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Strategies for Climate-Change Resilience Among Maize Farmers in Lesotho

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ABSTRACT

Maize is a staple crop in Lesotho; hence, it can be vital in improving food security and strengthening the economy. However, climate change necessitates the adoption of sustainable agricultural practices in the growing of maize. It is assumed that small-scale maize farmers lack awareness of climate change and mitigation strategies. This hypothesis has not yet been assessed in Lesotho, especially in the study area; hence, this study is conducted to evaluate it. One hundred small-scale maize farmers from Mafeteng and Mohale's Hoek Districts were selected to participate in the study. The data was collected using a structured questionnaire. The results show that small-scale maize farming in Mafeteng and Mohale's Hoek is dominated by older women (54%) who are within the age group 56 to 65 years (32%) with a low level of formal education (33%). 70% of farmers have been in farming for more than 20 years. Most (70%) of farmers indicated that their maize production is negatively affected by climate change, and 51.7% of farmers experienced poor yield, maize quality, and rainfall. This has led to food insecurity (44%). Therefore, 89% of farmers want to increase fertiliser use to maximise production and improve food security. 37% of farmers desire to switch to CSA, and the majority (83%) intend to adopt CA systems to mitigate climate change. Further studies are recommended to identify LikotiLikoti's system's ability to boost agricultural yields and increase food production, combat soil erosion, and enhance fertility and to assess if Machobane system - Mantsa Tlala, or "expeller of hunger leads to a rise in per capita food production and overall land productivity.

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1. INTRODUCTION

1.1. Background

Maize production and consumption levels are high in Lesotho. Maize production ranks first, followed by sorghum and wheat, with maize being the dominant one, accounting for 77% of the country's cereal production (Bureau of Statistics, 2014). However, Morojele and Sekoli (2016) stated that climate change has dramatically reduced maize production and total area planted. For instance, the production of maize in Lesotho has declined by 12% over 54 years from 1961 to 2013 (FAO, 2013). According to the Bureau of Statistics (2014), in 2013, a decrease in the area planted was due to late rainfall, drought that was prevalent at the beginning of the growing seasons, changes in the farmers' choice of a crop depending on the producer price, farmers' personal preference in that particular year, and the availability of production inputs such as farm power to start land preparation timeously.

In 1964 and 2012, the area planted maize was 135 000 and 97 711 hectares, respectively. However, there was an infinitesimally slight increase in the yield between 1964 and 2012 (Morojele & Sekoli, 2016). There is a decline of 37 289 hectares planted and an increase in maize yield over the period between 1964 and 2012. Generally, maize production has declined in recent years, although maize remains the country's staple food and provides jobs to illiterate people in rural areas (FAO, 2013).

1.2. Climate change and its Impacts

According to the UN, climate change refers to long-term shifts in temperatures and weather patterns. Such shifts can be natural due to changes in the sun's activity or significant volcanic eruptions. But since the 1800s, human activities have been the main driver of climate change, primarily due to burning fossil fuels like coal, oil and gas (UN, n.d.). The concept of climate change has attracted a lot of attention as temperature and precipitation changes have affected the health, livelihoods, food productivity, water availability, and overall security of the African people (350Africa.org, 2014).

Climate change negatively affects the sustainability of the agricultural sector and jeopardises future food security. Using organic and environmentally friendly farming practices, pushing for climate-friendly policies, protecting farmland, increasing soil health, and efficient irrigation

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management (Mauzerek, 2018) are all approaches to counteracting the effects of climate change.

In Lesotho, the prevalence of periodic droughts and variable meteorological conditions has led to crop failures and chronic poverty. This has been exaggerated by excessive soil erosion and declining rangeland conditions mainly resulting from, for example, ineffective agricultural management systems (World Bank Group, 2021). In 2017, 53.8% of the Lesotho population lived in rural areas. This could lead to a decline in an area used to grow maize and food insecurity since these people will need an area to build houses and socio-economic infrastructure. It was reported that 46.7% of those residing in rural areas experienced food insecurity (LVAC, 2017). According to LVAC (2019), 30% of the rural population already requires humanitarian assistance.

Climate change is expected to exacerbate existing environmental stress in Lesotho and thus undermine sustainable development efforts (World Group Bank, 2021). Climate change is expected to negatively impact agricultural productivity and soil quality (MEMWA, 2013). Meeting increasing food demands associated with a growing population is likely to require increases in food production of 50% or more by mid-century (Dickie *et al*., 2014).

To be able to mitigate climate change, farmers must adopt different strategies, including both specific actions (e.g., switching from one crop variety to another) and systematic changes (e.g., diversifying livelihoods against risks or institutional reform to create incentives for better resource management) (FAO, 2013). This study wants to assess if the small-scale maize farmers in Mafeteng and Mohale's Hoek are aware of climate change and recommend mitigation strategies.

2. MATERIALS AND METHODS

2.1. The Study Area

There are 10 administrative districts in Lesotho. The majority of rural people in these districts depend on farming to make a living (Moeletsi & Walker, 2013). These districts are Butha-Buthe, Leribe, Berea, Maseru, Mafeteng, Mohale's Hoek, Quthing, Qacha's Nek, Mokhotlong and Thaba-Tseka (Figure 1). However, the study was conducted in two districts of the southern lowlands of Lesotho: Mafeteng and Mohale's Hoek (Figure 1). According to FAO (2006),

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Mafeteng and Mohale's Hoek are ranked the fifth and sixth largest maize-producing areas in Lesotho.

The lowlands cover the western part of the country and occupy about 5 200 km^2, which is 17% of the total surface area. This region is a narrow strip of land extending at some places just 10km from the border to 60km at others, and it lies between 1 400 m and 1 800 m above sea level. Mafeteng geographical coordinates are 29° 49' 0" South, 27° 15' 0" East, while Mohale's Hoek geographical coordinates are 30° 9' 0" South, 27° 28' 0" East (bing.com/maps, 2023). In Mafeteng and Mohale's Hoek, the agricultural production is predominantly subsistence-oriented and rain-fed.

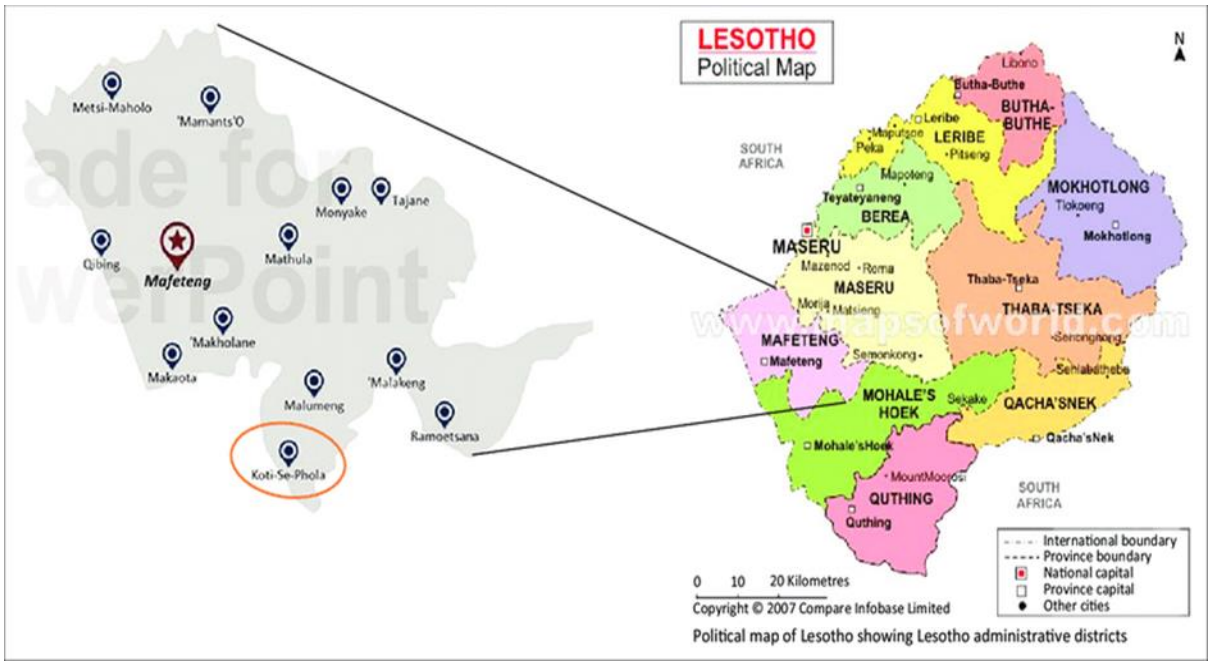

FIGURE 1: Map of Lesotho Showing Administrative Districts (Source: bing.com/maps, 2023)

2.2. Data Collection and Analysis

2.2.1. Snowball Sampling

The researchers did not know the total number of farmers producing maize in the study area. Therefore, the snowball sampling technique was used to select the farmers. As a result, a sample of 100 (Mafeteng = 50 and Mohale's Hoek = 50) farmers was covered. Primary data were collected using structured and semi-structured questionnaires. The collected data were captured and analysed using Statistical Package for the Social Sciences (SPSS).

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3. RESULTS AND DISCUSSION

3.1. Demographics of the Participants

The ancient farming analysis considered the agricultural sector as a male-dominated sector. However, these traditional and societal perceptions have changed rapidly with the discovery of paid employment in towns. The advent of modern industries has resulted in the migration of men into cities to seek paid employment. As a result, women are staying at home to look after children and elderly family members and are taking care of agricultural activities. Therefore, females perform agricultural activities in most African countries and elsewhere today while their husbands are employed in towns as migrant workers.

According to the results in Table 1, it is evidenced that there are changing roles of male and female people in society. Although farming is considered a male-dominated activity, the current situation in Mafeteng and Mohale's Hoek is contradictory. For instance, most (54%) of the farmers are females. This result corresponds with that of Rantšo and Seboka (2019), who discovered 42 female farmers in block farming compared to 18 male farmers. This unequal distribution of gender in agriculture in Lesotho can be linked to an exodus of men leaving their rural farming areas to seek employment in towns and outside the country. The cultural practices show that men are breadwinners in their families. Therefore, when agriculture provides little returns, they often migrate.

Many rural people in Africa depend on farming to make a living, where both men and women participate. However, many studies have revealed that small-scale maize farming in Lesotho is left in the hands of elderly women (Rantšo & Seboka, 2019), while young people have limited interest (Maseatile, 2011).

Against the above background, the study's findings in Table 1 show that approximately 32% of the maize farmers in Mafeteng and Mohale's Hoek are within the age group of 56 to 65 years. There is also an interesting observation that can be made from the results. The young people are found in small numbers (21%). This result concurs with the results of IFAD. IFAD reported that about 19.5% of youth in Lesotho are engaged in agricultural activity (IFAD, 2020). However, this still shows that maize farming in the study area is in the hands of the elderly, and the youth have some limited interest.

It is indicated that education plays an important role in sustainable food security. It helps farmers to read, analyse information and make informed decisions (Raidimi & Kabiti, 2019). Although, Rantšo and Seboka (2019) noted that in Lesotho, farming is done mainly by people with low levels of education. Likewise, the present study provides similar findings. For instance, the study's results indicate that the majority (33%) of farmers did not complete primary school, and the lowest percent (7%) obtained a tertiary qualification.

TABLE 1: Farmers' Gender, Age, and Level of Education

Variable		***Frequency***	***Percent***
Farmer's gender	Male	46	46
	Female	54	54
Farmer's age	18–35	21	21
	36–45	7	7
	46–55	25	25
	56–65	32	32
	Older than 65	15	15
Level of education	No schooling	9	9
	Did not complete primary	33	33
	Completed Primary	25	25
	Did not complete secondary	18	18
	Completed Secondary	8	8
	Completed Tertiary	7	7

3.2. Types of Farming Systems Utilised by Farmers and Key Farming Priorities

Oladele (2011) reported that experience in farming is important, and it comes first with several years in farming. Therefore, it is noted from the results in Table 2 that the majority (70%) of farmers have more than 20 years in agriculture. The farmers in this study can be considered experienced. Likewise, IFAD (2019) alluded that the majority of emerging farmers in Lesotho have many years in farming, whereas Maseatile (2011) echoed that the predominant years of

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farming experience in the Mafeteng district range from 16 to 30 years, where the majority of these farmers have up to primary education.

Generally, farmers in Lesotho adopted conventional and conservational farming systems. However, conservational agriculture (CA) and other climate-smart practices have been promoted in Lesotho for many years. The term climate-smart agriculture (CSA) itself is fairly new and has not been integrated into Lesotho's policies and programs. Lesotho is promoting CA to improve the integration of agricultural development and climate responsiveness, achieve food security and broader development goals under a changing climate, and increase food demand (World Bank Group, 2018).

It is shown that the government encourages farmers to adopt CA. However, the results of the study in Table 2 indicate that 50% of farmers practice CA and the other 50% practice conventional farming (CF). It can be deduced from these results that, although CA is considered to improve the integration of agricultural development and climate responsiveness and to achieve food security, half of Basotho maize farmers in the study area do not consider it. Farmers in this study concur with Oladele *et al*. (2016) that the production of crops, whether under conventional tillage, CA or *Likoti* farming utilises chemicals such as fertilisers, pesticides and insecticides; thus, only excessive utilisation of any of these chemicals may result in plummeted food security directly or indirectly if used over a long period.

Subsistence farmers in Lesotho have adopted CA to boost their yields and increase food production. The locally adapted practice is *Likoti* (Silici *et al*., 2011). However, the study's results (Table 2) show that approximately 43% of the farmers have been using their current farming system for more than 10 years. The question that one can ask is what system this is. Is the system used mainly by farmers like *Likoti* or conventional farming?

According to IFAD (2020), farming is the leading livelihood for the rural population, with 70% of households partly depending on it for income and food security. However, difficult agro-climatic conditions and limited arable land have been factors limiting farmers' expansion to more land. When taking farmer's farming priorities into consideration, it can be observed that 78% of farmers are engaging in farming to make a living. This is consistent with the findings by IFAD.

Over 85% of farmers' main priority is cultivating more land to increase production. These results suggest that farmers will find it extremely difficult to cultivate more land due to agro-climatic conditions and limited arable land. The results are in contrast with the results by Morojele and Sekoli (2016), who echoed that there is no need to increase the area under which maize is produced in Lesotho. Maximum benefits can be derived if the key factors influencing yield are controlled and mitigating strategies are employed.

Moreover, almost all (99%) farmers want to replace people labour with machines. This result is in contrast to the results by the World Bank Group (2018), which indicated that adopting machinery in farming will lead to low adoption of labour-intensive practices such as CA.

Maize production must increase in Lesotho to offset the food security crisis and meet the needs of future generations. Sustainably increasing maize production will require a portfolio of complementary technologies and policies. Against this above background, the results show that 89% of the farmers want to increase the use of pesticides and insecticides to maximise production. Cairns *et al*. (2021) affirmed this; they observed that increased fertiliser use tends to increase maize yields, but there is growing evidence that low and variable returns on investment can limit uptake.

TABLE 2: Farmers' Experience in Maize Production and Farming Key Priorities

Aspect	Variability	Percent
Number of years in farming	Less than 5 years	9
	More than 5 years, < 10 years	14
	More than 10 years, < 20 years	7
	More than 20 years	70
Farming system	Conventional	50
	Conservation	50
Number of years using farming systems	Less than 3 years	16
	Between 4 to 6 years	20
	Between 7 to 10 years	21
	More than 10 years	43
Farming priorities	Make profit	22

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Make a living	78
Till more land for cultivation	85
Practice good methods	15
Rely on people as labour	1
Replace people with machines	99
Farming for household only	14
Mitigate climate change impact	11
Increase pesticide and herbicide use	89

3.3. The Impact of Climate Change on Maize Production in Mafeteng and Mohale's Hoek

The Ministry of Agriculture and Food Security pointed out that blocking maize farming contributes to food security in Lesotho. In contrast, the results displayed in Table 3 reveal that most (44%) of the farmer's level of food security is declining. The results of this study are consistent with the findings of IFAD (2019), which stated that food security in Lesotho, especially for staple production of subsistence farmers, is going down due to challenges such as frequent droughts. In addition, Leduka *et al*. (2015) found that the majority of rural households in all areas of Lesotho are extremely vulnerable to food insecurity and dependent on food purchases for survival.

According to Morojele and Sekoli (2026), maize farming mostly takes place in the lowlands where the arable area is bigger and the climatic conditions allow maize to be planted over a longer period. Farmers tend to farm less in areas prone to drought and very hot in summer, which will adversely affect maize crop growth and yield. It is clear that climate change influences maize farming trends in Lesotho. The results of this study show a similar view. For instance, 93% of the farmer's farming trends are highly influenced by climate change.

Speculation showed that maize production and area planted in Lesotho is declining dramatically due to climatic factors such as drought, heavy rainfall, late rainfall, hailstorm, snow, wind and outbreak of pests (Bureau of Statistics, 2014). In this study, 87% of farmers showed that their production was affected negatively and experienced poor yield, maize quality, and rainfall due to climate change (51.7%). Similarly, Gilili (2021) also noted that

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maize production in Lesotho was reduced by 40%. In contrast, Morojele and Sekoli (2016) reported that the yield trendline was constant at 860 kg ha^{-1}.

TABLE 3: Impacts of Climate Change on Food Security, Maize Production and Yield

Issues	Variable	Percent
Food security level in the study area	Improving	32
	Declining	44
	Stable	23
	Don't know	1
Influence of climate change on maize farming	High	93
	Low	7
The way climate change affects maize production	Negative	87
	Positive	6
Impact of climate change on maize production	Declining yield	4,6
	Poor quality of maize	1,1
	Low amount of rainfall	34,5
	Poor yield, quality and rainfall	51,7
	Low yield and rainfall	1,1
	Low soil moisture content and rainfall	1,1

3.4. Farming Strategies Adopted to Mitigate Climate Change

World Bank Group (2018) stated that CA is Lesotho's most widely promoted CSA practice to mitigate climate change. However, other practices such as keyhole gardens, small-scale irrigation, organic manure application and tunnels (greenhouses) are common. Traditional CSA practices such as *Likoti* and *Machobane* also exist. In the case of farmers in the study area, the findings reveal that farmers have not adopted any strategy to mitigate climate change. As a result, the study shows that 56.3% have not adopted any strategy to mitigate climate change. The results are in contrast with the findings of Oladele *et al*. (2016), who examined Likoti farming under the changing climate in Lesotho and found that smallholders in Lesotho try to

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mitigate the impact of climate and sub-optimal nutrient contents through the practice of CA called Likoti farming. Elsewhere, AFSA (2015) discovered that to respond to the changing climate, thousands of Basotho farmers are turning to an integrated system such as *Machobane Farming System* (MFS) - *Mantsa Tlala*, or "expeller of hunger" in Sesotho that incorporates several agroecological principles.

According to Silici *et al.* (2011) and AFSA (2015), subsistence farmers in Lesotho have adopted CA, more particularly the locally known system as *Likoti* to boost agricultural yields and increase food production. Farmers prefer this system today because it contributes to combating soil erosion and enhances fertility. There are changes in agricultural practices for farmers in Lesotho. Farmers are switching to CA to conserve soil moisture and replenish soil fertility. Likewise, the farmers in the study area show a related view to that of Silici *et al.* (2011), AFSA (2015) and World Bank Group (2021). For instance, 37% (majority) of farmers are unsatisfied with their current farming system.

The Lesotho government has implemented different agricultural programmes such as block farming, CA system locally known as *Likoti* and *Machobane* (Rantšo & Seboka, 2021; World Bank Group, 2021; Silici *et al.*, 2011; Thierfelder *et al.*, 2017). The aim was to increase production in agriculture since colonialism. It is indicated in the literature that the government of Lesotho encourages farmers to adopt SCA practices. Likewise, the results by farmers in the study area provide the same view. For example, the results of the study indicate that 83% of farmers proposed the use of conservation farming to mitigate climate change,

TABLE 4: Climate Change Strategies

Issues		***Frequency***	***Percent***
Strategies applied to mitigate climate change	None	49	56,3
	Reducing synthetic fertilisers	4	4,6
	Use organic fertilisers	4	4,6
	Improve soil moisture content	30	34,5
	Not satisfied	37	37
	Satisfied	29	29

Farmer's level of satisfaction on no action taken to mitigate climate change	Very satisfied	34	34
Suggested system to relieve climate change	Conservational	83	83
	Conventional	12	12
	Conservational & organic	2	2
	Other	3	3

4. CONCLUSION AND RECOMMENDATIONS

4.1. Conclusion

The small-scale maize farming in Mafeteng and Mohale's Hoek is dominated by elderly women aged 56 to 65 years with a low level of formal education. The farmers have been engaging in farming for more than 20 years as a means of making a living. A changing climate negatively affects their maize production, where farmers experience poor yield, maize quality, and rainfall. As a result, this had led to a declining food security. Therefore, farmers want to increase fertiliser use to maximise production and offset food insecurity. Promotion of CSA practices has recently been on the agenda in Lesotho. As a result, 37% of farmers in the study area want to switch to CSA, where most farmers (83%) propose adopting CA systems to mitigate climate change.

4.2. Recommendations

There are different types of traditional CA practices, such as the locally known "*Likoti"* and "*Machobane"*. As a result, the following recommendations are made to the Lesotho government to improve the integration of maize production and climate responsiveness and to achieve food security and broader development goals under a changing climate:

First, further research is recommended to identify *Likoti's* system for boosting agricultural yields and increasing food production, combat soil erosion, and enhancing fertility.

Second, another study is recommended to assess if the *Machobane* system - *Mantsa Tlala*, or "expeller of hunger " will increase per capita food production and overall land productivity.

Third, another study should be conducted to determine a dominant farming system in Lesotho and its impact on maize production and yield.

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