352	100
Television	No	237	67.33
	Yes	115	32.67
	Total	352	100
Village meetings	No	337	95.74
	Yes	15	4.26
	Total	352	100

Throughout the world, the phenomenon of CC imposes adverse impacts on the livelihood activities such as agriculture, and water provision through recurring extreme events that include floods, cyclones, droughts, and unpredictable rainfall patterns (Urama and Ozor, 2010). The variations in climatic settings (changes in temperature and rainfall patterns) affect agricultural practices and subsequent production in tropical regions. The exposure of the farmers to the impacts of CC are proportionate to the degree of awareness on this subject. If farmers are equipped and capacitated in the aspects of CC, their operations are less likely to be exposed to the impacts of CC. Their awareness and knowledge on CC underlay an imperative prerequisite in their exposure to the impacts of CC (Maddison, 2007). Without knowledge, minor impacts of CC are stretched beyond their actual extent.

Almost all the farmers (96.17%) have heard about CC but only a few (3.83%). According to Maddison (2007), such a high proportion with some knowledge of CC is critical for the adaptation of the measures to use in response to climate challenges. While having heard about CC will not provide a meaningful basis to rate the farmers' exposure, the relative exposure can only be measured based on the comprehension of the farmers to this phenomenon. The farmers who were familiar with the concept of CC, provided where they learned about this subject. Based on the information presented in Table 1, multiple stakeholders capacitated farmers with CC information.

Unexpectedly, almost all livestock farmers (98.58%) have not heard about this topic from the government. This is rather unexpected, as there are multiple CC awareness programs at different spheres of the government. At a more relevant level, the Department of Agriculture initiated the CC adaptation programme for livestock farmers, yet the farmers nullified the role of the government in the dissemination of climate information. On the other end of the spectrum, radio was the most imperative medium for the conveyance of the CC information. Almost all farmers (94.32%) receive CC-related information through this medium. This is because, in rural areas, radios are used for entertainment and reception of current affairs. Its wider audience base is influenced by its mobility, accessibility, cost efficiency, ease of operation and wide reception coverage.

Newspaper and, television was also efficient mediums in the conveyance of this information, each with the outreach of 16.76% 32.67% respectively. Very few farmers (6.82%) heard about CC from their friends. The contribution of the NGO's and churches was close to nothing, the two contributed a little less than 1% and 1.99% respectively. A low figure of 4.26% heard this topic at the village meetings. Therefore, it is imperative to use radio to convey climate information and educate the farmers on CC issues. These concurrently bear the potential to marginalize the exposure of the farmers to the impacts of CC.

7.1.2. *Observable impacts of climate change*

Climate Change manifests in different forms, including rising temperatures, changes in water availability, floods, drought, etc. (Sonwa *et al.*, 2012). However, these outcomes hardly occur concurrently. This section attempts to appraise the prevalent impacts that haunt the small-holder livestock farmers. Table 2 portrays the beliefs of small-holder farmers on factors that influence Climate Change. The majority of the farmers (77.87%) expressed a dip in rainfall quantity and frequency as the major visual evidence to the down of CC. These results are in accord with the remarks of Maluleke and Mokwena (2017) that Limpopo province is branded as a drought-prone province. After these, there is a shortage of water resources and a shortage of pastures (Maluleke & Mokwena, 2017).

Table 2 Frequencies & respective percentages of small-holder farmer's beliefs on factors that influence Climate Change

Factors influencing Farmers Belief in CC		Frequency	Per cent
Low rainfall	No	81	22.13
	Yes	285	77.87
	Total	366	100
Rainy season starting late	No	300	81.97
	Yes	66	18.03
	Total	366	100
Heavy rains that bring floods	No	323	88.25
	Yes	43	11.75
	Total	366	100
Very hot summer	No	234	63.93
	Yes	132	36.07
	Total	366	100

This is rather unfortunate because climatic regions of the country are predominated by the intercalations of the arid to semi-arid climatic zone, which is strained with limited water resources (Mpandeli and Maponya, 2014). Beyond the scope of CC at a generalized level, the farmers expressed some of the impacts of CC that are experienced in their communities. The visual impacts of the CC that are experienced within the localities of the farmers are indicated in Table 2. The majority (80.87%) outlined that the most imperative predicament that is correlated to CC is the drought. These findings are in congruence with the findings of Maluleke and Mokwena (2017) which indicate that the Limpopo is prone to drought. Moreover, Kotir (2010: 587), also establishes that CC affects rains, an increase in the frequency of drought and rising temperatures. Drought could be easily correlated to the reduction of rainfall.

Table 3 shows the frequencies and respective percentages of small-holder farmers and their perception of changes that may be due to climate change. The rest showed that the farmers did not correlate the occurrence of the following climatic phenomena to the CC; tropical cyclones/ wind change, land erosion and degradation, destruction of buildings and, unpredictable seasons. The following percentile of the farmers indicated that each of these factors does not conform to the CC; tropical cyclones 95.63%, land erosion/degradation 93.17%, destruction of buildings 98.91 and Unpredictable seasons (short or long rainy season) 96.17%. While these factors are primal correlated with CC, especially in South Africa. In addition, Turpie and Visser (2013) reveal that CC in South Africa manifests in various ways

that incorporate higher temperatures, sporadic rainfall patterns, and frequent droughts. Past beyond the point of mere awareness, it all comes down to how equipped are the individual to deal with the impacts of CC.

Table 3: Frequencies & respective percentages of small-holder farmers and their perceptions on changes that may be due to Climate Change

Perceived impacts & changes due to CC		Frequency	Per cent
Changes	No	326	89.07
	Yes	40	10.93
	Total	366	100
Drought	No	70	19.13
	Yes	296	80.87
	Total	366	100
Flooding	No	353	96.45
	Yes	13	3.55
	Total	366	100
Hurricanes/ wing change	No	350	95.63
	Yes	16	4.37
	Total	366	100
Soil erosion/ land degradation	No	341	93.17
	Yes	25	6.83
	Total	366	100
Destruction of buildings	No	362	98.91
	Yes	4	1.09
	Total	366	100
Unpredictable seasons (short or long rainy season)	No	352	96.17
	Yes	14	3.83
	Total	366	100

In Table 4, the frequencies and per cent of the farmers who have attended a CC workshop are presented and the topics that were discussed. It is rather unfortunate that almost no farmers (4.11%) had attended any CC workshop. Workshops are of paramount significance in equipping the attendees with the necessary knowledge on the subject matter. Lack of training is an imperative indicator to portray high exposure of livestock farming to the impacts of CC. According to Maddison (2007), knowledge of CC is critical for the adaptation of the measures to use in response to climate challenges. The farmers do not have experience with such gatherings on CC making them highly exposed to the impacts of CC.

The few farmers who have attended CC workshops connoted that these events were held in the following premises; at school meetings (30%), chief place (60%), and village meetings (10%). The supremacy of the chief palace as the meeting gathering point and information dissemination point reflects how well the rural communities uphold their traditional leaders. The farmers reflected the following issues were discussed in the meetings; a third (33.33%) indicated the discussions were on the causes of CC, the widely covered aspect (73.33%) was on how to adapt to CC. However, 86.67% outlined the discussions were on the importance of adapting to CC. More than half (60.00%) indicated that there were no issues with community participation in CC.

Table 4 Frequencies & respective percentages of small-holder farmers who have attended facilitated Climate Change workshops

Climate Change workshop facilitation		Frequency	Per cent
Have you ever attended any CC meetings or training programs?	No	350	95.89
	Yes	15	4.11
	Total	365	100.00
If yes, Where?	At school meetings	3	30.00
	Chief place	5	50.00
	In the Royal Place	1	10.00
	Village meetings	1	10.00
What topics were discussed?			
Causes and effects of Climate Change	No	10	66.67
	Yes	5	33.33
	Total	15	100.00
How to adapt to Change Climate	No	4	26.67
	Yes	11	73.33
	Total	15	100.00
Importance of adapting to Climate Change	No	13	86.67
	Yes	2	13.33
	Total	15	100.00
Community participation in climate adaptation	No	9	60.00
	Yes	6	40.00
	Total	15	100.00
Awareness	No	14	93.33
	Yes	1	6.67
	Total	15	100.00
Ways of mitigation and adaptation	No	6	40.00
	Yes	9	60.00
	Total	16	106.67
Have you talked about Climate Change with your neighbours	No	155	42.47
	Yes	210	57.53
	Total	365	100.00

Grass has a short lifespan and usually pick up after the rainy season. According to Turpie *et al.*, (2002), there is a significant reduction in the land for grazing. Correspondingly, almost all the respondents deny the emergence of the new grass species. The majority of the respondents (70.22%) also outlined that the shrubs dominate the pasture. This implies that the pasture is threatening the existence of livestock farming. The pasture available at any given point in time has specific grazing support for a particular number of the livestock. Any exceeds would deem the pasture insufficient. Often the small-holder livestock farmers are not aware of this, as it requires scientific studies to do. Consequently, livestock fatality is likely to escalate.

To sustain their practice, the farmers have to turn to supplementary feeding with forage and Lucerne.

However, they may not have the financial muscles to feed their livestock, the strain intensifies if the feeding has to be for a prolonged period. Consequently, livestock fatality is very much likely. Given these, livestock farmers are highly exposed to the impacts of CC.

Table 5 Frequencies & respective percentages of small-holder farmers on the change of feeds availability after Climate Change

Change in livestock feeds		Frequency	Per cent
Less grass in pastures	No	34	9.29
	Yes	332	90.71
	Total	366	100
Less shrubs in pastures	No	257	70.22
	Yes	109	29.78
	Total	366	100
New grass species	No	363	99.18
	Yes	3	0.82
	Total	366	100
New shrubs invasion of pastures	No	358	97.81
	Yes	8	2.19
	Total	366	100
Raising of exotic breeds	No	352	96.17
	Yes	14	3.83
	Total	366	100

The dominance of the topics on the adaptation serves to instil that those who attend such gatherings are less exposed to the impacts of climate exposure. Unfortunately, those who attend such gatherings are in a minority which implies that their impact would be marginal. Surprisingly, the majority (93.33%) there was no awareness of Climate Change. This explains why the majority of farmers are not familiar with this phenomenon. Although 60.00% affirm that the mitigation and adaptation were prioritized. The minority composition of the farmers has attended the workshops on CC.

Though the assumption that the farmers are blank on this subject matter could not be true, the workshops are ideal for capacity building more especially because it holds the fate of farming since the majority of the farmers are only reliant on farming for livelihood. Given these issues, the sector is highly exposed to the impacts of CC.

7.1.3. Feeds resources variability

The small-holder livestock farmers almost entirely rely on the natural feed system. Feeding is an important aspect of livestock farming, without it, this type of farming is would not be possible. The livestock feeds type and availability responds directly to the variations in the rainfall pattern and amount. Given these, as depicted in Table 5, the frequency and per cent of the livestock feed change in response to CC. It is logical to pre-assume a dip in feed availability in response to the declination of the rainfall. Almost all farmers (90%) confirmed that there is a change in grass availability. With the consideration that the majority of the

livestock farmers participate in cattle farming, this is a critical impact as such animals rely mostly on grazing.

7.1.4. Livestock Fatality.

The profitability of livestock farming is high affected by the fatality of the animals. Table.6 indicates the frequency and per cent of the livestock fatality in correspondence to different causes. Over half of the farmers (55.19%) asserted that the main contributing factor to the livestock fatality is the lack of pastures. This view is in accord with Turpie *et al.*, (2002), who established that there is a decline in pastures for livestock. The lack of drinking water follow suit with 39.89%, however, 60.11% do not consider drinking water that important. Heat stress/ cold, unknown disease and floods accounted for 34.70% and, 29.23 and 20.22% out of hundred respectively but the 65.30%, 70.77% and 79.18 suggested otherwise. DEA, (2017a) supports the claim that the temperature incline is affecting the livestock with an issuing of the general increase in temperature over the past century.

Table 6 Frequencies & respective percentages of small-holder farmer’s livestock fatality

Factors contributing to the loss of livestock		Frequency	Per cent
Heat stress/ cold	No	239	65.3
	Yes	127	34.7
	Total	366	100
Lack of feed	No	164	44.81
	Yes	202	55.19
	Total	366	100
Lack of drinking water	No	220	60.11
	Yes	146	39.89
	Total	366	100
Unknown diseases	No	259	70.77
	Yes	107	29.23
	Total	366	100
Floods	No	292	79.78
	Yes	74	20.22
	Total	366	100

The potential impacts on livestock include changes in production and quality of feed crop and forage (Polley *et al.*, 2013); because of these, the small-holder livestock farmers are highly exposed to the CC impacts.

8. Early warning system

Wigmore (2019), defined the early warning system as the technology, and associated policies and procedures designed to predict and mitigate the harm of natural and anthropogenic disasters and other undesirable events. An early warning system is critical for forecasting disasters before occurrence. Our findings showed that the majority of the small-holder livestock farmers (80.77%) do not have any mode of the early warning system. A further 16.76% were

not aware of any early warning system. Only 2.47% were aware of the early warning system. Out of those aware of the early warning system, they classified the system into the key stakeholder responsibility. Disaster management was reported to be the most known early warning system provider with 57.14%. Secondly, the drying of streams was also an imperative indicator with 28.57%. Lastly, 14.29% are reliant on the local radio for weather forecasting.

Table 7 shows the frequencies and the per cent of the availability of the early warning system and operational level in Limpopo and Mpumalanga smallholder farmers. The majority of the smallholder livestock farmers (80.77%) do not have any mode of the early warning system. A further 16.76% are not aware of any early warning system. Only 2.47% were aware of the early warning system. Out of those aware of the early warning system, they classified the system into the key stakeholder responsible. Disaster management was reported to be the most known early warning system provider with 57.14%. Secondly, the dry of streams was also an imperative indicator of the down of the drought by 28.57%. Lastly, 14.29% are reliant on the local radio for weather forecasting. The District Municipality also offers the early warning system in the form of weather forecastings weekly and 3-monthly. Only a single respondent reported each of the two initiatives. The inexistence of the early warning system implies that the farmers have to absorb the entire hock of the impacts. In this regard, they are highly exposed to the impacts of climate change.

Ninety-six per cent of the respondents were not entirely informed when the early warning systems were installed. Only 2% outlined that the systems were introduced between 2016 and 2017 concurrently. However, 43.24% indicated that the existing systems are not effective. A further 54.73% was not sure if the system is informative. Only 2.03% believe that the early warning is an effective tool to get them prepared for the rising of the drought. To curb the dissatisfaction of the farmers with the efficiency of the existing systems, the livestock farmers (30%) requires early warning education to stay alert. According to 40%, the dissemination of the information is also critical to be prepared to combat climatic extremes. Also, 20% is not aware of how the system should be improved. The limited information on the early warning system implies that the majority of the smallholder farmers are caught off-guard when such events unfold. Subsequently, they have to absorb the total impacts of the extreme event due to the unpreparedness. These, therefore, indicate that the smallholder farmers are highly exposed to the impacts of the climate extremes that are after climate change.

Based on the consultations with key Agricultural Advisors the early warning system of government is operational and effective at the level of less than 30 per cent. The main challenge is the capacity of the government at the provincial level to deliver on the three key areas of the broader Disaster Management function namely Early Warning, Risk Assessment and Disaster Recovery. Weather and Seasonal Fore-castings are developed and sent to the provinces for dissemination to the end-user who is the smallholder farmer. Provinces in the main have officials at the provincial level but have no dedicated human capacity in districts and local municipalities where the early warning information is supposed to be disseminated. Early warning and Disaster-related matters have not been fully assimilated in the organograms of the Department of Agriculture in the provinces. Agricultural Advisors also need to be trained on Early Warning systems whilst being assigned functions of disaster management individually and as a collective.

Table 7. Frequencies and respective percentages of smallholder farmers' perception of the availability of the early warning system

Availability of Early Warning system		Frequency	Per cent
Early warning system	No	294	80.77
	Not sure	61	16.76
	Yes	9	2.47
	Total	364	100
National	Disaster management	4	57.14
	Dry of streams	2	28.57
	Local FM Radio (weather)	1	14.29
	Total	7	100
District	Disaster Management	1	1
	Distance Management	1	1
	Total	2	2
	When was the system established	2016	1
2017		2	1.32
No		2	1.32
Not sure		146	96.69
Total		151	100
Does the early system function effectively	No	64	43.24
	Not sure	81	54.73
	Yes	3	2.03
	Total	148	100
What functions of early warning should be improved	Drill own borehole	1	10
	Don't know	2	20
	Information Availability	4	40
	Early warning Education	3	30
	Total	10	100

9. Contingency

Since the livestock smallholder farmers lack a robust early warning system, it is only logical that the impacts of the climatic extremes are always in proportion to the phenomenon itself. Therefore, the farmers are usually caught unprepared to deal with such events and have a mountain to climb to deal with such events. Table 8 shows the frequencies and the per cent of the contingency to curb the impacts of climate change on the livestock.

Table 8. Frequencies & respective percentages of smallholder farmers' perception of the availability of Climate Change Contingency plans

Availability of Contingency Plans	Frequency	Percent
No	308	84.38
Yes	57	15.62
Total	365	100

Despite the absence of the early warning system, 84.36% of the livestock smallholder farmers indicated that there are no contingency plans to alleviate the impacts of climate change on their farms. Only 15.62% have some sort of plan in place to mitigate the impacts of climate change. This implies that the farmers absorb all the impacts of the disaster when they strike. This translates to financial losses in the form of livestock death when there is a disaster impeding a serious need for disaster preparedness seminars. The respondents who confirmed the existence of the contingency plan also revealed the intrusive aspects of the plan.

Table 9 indicates the evolution that the contingency plan had undergone to deal with the recent challenges. Out of 54 respondents who responded to this section (79.63%) indicated that the contingency in place has transformed within the past 5-10 years. This illustrates an attempt to stay relevant in an attempt to marginalize the impacts of climate change. We are in a global world that is moving very fast, in response, an approach that was established 10 years would be outdated today. However, 20.37% insisted that the contingency plans have not been modified since inception. This would not be ideal to curb recent challenges. Although the study focused on the contingency to address climate change, the respondents leaned their response towards the drought.

Seventy-one per cent indicated that improved aspects of the plan incorporate the provision of the feeds. 2.22% are planning to drill a borehole, and 20% is not sure how the improvement should be intertwined with their existing models. 4.44 and 2.22% indicated that there was the provision of the water resource and erection of a dam respectively.

Table 9. Frequencies & respective percentages of smallholder farmer's perception of the dynamic nature of the contingency plans

Contingency to climate change	Frequency	Per cent
Have /the contingency changed in the last 5-10 years	No	11
	Yes	43
	Total	54
How did they change?	Providing feeds	32
		71.11

	Plan to drill a communal borehole	1	2.22
	not sure	9	20
	Water provision	2	4.44
	Building a dam	1	2.22
	Total	45	100
Describe how the contingency have changed	Because of climate change	7	15.56
	Lack of grazing area	31	68.89
	Lack of water	2	4.44
	Others	5	11.11
		45	100
Do the contingency include agriculture and food security	No	345	96.64
	Yes	12	3.36
	Total	357	100

Four issues were cited for the alterations and adjustment of the contingency plans as answered by 45 respondents. The intensification of the climate change was outlined by 15.56%, 68.89% revealed a lack in the grazing area, while 4.44 and 11.11 successively suggested a lack of water and other reasons for the evolution of the approach. Agriculture, Food security was not part of the contingency (96.64%) while 3.36% suggests otherwise.

10. Conclusions

The study of the perception of smallholder farmers on the impact of climate change has shown the level of exposure that affects their daily choices for their livelihood. Their awareness and knowledge of climate change underlay an imperative prerequisite in their exposure to the impacts of climate change. Though multiple stakeholders capacitated farmers with climate change information their level of education impedes their understanding of this phenomenon to their livestock business ventures. Unexpectedly, almost all livestock farmers (98.58%) have not heard about climate change from the government. On the other end of the spectrum, radio was the most imperative medium for the conveyance of climate change information. Almost all farmers (94.32%) receive climate change-related information through the radio. It may also be a consequence of the language being used by the radio which is mostly their indigenous languages. The intervention that could empower the farmers will be regular workshops within commodity groups on climate change. Unfortunately, 95.89 % of the farmers have not attended a workshop on climate change.

The manifestation of climate change to smallholder farmers is identified through the drought. The majority of the farmers (77.87%) identified a dip in rainfall quantity and frequency as the major visual evidence of the down of climate change. The other evidence is the loss of natural grazing, almost all farmers (90%) confirmed that there is a change in grass availability. With the consideration that the majority of the livestock farmers participate in cattle farming, this is a critical impact as animals rely on grazing. The majority of the respondents (70.22%) also outlined that the shrubs dominate the pasture which is symptomatic of over-grazing. Consequently, over half of the farmers (55.19%) asserted that the main contributing factor to the livestock fatality is the lack of pastures. When small-holder farmers were exposed to extreme weather they were not comprehending the events as part of the climate change phenomenon. The following percentile of the farmers indicated that each of these factors does

not conform to climate change; tropical cyclones 95.63%, land erosion/degradation 93.17%, destruction of buildings 98.91 and Unpredictable seasons (short or long rainy season) 96.17%.

It can be concluded from the study that the Early Warning system of government is operational and effective at the level of less than 30 per cent. The main challenge is the capacity of the government at the provincial level to deliver on the three key areas of the broader Disaster Management function namely Early Warning, Risk Assessment and Disaster Recovery. Weather and Seasonal Fore-castings are developed and sent to the provinces for dissemination to the end-user who is the smallholder farmer. Provinces in the main have officials at the provincial level but have no dedicated human capacity in districts and local municipalities where the early warning information is supposed to be disseminated. Early warning and Disaster-related matters have not been fully assimilated in the organograms of the Department of Agriculture in the provinces. Agricultural Advisors also need to be trained on Early Warning systems whilst being assigned functions of disaster management individually and as a collective. The study, based on smallholder farmers' perception suggests a need for strategic shifts from natural pastures to small scale feedlots. The shift should be coupled with the need to establish a dedicated fodder bank as a specialized business. For the farmers to cope and adapt to climate change there is a great need for an early warning system. Government should intervene by providing facilitated water and small scale feedlots infrastructure for the smallholder farmer.

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