

## Quality of Climate Change Extension Services Provided to Smallholder Farmers in Raymond Mhlaba Local Municipality, Eastern Cape Province, South Africa

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### **ABSTRACT**

*The study ascertained the quality of climate change extension service and its determinants for smallholder farmers in Raymond Mhlaba Local Municipality. The study utilised a cross-sectional survey of 100 households obtained through random sampling. Ordered logistic regression was used to analyse the data. Half of the respondents were female, mainly from Dyamala Village. Most respondents were between 50 and 59 years, married with a primary education level, with household sizes of between five and eight. Most of the respondents were unemployed, with the primary source of income being social grants and a monthly income of R2100-R3000. Most of the respondents knew about climate change, especially from other farmers. Respondents had access to extension advisory services, and 80% of them indicated that the extension services were helpful. However, most respondents indicated that the quality of climate change-related extension services was poor. Age, marital status, employment status, knowledge about climate change, and access to the extension were significant factors in the perceived quality of extension services provided. The study concludes that socioeconomic factors affected the perceived quality of extension service. The study recommends improving the accessibility and spread of extension services. There's also a need to enhance extension training to improve the quality of service delivery.*

**Keywords:** Climate Change, Extension Service, Quality, South Africa

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## 1. INTRODUCTION

Extension services are an important structure developed by the Department of Rural Development and Agrarian Reform to assist farmers in achieving their development goals (Nyawo & Mubangizi, 2021; Maoba, 2016). Agricultural extension services mainly aim to help smallholder farmers produce at their maximum potential (Uddin & Qijie, 2013). Extension is a major component of providing high-quality inputs and essential tools that increase farmers' production (Zhou & Babu, 2015). Access to extension services provides farmers with information on farming techniques, raises their awareness of changing climate conditions, and helps them learn about management practices that can help them cope with climate change and sustain their agricultural production (Loki, Aliber, & Sikwela, 2021; Afsar & Idrees, 2019; Arbuckle *et al.*, 2015). Smallholder farmers in South Africa continue to be affected by climate change, despite the extension services support provided to assist them in adapting to climate change (Kephe, Ayisi & Petja, 2020). This can be attributed to poor agricultural extension services and poorly aligned with smallholder farmers' needs (Nyawo & Mubangizi, 2021; Majokweni, 2018; Raidimi & Kabiti, 2017).

Agriculture extension services play a minor role in smallholder farmers' knowledge about climate change (Popoola, Yusuf & Monde, 2020). In the Eastern Cape province, smallholder farmers have a limited capacity to adapt to climate change (Hosu *et al.*, 2016). This can be attributed to smallholder farmers' lack of access to adequate climate-related extension services compared to commercial farmers, which makes them more vulnerable to changing climatic conditions. This, however, cannot be generalised as smallholder farmers are not homogenous. They differ regarding socioeconomic characteristics, access to extension services, and agroecological zones. Thus, there should be differences regarding access to extension services and the quality of climate change extension services provided to smallholder farmers.

There is limited empirical literature that specifically looks at the quality of climate-related extension services provided to smallholder farmers; the focus has been largely on the role of extension services towards smallholder farmers' adaptation to climate change (Agyi & Striger, 2021; Asare-Nuamah, Botchway & Onumah, 2019; Maka & Ighodaro, 2016). Understanding the quality of climate extension services specifically designed to assist smallholder farmers in coping with climate change is essential. It is, therefore, against this background that this study was carried out to determine the quality of climate extension services and its determinants for smallholder farmers in Raymond Mhlaba Local Municipality.

## **2. METHODOLOGY**

### **2.1. Study Area**

This study was conducted in two villages within the Raymond Mhlaba Local Municipality. The two villages were Ncera Sikhweyiya and Dyamala. The study area was chosen because it is predominantly rural, with the majority of households farming and is one of the most areas affected by climate change in Amathole District Municipality due to low rainfall and high temperatures (Raymond Mhlaba Local Municipality, 2017; Community Survey, 2016; ECSEC., 2012). Moreover, in the study area, studies contradict each regarding smallholder farmers' access to extension services which led to this study (Loki, Aliber, & Sikwela, 2021; Maka, Ighodaro, & Ngcobo-Ngotho, 2019; Ngumbela, 2019).

### **2.2. Study Design and Sampling Procedure**

This study aimed to determine the quality of climate service extension and its determinants among smallholder farmers in the study area using qualitative and quantitative methods. The study used a cross-sectional survey of 100 farming households obtained through random sampling. A semi-structured, pre-coded questionnaire collected data from smallholder farmers in the two villages. This was done to explore what smallholder farmers think about the quality of climate change extension services in the study area.

### **2.3. Analytical Framework**

This study used an ordered logistic regression model to analyse climate change extension service quality determinants. The assumption is that a latent index linearly depends on a set of covariates, where a vector of parameters, represents the covariates and is the error term, which is identical and independently distributed. The perceived quality of extension advisory services depends on the value of the latent. The perceived quality is described as follows:

Where are unknown threshold parameters that are estimated. The data that was used in the ordered logistic model are shown in Table 1.

**TABLE 1: Variables Used in the Ordered Logistic Regression**

Variable	Explanation	Type of measurement	Expected sign
<b>Dependent</b>			
	Quality of advisory service	Ordered categorial: 1-Poor, 2-Good, 3-Best	
<b>Independent variables</b>			
Location	Location as measured by study area	Binary: 1-Ncera Sikhweyiya, 2-Dyamala	+/-
Gender	Gender of household head	Categorical: 1-Male, 2-Female	+/-
Age	Age of household head	Ordinal: 1-30 – 39 years, 2-40 – 49 years, 3-50 – 50 years, 4-60 – 69 years, 5-70 and above	+/-
Marital status	Marital status of household head	Categorical: 1-Single, 2-Married, 3-Widowed	+/-
Household size	Household size	Ordinal: 1-1 – 4, 2-5 – 8, 3-9 – 13	+/-
Employment status	Employment status of household head	Categorical: 1-Unemployed; 2-Employed, 3-Self employment	+/-
Source of climate change information	The type of sources where climate change information is obtained	Categorical: 1-Extension officers, 2-Farmer/neighbour, 3-Radio, 4-Community meetings	+/-
Knowledge about climate change	Knowledge about climate change	Categorical: 1-Yes, 2-No	+/-
Understanding about climate change	Understanding about climate change	Categorical: 1-Drought and increasing temperature, 2-Rising sea levels, 3-Storms, and irregular rains	+/-

### 3. RESULTS AND DISCUSSION

#### 3.1. Demographics

Table 2 shows that 61% of the respondents were from Dyamala, of of the respondents being female. These findings align with the literature highlighting that females are now actively involved in agriculture in communal areas of South Africa (Stats SA., 2016). Sixty-five percent of the respondents were aged 50 – 59, while 62% were married. Most respondents had primary education (46%) and household sizes of 5-8 (50%). About 81% of the respondents were unemployed, with 73% having social grants as the primary source of income and 57% of the respondents with income between R2001 and R3000. This confirms the South African Social Security Agency (2019) findings and Maka, Ighodaro, and Ngcobo-Ngoto (2019) findings that one-third of South Africans rely on social grants as their primary source of income, receiving less than the recommended minimum wage of R3500 per month.

**TABLE 2: Demographic Information of the Respondents**

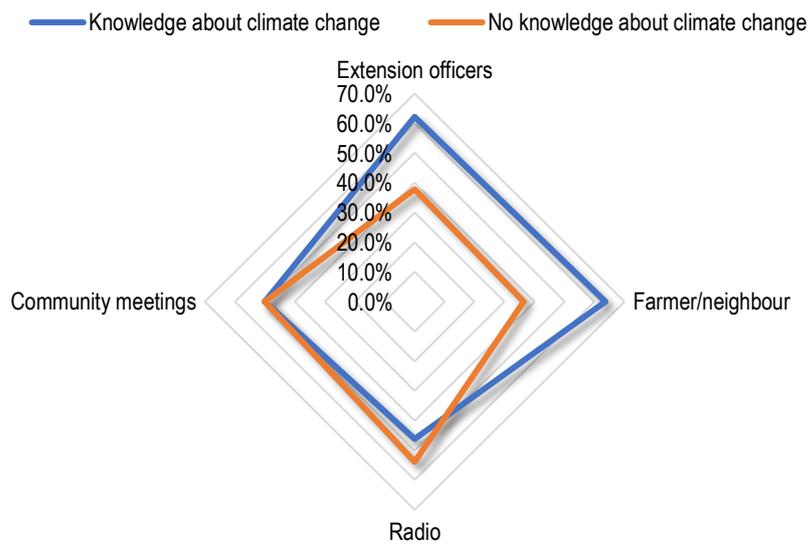
Variable		%
Village	Ncerha Sikweyiva	39
	Dyamala	61
Gender	Male	50
	Female	50
Age	30-39 years	8
	40-49 years	25
	50-59 years	65
	60 years and above	2
Marital status	Single	12
	Married	62
	Widowed	26
Level of education	Primary	46
	Secondary	36
	Tertiary	3
	None	15

Household size	1-4	44
	5-8	50
	9-13	6
Employment status	Unemployed	81
	Employed	15
	Self-employed	4
Source of income	Salary and wages	15
	Social grants	73
	Agricultural activities	6
	Remittances	6
Monthly income	R400-R1200	9
	R1201-R2000	17
	R2001-R3000	57
	R3001-R5000	7
	R5001 and above	10

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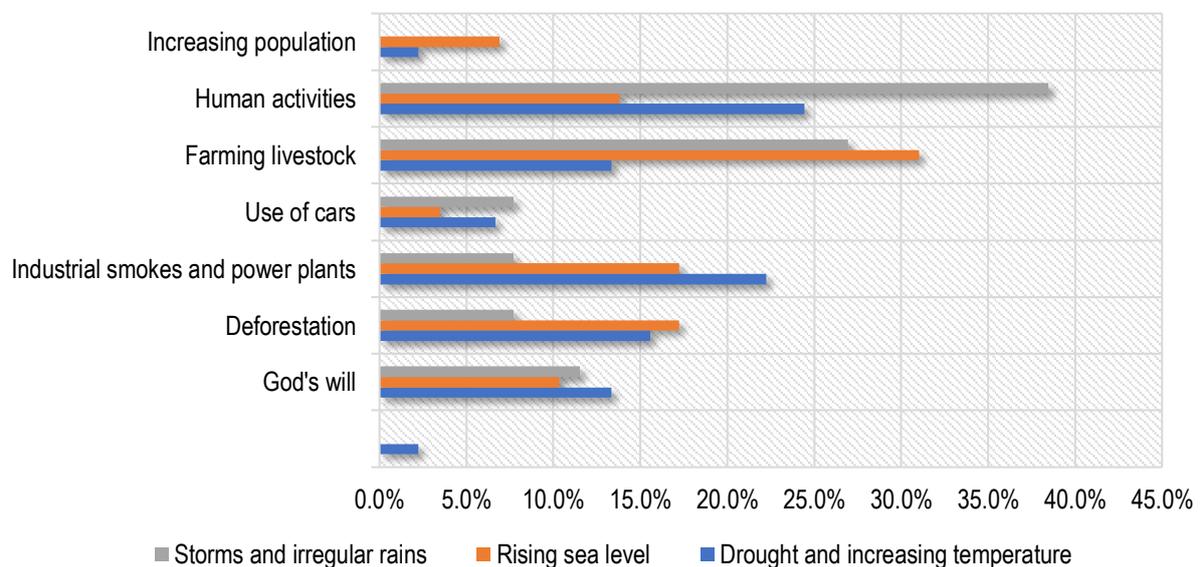
### 3.2. Climate Change Information and Farmers' Perceptions

In this study, smallholder farmers accessed climate information through different channels. More than 63% of the respondents that know about climate change have obtained it through other farmers/neighbours, whilst 62% also had climate information from extension officers (Figure 1). Radio was the least used source of climate change information. These findings imply that farmers/neighbours and extension officers were the study area's primary sources of climate change information. This could be because farmers/neighbours and extension officers used understandable or local language to disseminate the climate change information. Below *et al.* (2014) found that farmers with access to more than one source of climate change information can make informed, effective, and rational decisions that will enable them to adapt to climate change effectively.



**FIGURE 1: Knowledge and Sources of Climate Change Information**

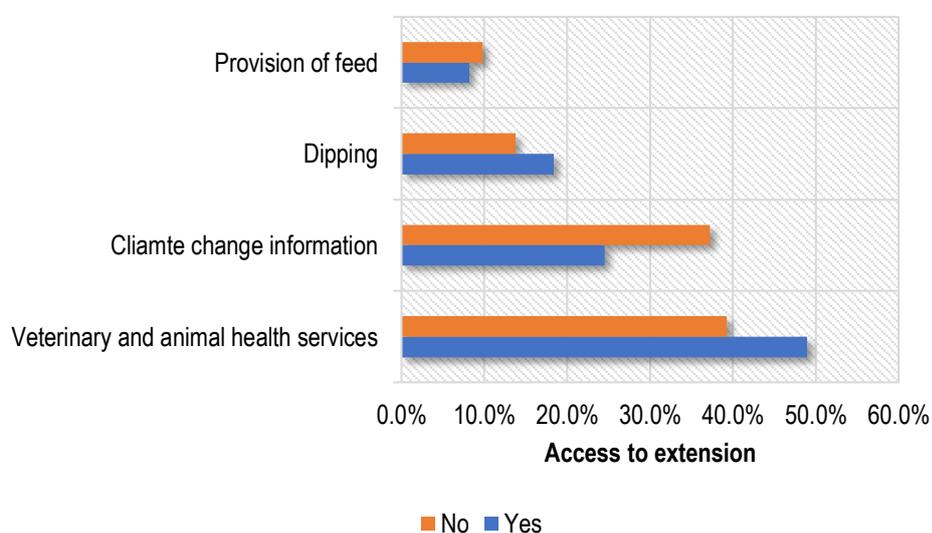
Figure 2 shows that 38% of the respondents think that human activities cause storms and irregular rains, while 31% think farming livestock causes rising sea levels. The respondents identified that drought and increasing temperature were mainly caused by human activities (24%), industrial smoke and power plants (22%), and deforestation (15%), respectively.



**FIGURE 2: Causes of Climate Change**

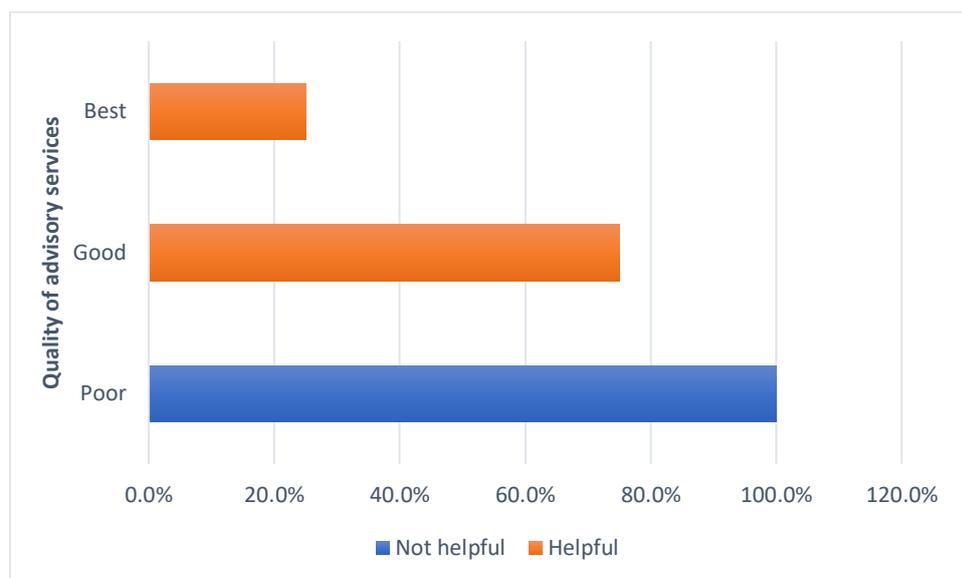
### 3.3. Extension Services

Forty-nine percent of the extension advisory services were in the provision of veterinary and animal health extension services, followed by climate change information (24%), dipping (18%), and feed provision (8%) (Figure 3). These results reveal that veterinary and animal health services were the most common extension services for smallholder farmers in the study area. This could be because climate change caused sudden outbreaks of livestock diseases that led to the high provision of veterinary and animal health extension services. A study by Shubeena *et al.* (2018) states that veterinary extension services can improve livestock health and production during climate change.



**FIGURE 3: Access to Extension and the Type of Extension Services Provided**

All the respondents that identified extension advisory services as being non-helpful indicated a poor quality of extension services. In contrast, 75% of respondents that found extension advisory services helpful had a good quality of extension advisory services. Only 25% of respondents that found climate change advisory services helpful had the best quality of advisory services. These results clearly indicate that most of the extension services received by farmers in the study area were of poor quality and not helpful in addressing their challenges and needs. Access to high-quality extension services could assist smallholder farmers in accessing accurate, reliable, and timely climate change information that could help them improve their production and build resilience to the effects of climate change.



**FIGURE 4: Quality and Helpfulness of Climate Change Advisory Services**

### 3.4. Empirical Analysis

Table 3 shows the determinants of the perceived quality of climate change extension services. The Nagelkerke of 0.549 shows that the variables used in the model represent 54.9% of the determinants of the perceived quality of climate change extension service, which was acceptable. Age and unemployment were significant factors in the perceived quality of climate change extension service at 1%. In contrast, being married, knowledge about climate change, understanding climate change as drought and temperature increase, and access to the extension was significant at 5%. Being single and understanding climate change as rising sea levels were significant at 10%. This points out that age, employment status, marital status, knowledge of climate change, and access to extension services are key factors influencing the perceived quality of climate change extension services provided to smallholder farmers in the study area.

Even though most respondents were above 40 years old, the results indicate that the perceived reduction in the quality of climate change extension services is amplified as age reduces. This implies that the perceived decline in the quality of extension services becomes more apparent as the respondents' ages decrease.

**TABLE 3: Determinants of Quality of Climate Change Extension Service**

Variable		Estimate	Std. Error	Sig.
Threshold <sup>#</sup>	Poor quality of advisory service	16,276***	2,721	0,000
	Good quality of advisory services	19,129***	2,841	0,000
Location	Ncerha Sikweyiwa	0,965	0,833	0,247
	Dyamala	0 <sup>a</sup>		
Gender	Male	-0,654	0,865	0,450
	Female	0 <sup>a</sup>		
Age	40-49 years	14,618***	1,467	0,000
	50-59 years	14,533***	0,823	0,000
	60-69 years	14,264	0,000	
	70 years an above	0 <sup>a</sup>		
Marital status	Single	3,234*	1,737	0,063
	Married	4,336***	1,554	0,005
	Widowed	0 <sup>a</sup>		
Household size	1-4	1,158	1,642	0,481
	5-8	-0,613	1,655	0,711
	9-13	0 <sup>a</sup>		
Employment status	Unemployed	-6,521***	1,887	0,001
	Employed	-1,410	1,487	0,343
	Self-employed	0 <sup>a</sup>		
Source of climate change information	Extension officers	0,131	1,916	0,945
	Farmer/neighbour	0,791	2,161	0,714
	Radio	0,884	2,014	0,661
	Community gardens	0 <sup>a</sup>		
Knowledge about climate change	Yes	1,514**	0,764	0,047
	No	0 <sup>a</sup>		
	Drought and increasing temperature	3,092**	1,335	0,021

Understanding about climate change	Raising sea levels	2,615*	1,491	0,079
	Storms and irregular rains	0 <sup>a</sup>		
Access to extension	Yes	-1,422**	0,724	0,050
	No	0 <sup>a</sup>		

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Model summary

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Cox and Snell	0,388
Nagelkerke	0,549
McFadden	0,400

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<sup>a</sup> This parameter is set to zero because it is redundant

# The base category was perceiving the best quality of extension services

Sig at \* 10%, \*\* 5% and \*\*\*1%

However, unemployed respondents perceive the improved quality of climate extension services. This implies that farmers who are unemployed and always at home most of the time perceived climate extension service as being of higher quality. This may be because these farmers were always at home and could interact with the extension officers when they visited the study area. Respondents who were married had knowledge and understanding about climate change as drought and increase in temperature perceived a reduction in the quality of extension services. This was also observed for single respondents, with however having access to extension perceived the improved quality of the advisory services.

#### 4. SUMMARY, CONCLUSION, AND RECOMMENDATION

The study sought to investigate the quality of climate change extension services and their determinants for smallholder farmers. This study concludes that most farmers knew about climate change acquired from other farmers/neighbours and extension officers. Extension services provided to farmers were mostly veterinary and animal health-related services. Most farmers believe climate change extension services offered are of poor quality. They are not very helpful in mitigating the effects of climate change. In contrast, a minority of farmers believed that climate change extension advisory services are highly beneficial. The study further concludes that socioeconomic factors, knowledge about climate change, and access to extension services influenced the perceived quality of extension services in this study.

Therefore, the study recommends that high-quality climate extension services aimed at addressing the challenges of climate change be provided to smallholder farmers. Agricultural extension services must be made more accessible and more widely disseminated to smallholder farmers through the Department of Rural Development and Agrarian Reform. The agricultural advisors must regularly educate farmers about climate change issues through awareness campaigns. Training agricultural advisors regularly is also necessary to improve the quality of extension services.

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