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Data Article

Data on climate change effect and use of adaptation strategies among smallholder maize farmers: Evidence from a microlevel survey in Ehlanzeni District, South Africa

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ABSTRACT

Climate Change and its effects on agriculture and human survival remain a global concern requiring continual research and the use of coping strategies. This paper focus on presenting a data article on climate change effect and use of adaptation strategies by exploiting the insight from a microlevel survey carried out among smallholder maize farmers in South Africa. The data present the change in maize output and income farmers have experienced in the last two growing seasons attributed to the effect of climate change, climate change adaptation and mitigation strategies currently utilized, and constraints faced by the maize farmers. The collected data were analyzed using descriptive statistics and t-Test analysis. The findings revealed that climate change effect is very evident in the area by the significant reduction in output and income observed among the maize farmers, and thus, it is still pertinent for farmers to scale-up their use of adaptation and mitigation strategies in the area. However, the farmers can only effectively and sustainably achieve this if extension agencies provide continuous climate change-related training for maize farmers and government harmoniously work with improved seed production agencies to ensure smallholder maize farmers can adequately access seeds when needed and at subsidized rates.

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Specifications Table

Subject area	Agricultural Sciences
More specific subject area	Climate change effects and adaptation strategies utilization
Type of data	Tables and Figures
How data was acquired	Smallholder maize farmers survey using a structured questionnaire
Data format	Raw and analysed statistical data
Data collection parameters	Interview administered questionnaire to individual farmer
Data source location	Dataset was elicited through a survey of 218 randomly sampled registered smallholder maize farmers in two selected municipalities of Ehlanzeni district.
Data location	Ehlanzeni district, Mpumalanga, South Africa
Data accessibility	Raw data has been deposited in Dryad repository. It is accessible using this link: https://datadryad.org/stash/share/zC28dNShcuILvvRyzFyAom98kV1VI6tC-sbrra9Ap5w
Related research article	None

Value of the Data

- The data set provides a description of the socioeconomic characteristics of smallholder maize farmers as it relates to the effect of climate change on their farms and their use of adaptation strategies. This is to understand the extent of change in income and output experienced on their farms and their current utilization level of adaptation and mitigation strategies.
- The data also showed the constraints faced by these farmers. This information has great implication for scaling-up the use of adaptation strategies and providing adequate support to the farmers.
- This data also provides avenue for other researchers to carry out further statistical analyses that can promote an empirical understanding of the correlates between smallholder maize farmers utilization of climate change adaptation strategies and the constraints they face.
- Considering the continuous need to ameliorate climate change effects among smallholder farmers, the data from this study can be utilized by researchers, extension organizations and policy makers to understand the degree of climate change effects among small holder maize farmers. This will assist them to play their roles of providing adequate support for these farmers more effectively towards the attainment of sustainable agricultural practices.

1. Objective

Climate change keeps on posing significant negative influence on maize yield and the livelihoods of several smallholder farmers that grow and consume it as a staple food [1]. Despite numerous environmental and technological adaptation strategies that have been developed by researchers and scientists, there is a growing need for smallholder maize farmers to scale-up their use of these adaptation strategies. This is to alleviate the currently reported and projected poor maize yield which is attributed to the effect of the changing climate [2,3]. However, research studies and data documenting the effect of climate change among smallholder maize farmers and the advances made as it relates to their current use of climate change adaptation strategies, especially in the study area is limited. Therefore, this research provides empirical data on climate change effect among smallholder maize farmers, their use of adaptive strategies and

the constraints faced by these farmers. This will guide strategies that need to be embarked upon to decrease the vulnerability of maize farmers to the effect of climatic fluctuations and ensure an upscale in the use of climate change adaption and mitigation strategies.

2. Data Description

This data was compiled from a micro level survey elicited with the aid of a face-to-face interview administered questionnaire to two hundred and eighteen (218) smallholder maize farmers between January and April 2022. The data in Table 1 reveals the socio-economic characteristics of the smallholder maize farmers sampled in Ehlanzeni District in South Africa. More than one-third (39.3%) of the farmers were aged 45 years or less while 20.8% were 66 years and above. The mean age among the respondents was 50.76 years. Furthermore, the results from Table 1 indicates that the majority (71.0%) of the respondents had a household size ranging from 1-7 persons, while the remaining 29.0% had 8 and above persons in their households. The mean household size found among the maize farmers in the area is 6 persons with a standard deviation of 2 persons. Also, more than half (54.6%) of the smallholder maize farmers had more than 10 years of farming experience with an average of 13.84 years of farming experience recorded in the area. This is in line with previous research findings among smallholder farmers in the region [4,5].

Table 1
Distribution of respondents according to their socio-economic characteristics

Characteristic	Frequently	Percent	Mean (SD)
Age (years)			50.76(15.14)
≤35	38	17.4	
36-45	48	21.9	
46-55	46	21.2	
56-65	41	18.8	
66 and above	45	20.7	
Household Size (persons)			
1-7	155	71.0	6 (2)
8-14	61	28.0	
15 and above	2	1.0	
Farming experience (years)			
≤10	99	45.4	13.84(9.15)
11-26	95	43.6	
>27	24	11.0	

N = 218

2.1. Assessing the change in output and income among the smallholder maize farmers in the area

The results in Table 2 shows that more than half (51.4%) of the farmers had more than 5000kg of maize output in the last two growing seasons, however, more than half (57.8%) indicated reduced output to 2000kg and less in the last growing season. The mean maize output among the maize farmers in the last two growing seasons was 2333.07kg while the mean output in the last growing season was 1445.95kg. This shows a reduction in maize output recorded among the farmers in these two growing seasons. Further engagement with the farmers as to what led to the reduction in maize output revealed that this was largely attributed to issues relating to the vagaries of climate variations experienced during these two growing seasons. Further analysis was conducted below to indicate if the change in output experienced among the maize farmers in the two growing seasons was statistically significant.

Table 2
Change in output in the last season and the last two growing seasons

Output (Kg)	Frequency	Percent	Mean(SD)
In the last season			
≤2000	126	57.8	1445.95(957.543)
2001-4000	89	40.8	
4001 and above	3	1.4	
In the last two seasons			
≤5000	106	48.6	2333.07(1812.880)
50001-10000	91	41.7	
10001-15000	16	7.4	
15001and above	5	2.3	

Moreover, the results in Table 3 reveals the change in income experienced by the smallholder maize farmers in the study area. The findings showed that more than half (52.3%) of the farmers indicated having generated more than R10000 income from their maize farm in the last two growing seasons, however, the majority (79.8%) indicated reduced income to R10000 and less in the last growing season. The average income generated by the maize farmers in the last two growing seasons was R12699.95 while the average income in the last growing season was R6336.39. This shows a reduction in the income generated by the maize farmers in these two growing seasons. As stated earlier, the reduction in the income generated by the farmers from their maize farmers was because of the reduced production output experienced in these two growing seasons which as indicated by the farmers was largely attributed to issues relating to the vagaries of climate change experienced during these two growing seasons. Further analysis was conducted below to indicate if the change in the income generated among the maize farmers in the two growing seasons was statistically significant.

Table 3
Change in income in the last season and in the last two growing seasons

Income (Rands)	Frequency	Percent	Mean(SD)
In the last season			
≤10000	174	79.8	6336.39(6176.722)
10001-20000	42	19.3	
≥20001	2	0.9	
In the last two season			
≤10000	104	47.7	12699.95(10210.554)
10001-20000	74	33.9	
≥20001	40	18.4	

2.2. T-test analysis of change in farmer's income and output across two growing seasons

A paired sample t-test was carried out to compare the output of smallholder maize farmers across the two separate growing seasons. Table 4 indicates that there was a statistically

Table 4
Paired sample T-test for change in smallholder farmers output across the last two growing season

	Growing Seasons	Mean	Std. dev	N	T	df	Sig.
Change in Output	Last two Seasons	2333.07kg	1812.88	218	9.813	217	0.001
	Last Season	1445.95kg	957.54	218			

Significance tested at 0.05 level

significant difference (t = 9.813; P = 0.001) between the smallholder maize farmers' output in the last two growing seasons (M = 2333.07kg, SD = 1812) and the immediate past season (M = 1445.95kg, SD = 957). This implies that the maize farmers experienced a considerable reduction in their production output from their maize farms in these two growing seasons which as attested to by the farmers is mainly attributed to the climatic variations experienced in the study area during these two growing seasons. This finding is in line with [1] and [2] who reported that smallholder maize farmers in South Africa are reporting poor production and they further predicted a projected drop in yield as a result of the effect of changing climate. This, therefore, signals the need for smallholder maize farmers to upscale their acceptance and usage of existing adaptation techniques to reduce their vulnerability and adequately be able to sustainable cope with the effects associated with the changing climate.

Furthermore, a paired sample t-test was carried out to also compare the income of smallholder maize farmers across two separate growing seasons. Table 5 indicates that there was a statistically significant difference (t = 16.852; P = 0.001) between the smallholder maize farmers' income output in the last two growing seasons (M = R12699.95, SD = 10210.55g) and the immediate past growing season (M = R6336.39, SD = 6176.72). The implication of this is that the maize farmers experienced a considerable reduction in the income generated from their maize farms in these two growing seasons which as indicated by the farmers was a result of the reduced production output earlier reported which was largely attributed to variations experienced in the area due to the changing climate during these two growing seasons. This finding is in line with [3] who reported that smallholder maize farmers in South Africa are experiencing reduced output and thus income from their maize production enterprise because of climate change.

Table 5
Paired sample T-test for change in smallholder farmer's income across the last two growing season

	Growing Seasons	Mean	Std. dev	N	T	df	Sig.
Change in Income	Last two season	R12699.95	10210.55	218	16.852	217	0.001
	Last Season	R6336.39	6176.72	218			

Significance tested at 0.05 level

2.3. Climate change adaptation strategies utilization by the maize farmers

The results in Fig. 1 overwhelmingly shows that the maize farmers had a relatively high level of utilization of climate change adaptation and mitigation strategies. the prominent strategies used by the smallholder maize farmers were the use of crops rotation (90.4%), Use of crop residue for blanketing (88.1%), planting of cover crops (86.7%), changing of planting depths (85.3%), and use of irrigation techniques (85.3%). These results are consistent with [6] who reported a similar trend in the use of climate change adaptation strategies among smallholder farmers in a climate change study conducted in Central America.

2.4. Constraints faced by the smallholder maize farmers

The maize farmers as shown in Fig. 2 indicates that the majority of the constraint items were severe in the area. the prominently severe constraints among the maize farmers were "lack of training on the use of adaptation strategies" (87.6%), "inadequate access to timely and accurate rainfall predictions" (87.2%), Inadequate access to credit facilities and support (86.7%), "poor access to timely and updated information on climate change" (86.2%) and "inadequate access to extension services" (85.8%). This finding is in agreement with [7,8] who discovered that the constraints and challenges facing smallholder farmers in South Africa were poor knowledge on climate change issues, inadequate access to extension services and increased post-harvest losses.

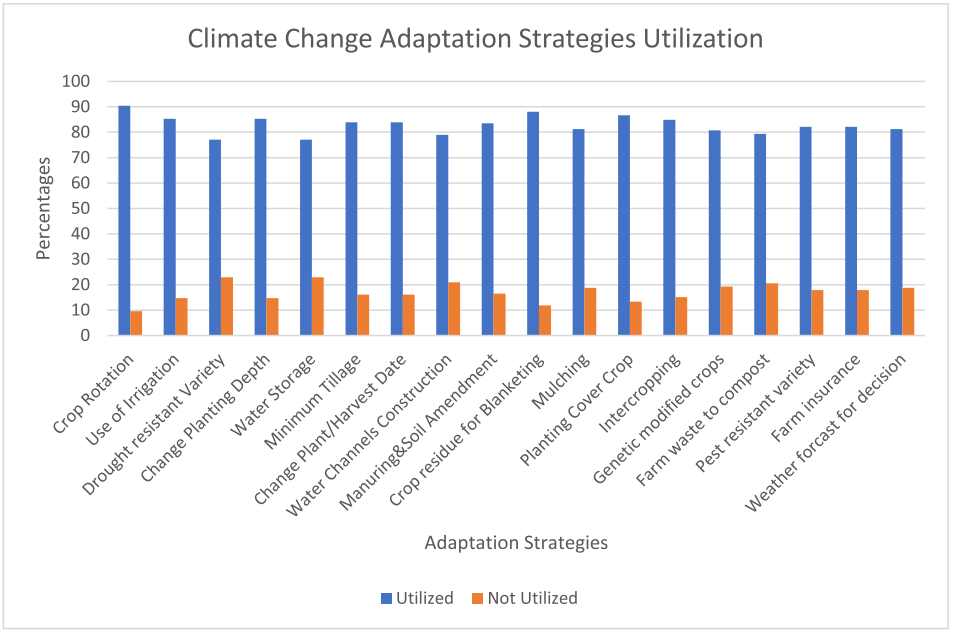

Fig. 1. Climate Change adaptation strategies utilization

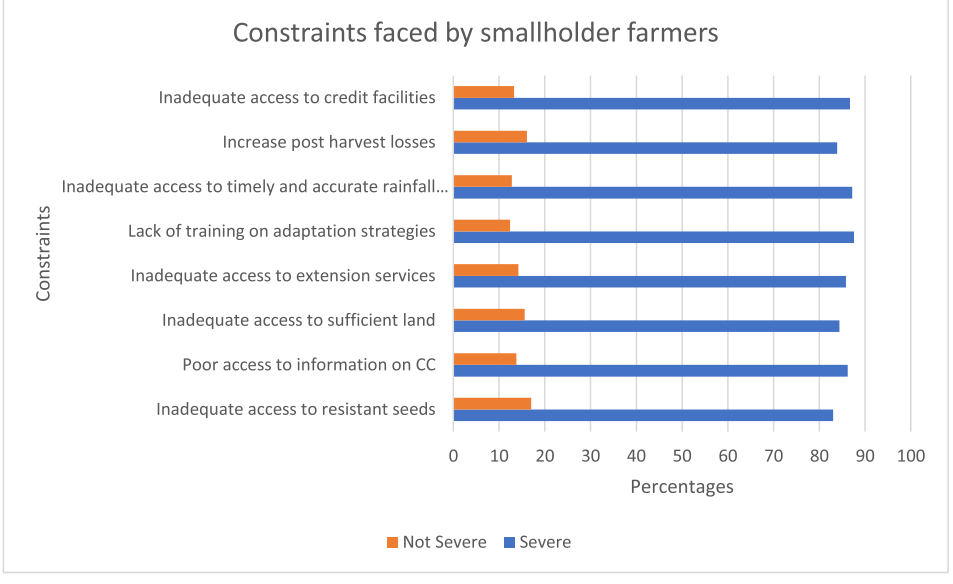

Fig. 2. Constraints faced by the smallholder maize farmers.

3. Experimental Design, Materials and Methods

The dataset presented in this study was compiled from a survey conducted between January and April 2022. The research data was collected using a structured questionnaire that was administered by trained enumerators. A pre-test of the instrument was conducted utilizing the

test-re-test method of reliability. This was to ensure the adequate consistency of the instrument and avoid ambiguity. A high-reliability coefficient of r = 0.86 was obtained by correlating the two intervals of data collected which shows that the instrument was very reliable. A two-stage sampling procedure was utilized in the selection of smallholder maize farmers in the Ehlanzeni District of South Africa. The first stage was the purposive selection of two municipalities in the Ehlanzeni district prominently known for maize production and with the highest number of registered farmers based on the statistics obtained from the Department of Agriculture, Land Reform and Rural Development (DALRRD). The selected municipalities are Nkomazi local municipality and Bushbuckridge Municipality. The total number of registered maize farmers in Nkomazi was 210 while that in Bushbuckridge was 102. The second stage was then a proportionate random selection of 137 and 81 maize farmers from Nkomazi and Bushbuckridge respectively using the Raosoft sample size calculator. The calculator helps to determine the appropriate sample to select from a known population at a 95% confidence level and a 5% margin of error. Therefore, the sample size that was selected for the study was two hundred and eighteen (218) registered smallholder maize farmers. The collected data were analyzed using descriptive statistics and t-Test analysis.

Ethical Statements

Ethical clearance letter was required for this study and obtained from the Institutional Research Ethics Committee for Human Sciences with ethics approval number UMP/CS Nkosi/MAgric/2021. Also, informed consent was obtained from all the participants involved in this study.

Declaration of Competing Interest

The authors hereby declare that there is no known competing interest as related to the information and data presented in this manuscript.

Data Availability

Data on Climate Change Effect and Use of Adaptive Strategies among smallholder maize farmers (Original data) (Dryad).

CRediT Author Statement

Chrescewell Sanele Nkosi: Conceptualization, Data curation, Investigation, Methodology, Writing – original draft; **Oluwasogo David Olorunfemi:** Conceptualization, Data curation, Investigation, Software, Formal analysis, Supervision, Writing – review & editing; **Humphrey Khwidzhili:** Investigation, Methodology, Visualization, Writing – review & editing.

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