Leveraging Indigenous Agricultural Practices for Climate Change Resilience in Kenya: A Case of Mogotio Sub-County, Baringo

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Abstract

Indigenous agricultural practices, refined over generations, present viable solutions for strengthening climate change resilience. However, limited research exists on their effectiveness in mitigating climate impacts in Mogotio sub-County. This study aimed to assess the role of indigenous agricultural methods in enhancing climate resilience in Mogotio sub-County, Baringo, Kenya. A descriptive survey research design was adopted, targeting 384 households selected through stratified and simple random sampling techniques. Primary data were collected using household questionnaires. Qualitative data were analyzed using thematic analysis, while quantitative data were analyzed using descriptive and inferential statistics, including logit regression analysis. The findings revealed that drought-resistant crop varieties (43.2%), indigenous livestock breeds (25%), water conservation techniques (15.9%), and indigenous seeds (15.9%) were the major indigenous practices used to cope with climate variability. Respondents reported that indigenous practices improved agricultural yields through increased resistance of indigenous livestock breeds to harsh climatic conditions (46.2%), maintenance of production during dry seasons (27%), faster crop maturity (15%), and reduced production costs (12%). Logit regression results showed that coping with reduced rainfall (odds ratio = 2.11, p = 0.004), perceived improvement in agricultural yields through indigenous practices (odds ratio = 3.32, p = 0.001), and community knowledge sharing (odds ratio = 2.59, p = 0.002) significantly enhanced climate change resilience. The study concludes that indigenous agricultural practices and community knowledge systems play a significant role in strengthening climate resilience in Mogotio sub-County. The study recommends increased awareness programs on the benefits of indigenous agricultural practices and greater support from county and national governments through subsidized indigenous seeds, livestock breeds, and farming inputs suited to local climatic conditions.

Keywords: Indigenous Agricultural Practices, Indigenous Knowledge, Climate Change, Resilience, Mogotio Sub County

Introduction

Climate change has widespread and significant impacts on the agriculture sector worldwide. This consequently harms agricultural efficiency and food supply, which negatively affects food production systems and disrupts sources of income of rural communities (FAO et al., 2019). Across Kenya's semi-arid and arid landscapes (ASALs), which make up about 80% of the country's overall area, more intense and frequent droughts have resulted in extensive crop failures, livestock losses, and great shortages in food. By 2023, people living in ASAL areas in Kenya, including Baringo County, had encountered a fifth uninterrupted season of below-average rainfall (Medina et al., 2023). Individuals who rely on agricultural resources are particularly highly exposed to climate change effects (Gwambene & Liwenga, 2016).

Climate-resilient agriculture (CRA) is regarded as an approach to mitigate the negative effects of climate change on agriculture. The execution of programs to address variations in climate and enhance resilience primarily relies on convectional scientific information. This approach often overlooks the importance of aboriginal knowledge, considering such knowledge less important within this context (Belfer et al., 2017; Whitfield et al., 2015). Local expertise plays a crucial role in making evidence-based decisions, managing natural resources, and conducting ecological research (Alexander et al., 2019). Despite the widespread recognition of indigenous people as being greatly susceptible to consequences of the changes in climate (Culas, 2012; Whitfield, 2015), their valuable knowledge and expertise are still largely untapped by interventions seeking to mitigate vulnerability or enhance adaptation to changing conditions.

According to Hezron et al. (2024), traditional knowledge can have a significant impact in reducing poverty through practices such as traditional food cultivation and preservation, as well as utilizing traditional medicinal methods for healing purposes. The Maasai pastoralists in Kenya have successfully sustained their way of life through a well-established land use and management system, which has provided them with a reliable source of income for many years (Hezron et al., 2024). This has allowed them to manage their rangeland resources to achieve optimal meat and milk production levels. Formulating robust strategies to mitigate climate effects necessitate the ongoing development of innovative adaptation approaches, in addition to refining the existing ones by encouraging their extensive uptake among small-scale farmers (Kalungu & Leal, 2018). Therefore, it is crucial to align adaptation initiatives with the unique realities of Africa. This research aimed to establish the contributions of indigenous agricultural practices to climate change resilience in regions classified as arid and semi-arid in Kenya with an emphasis on Mogotio sub-County, Baringo. This research emphasizes the significance of locally developed solutions in tackling climate challenges and promoting community-based approaches to resilience. The study helps advocate for achievement of SDG 2, which targets zero hunger, SDG 13 on climate action, and SDG 15, which is focused on life on land through promoting indigenous agricultural practices.

Methods and Materials

This describes the research design, area of study, methods of data collection and data analysis.

Research Design

The research utilized descriptive survey design. The design is pertinent as it allows for the accurate depiction of the current state of an event or phenomenon. Data was gathered using questionnaires.

Study Area

The study was carried out in Mogotio Sub County. The sub-County is among the six sub counties that constitute Baringo County. It shares its borders with Rongai Sub County in Nakuru County, Eldama Ravine, Baringo Central and Baringo South Sub Counties. The area has an estimated area of 1,303.87 square kilometers and is segmented into three wards: Mogotio ward (287.53 km^2), Emining ward (529.21 km^2), and Kisanana ward (487.13 km^2) (Mwaniki, 2019). It lies between latitude 0^0 1’ 20S and longitude 35^0 37’ E (Figure 1). The rainfall amount ranges between 300 mm and 500 mm yearly, declining as one move from the Southern to Northern part. This area is a semi-arid climatic zone, receiving mean annual temperature of 27°C. Some places in the study area have shallow and rocky soil. The soils exhibit a range from very deep and well-drained to relatively deep, with textures that include clay, loam, and sandy clay. The permanent rivers in the study area include Perkerra, Molo and Emining which flow through the sub county and drain into Lake Baringo. Crop production and animal rearing is the primary income generating activity for more than 80% of the people in Mogotio sub-County (MoALF, 2017).

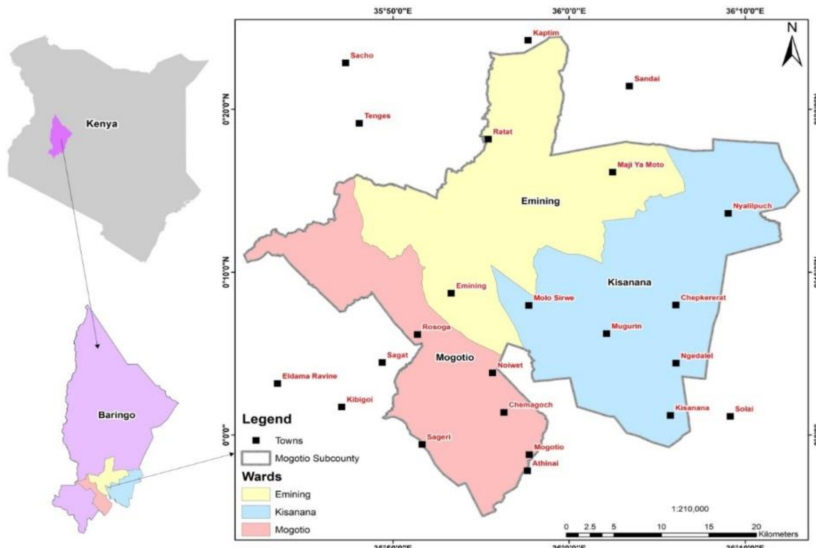

Figure 1: The study area

Sampling Procedures and Sample Size

The study targeted 91,102 people residing in 16,547 households, spread across 336 villages in Mogotio sub-County (KNBS, 2019). A stepwise sampling technique was utilized in the study. The research area was stratified into three sections based on the three wards (Mogotio, Kisanana and Emining) in the sub-County. Sample selection was based on the proportionate sampling method (Mwendwa, 2020) where size of each ward was applied in determining the sample size. With the sample size of 384 (determined using equation 1) the proportional method of 1:2:3 where 1 was Mogotio since it’s the smallest ward; Kisanana was 2 while Emining was 3 since it’s the largest ward. Thus, the number of respondents in each ward was; 64 for Mogotio, 128 for Kisanana and 192 for Emining. Simple random sampling was employed to choose respondents from every ward for inclusion in the sample.

$n = \frac{z^2 pq}{e^2}$……………………………………………………………………………Equation 1

In this context,

n denotes the sample size, P illustrates the estimated ratio of a characteristic within the population (0.5), q equals 1 minus P, and z^2 is the value from the normal curve that corresponds to a specific area α in the tails.

Data Collection

Questionnaires were the primary data collection tools for gathering primary data in order to establish the nexus of indigenous agricultural practices and climate change resilience in Mogotio sub-County. Random distribution of questionnaires was done along three selected transects in the study area, corresponding to the three wards (Mogotio, Kisanana and Emining) in the study area. Five research enumerators randomly distributed the questionnaires in each of the three wards. 64 questionnaires were distributed among the selected participants in Mogotio ward, 128 in Kisanana and 192 in Emining wards. Additionally, focus group discussions were conducted with five (5) focus group discussions in each of the wards. The focus group discussions were conducted in the market or trade centers within the study area. The researcher used local administrators to help identify the household heads to be included in each group.

Data Analysis

Both qualitative and quantitative data analyses were conducted in this study. Qualitative data obtained from focus group discussions were analyzed thematically to identify recurring patterns and perceptions regarding indigenous agricultural practices and climate resilience. Quantitative data from household questionnaires were analyzed using descriptive and inferential statistics. Descriptive statistics, including frequencies and percentages, were used to summarize the data and present trends through tables and figures. Inferential analysis was conducted using binary logistic regression to examine the influence of indigenous agricultural practices on climate change resilience in Mogotio Sub-County. The Logit regression model was formulated using equation 2 below

Log $(\frac{P}{1-P}) = \beta o + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$…………………………………………………equation 2

In which, P represents the probability of a household being climate resilient, β_0 indicates the starting value when all predictors are zero, β_1 to β_3 are the estimated coefficients, and X_1 represents coping with reduced rainfall, X_2 represents the contribution of indigenous practices to agricultural yields and X_3 represents community knowledge sharing. The term ε represents the stochastic error, assumed to serve as a random variable that has an average of 0 and spread of σ^2.

Climate resilience was operationalized as a binary outcome variable based on households' reported ability to sustain agricultural production and adapt to climate-related shocks using indigenous agricultural practices. Households reporting effective adaptation and sustained production were coded as resilient (1), while those reporting otherwise were coded as non-resilient (0). Model diagnostics included tests for multicollinearity using Variance Inflation Factors (VIF), assessment of model fit using the Hosmer–Lemeshow goodness-of-fit test, and evaluation of predictive power using odds ratios and significance levels at 5%. The descriptions of the explanatory variables are shown in Tables 1.

Table 1: Explanation of the Variables Used in Predicting Contribution of Indigenous Agricultural Practices on Climate Change Resilience in Mogotio sub-County

Variable	Description	Expected sign
*Y	Climate change resilience (Yes=1, Otherwise=0)	
X_1	Coping with Reduced Rainfall (Resilient agricultural practices)	+/-
X_2	How Indigenous Practice Improve Agricultural Yields (1=Yes, 0=No)	+/-
X_3	Community Knowledge sharing (Different roles played by sharing indigenous knowledge)	+/-

*Dependent variable

Results and Discussions

The key findings of the study are presented in this section.

Contribution of Indigenous Agricultural Practices to Climate Change Resilience

Analyses of the different ways through which traditional agricultural practices contribute to climate change resilience in Mogotio sub-County are presented in this section. The section examines the extent to which indigenous farming methods mitigate climate-related risks, including erratic rainfall patterns, prolonged dry spells, crop failure and threats to food security.

Indigenous Agricultural Practices in Coping with Climate Change

The results shown in Table 2 demonstrate the significance of indigenous agricultural practices in coping with climate change, show casing the proportions of various strategies employed by communities in Mogotio sub-County. The data indicates that drought-resistant crop varieties are the most widely adopted practice, accounting for 43.2% of responses, followed by the use of indigenous breeds at 25%, and both water conservation techniques and use of indigenous seeds at 15.9% each (Table 2). This distribution reflects a strategic approach to enhancing resilience against climate variability, particularly in regions experiencing erratic rainfall patterns.

The predominant reliance on drought-resistant crop varieties, which constitutes 43.2% of the responses, underscores a proactive adaptation strategy among farmers in Mogotio. The dominance of drought-resistant crops suggests that households prioritize practices that directly reduce exposure to climate-induced production risks, particularly rainfall uncertainty and crop failure. Communities were cultivating sorghum, millet and maize. This concurs with Endorois Community (2022) which observed that the Endorois community in Mogotio cultivates crops like sorghum and millet, which are well-suited to arid conditions and have historically formed a part of their agricultural practices. The use of indigenous breeds, representing 25% of the practices identified, reflects an understanding of local livestock adaptation to environmental stresses. For instance, the indigenous Zebu cattle raised by the Endorois are known for their resilience to harsh climatic conditions and ability to thrive on limited forage (Endorois Community, 2022). These breeds provide the community with meat, milk and income once the livestock is sold. This indicates that livestock selection is not random but influenced by long-term environmental adaptation, where resilience to climate stress is a key criterion for production decisions. The integration of indigenous livestock breeds into farming systems is supported by findings from Davis and Terblanché (2016), who emphasize that local breeds are often better adapted to withstand droughts and diseases compared to exotic breeds.

Water conservation techniques account for 15.9% of the practices employed by communities in Mogotio. These techniques include rainwater harvesting and soil moisture retention strategies, which are critical in arid regions where water scarcity is prevalent (Dejene et al., 2011). For instance, Farmer Managed Natural Regeneration (FMNR) approaches have been employed in Mogotio to restore degraded land and improve water retention through natural vegetation growth (FMNR Hub, 2016). These techniques not only improve soil fertility but also provide shade for crops, reducing evaporation rates and increasing resilience against drought. The use of indigenous seeds also represents 15.9% of the practices identified, indicating a continued reliance on indigenous seed varieties that thrive in the local environmental conditions. This practice is particularly important in Mogotio, where farmers often select seeds based on historical performance under specific climatic conditions. This reliance reflects an adaptive seed selection system grounded in experiential knowledge. As noted by Morton (2007), utilizing native seed varieties enhances resilience by ensuring that crops are better suited to withstand local climate challenges. Similarly, Chigavazira (2012) found that farmers often select seeds based on historical performance under specific climatic conditions, thereby ensuring better crop yields during periods of low rainfall.

Table 2: Indigenous Agricultural Practices for Coping with Climate Change

	Number of respondents	Percentage (%)
Water conservation techniques	61	15.9
Drought-resistant crop varieties	166	43.2
Use of indigenous breeds	96	25
Use of indigenous seeds	61	15.9
Total	384	100

Source: Author, 2025

How the Indigenous Practices Improve Agricultural Yields in Mogotio Sub-County

Findings of this study indicated that indigenous crop and livestock production practices were highly beneficial to the farmers in Mogotio sub-County. These practices enabled the respondents to maintain crop production throughout the year and minimize production cost. The indigenous crops also mature faster while the indigenous livestock breeds are more resistant to climate change (Figure 2).

The analysis indicates that 46.2% of the respondents believe that indigenous animal breeds are more resistant thus they can improve agricultural yields despite the changing climatic conditions in the study area. Indigenous animal breeds are more suited to the local weather conditions, making them resistant to pests, diseases, and extreme weather. This advantage significantly contributes to yield stability in Mogotio. The indigenous animal breeds such as Zebu and the Galla goats thrive very well in this arid environment while providing essential products like milk and meat. This adaptability not only supports food security but also enhances farmers' livelihoods by ensuring consistent production even during adverse weather conditions. This agrees with Mason and Maule, (2015) who established that the indigenous breeds often exhibit better health and productivity compared to exotic breeds under similar conditions.

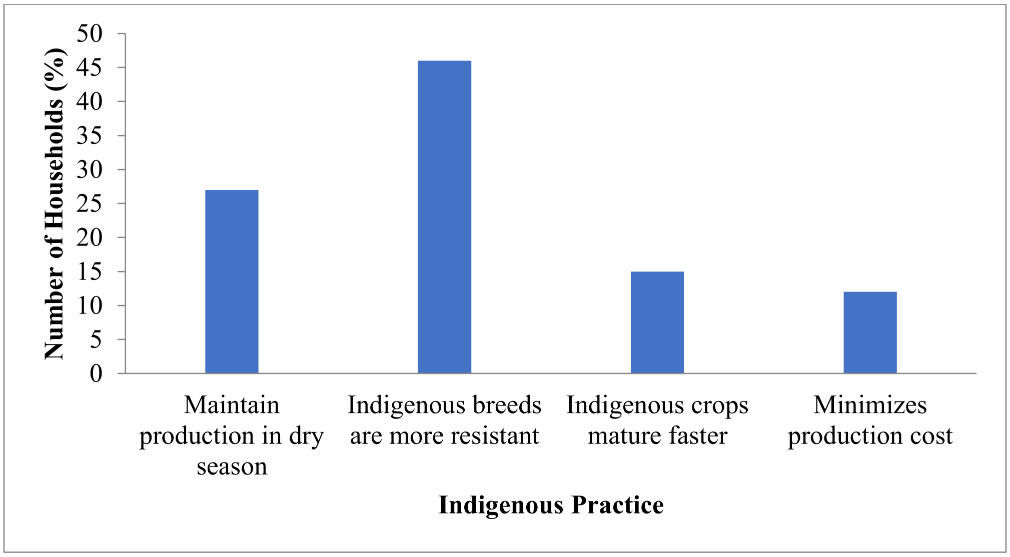

Figure 2: How Indigenous Practice Improve Agricultural Yields
Source: Author, 2025

The practice of maintaining production during the dry season accounts for 27% of responses, indicating its significance among farmers in Mogotio sub-County. Farmers in this area employ strategies such as implementing irrigation systems and selecting drought-resistant crop varieties that allow for continued cultivation despite reduced rainfall. This indicates that production continuity under climate stress is achieved through adaptive farm management rather than reliance on external technological inputs alone. The findings concurs with Kamau et al. (2018) who observed that the use of zai pits and intercropping with drought-tolerant legumes improved yields by up to 30% during dry seasons in Eastern Kenya. The finding that 15% of respondents believe indigenous crops mature faster suggests that these varieties provide a crucial advantage in maximizing yield potential within shorter growing seasons. In this area, traditional varieties of millet and sorghum are often selected for their rapid maturation rates, enabling farmers to harvest before the onset of severe droughts. In agreement, Nyaga and Barasa (2020), noted that farmers in Kitui County preferred planting early maturing cassava varieties to adapt to shortened rainfall seasons.

Finally, the belief that indigenous agricultural practices minimize production costs represents 12% of responses. Farmers in this area utilize traditional practices like using organic manure and use of ash to preserve their produce. This minimizes the reliance on expensive synthetic fertilizers and pesticides. This approach not only lowers costs but also promotes sustainable agricultural practices that enhance climate change resilience. In concurrence, Mutegi et al. (2017) found that in Central Kenya, the use of organic manure and agroforestry reduced costs by 20% compared to conventional farming systems.

Role of Community Knowledge Sharing in Enhancing Climate Resilience

The analysis of knowledge sharing among community members in Mogotio Sub County reveals significant potential for enhancing climate resilience through improved awareness of indigenous practices, education on coping strategies, and effective information sharing. This approach empowers local farmers by improving their awareness of indigenous practices, educating them on coping mechanisms, facilitating information sharing, and aiding in rainfall prediction.

The majority of respondents (56%) identified improved awareness of indigenous agricultural practices as the most significant outcome of community knowledge sharing (Figure 3). This indicates that farmers are increasingly recognizing the significance of traditional methods in mitigating the negative effects of climate variability. Improved awareness empowers farmers to integrate indigenous approaches like soil conservation, water harvesting, and mixed cropping into their farming systems, which enhances climate resilience. The findings are consistent with a study conducted by Muthoni et al. (2020) that emphasized importance of awareness and education about indigenous farming methods in strengthening the adaptive capacity of rural communities to climate change.

Educating the community on coping mechanisms accounted for 19% of responses. This underscores the significance of equipping societies with strategies to handle climate-induced challenges, like unpredictable rainfall and prolonged droughts. Education on coping mechanisms helps reduce vulnerability by fostering preparedness and adaptability. Similar studies, such as Mwaura et al. (2019), emphasize that capacity-building programs targeting smallholder farmers significantly enhance their ability to withstand climate shocks. Additionally, Njeru et al. (2021), which highlighted those educational initiatives and effective communication, enhance the ability of the communities to develop adaptive capacities in response to climate variability. Another 19% of respondents highlighted the importance of general information sharing. This underscores the value of creating networks where farmers can exchange ideas, lessons learned, and best practices for climate resilience. Effective information exchange ensures that the community members access current and relevant knowledge that assists them make informed decisions. According to Asfaw et al. (2018), the establishment of community forums and extension services has proven effective in promoting collaborative adaptation measures in rural agricultural settings.

Rainfall prediction was mentioned by 6% of respondents as a benefit of community knowledge sharing. Although this percentage is relatively low, it highlights the role of traditional weather forecasting methods, which are often grounded in environmental observations and indigenous knowledge. This shows that indigenous forecasting systems still function as supplementary tools in agricultural planning, especially where formal meteorological services are limited. Rainfall prediction assists farmers in optimizing their agricultural calendar, lowering the likelihood of crop losses. This corresponds to Radeny et al. (2019) findings that indigenous rainfall prediction methods remain valuable, especially in places where meteorological data is not easily accessible.

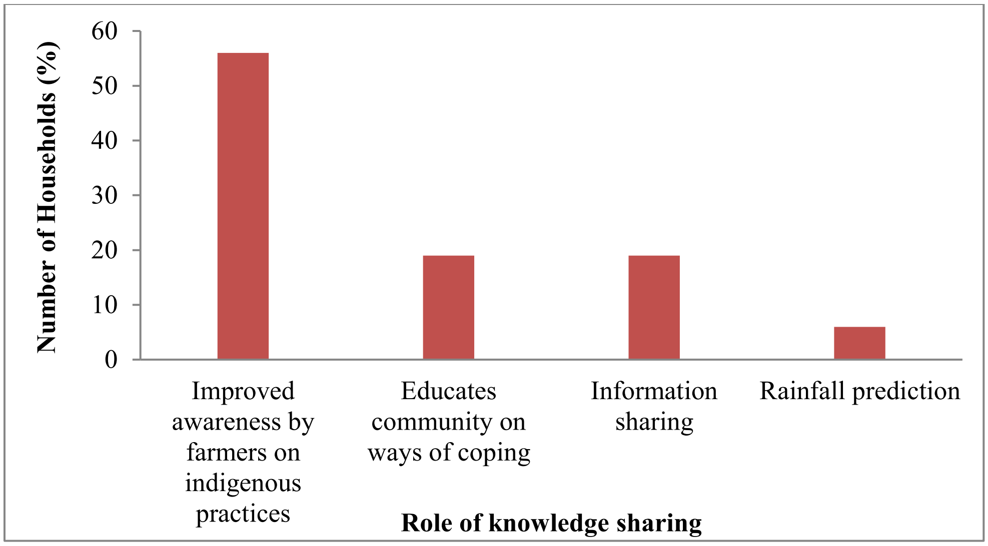

Figure 3: Role of Community Knowledge Sharing in Enhancing Climate Resilience
Source: Author 2025

Regression Analysis for Contribution of Indigenous Agricultural Practices to Climate Change Resilience

Binary logistic regression analysis was conducted to examine the association between indigenous agricultural practices and climate change resilience among households in Mogotio Sub-County. The analysis focused on coping with reduced rainfall, perceived contribution of indigenous practices to agricultural yields, and community knowledge sharing.

The results indicate that coping with reduced rainfall was positively and significantly associated with climate resilience (coefficient = 0.75, odds ratio = 2.11, p = 0.004). This suggests that households adopting resilient agricultural practices were more likely to report climate resilience compared to those that did not adopt such practices. This is consistent with Kabore & Reij (2004); Kiboi et al. (2017) studies in semi-arid Kenya where drought adaptation practices such as water harvesting, zai pits, and soil moisture conservation have been shown to improve household resilience to rainfall variability and crop failure. The perceived contribution of indigenous agricultural practices to improved yields was positively associated with climate resilience (coefficient = 1.20, odds ratio = 3.32, p = 0.001). Households perceiving indigenous practices as beneficial to agricultural productivity were more likely to exhibit resilience to climate-related challenges. This aligns with FAO (2019) findings that drought-tolerant crops such as sorghum and millet enhance yield reliability in arid and semi-arid environments. Community knowledge sharing also demonstrated a positive and statistically significant association with climate resilience (coefficient = 0.95, odds ratio = 2.59, p = 0.002), indicating the importance of indigenous knowledge exchange in strengthening adaptive capacity. The findings demonstrate significant statistical associations between indigenous agricultural practices and climate resilience.

Table 3: Contribution of Indigenous Agricultural Practices to Climate Change Resilience

Explanatory Variable	Estimated Coefficient	Odds Ratio	P Value
Coping with Reduced Rainfall	0.75	2.11	0.004*
How Indigenous Practice Improve Agricultural Yields	1.2	3.32	0.001*
Community Knowledge sharing	0.95	2.59	0.002*
Constant	1.5	0.45	0.001*

*Note: *indicates significance at 5%*

Conclusions

The study concludes that indigenous agricultural practices play a significant role in enhancing climate change resilience in Mogotio Sub-County. The most commonly adopted practices include drought-resistant crop varieties, indigenous livestock breeds, water conservation techniques, and use of indigenous seeds, indicating a strong reliance on locally adapted coping strategies. The findings further show that indigenous agricultural practices contribute to improved agricultural performance through enhanced livestock resilience to climatic stress, continued production during dry seasons, faster crop maturity, and reduced production costs. These factors collectively support household-level food security and production stability under climate variability. The logit regression results confirm statistically significant positive associations between climate resilience and coping with reduced rainfall, perceived improvement in yields from indigenous practices and community knowledge sharing. This indicates that households engaging in these practices are more likely to report climate resilience outcomes.

Recommendations

The study recommends the Ministry of Agriculture and Livestock Development to allocate funds for subsidized inputs, such as indigenous seeds and tools tailored for traditional farming practices. The Ministry should also create frameworks to develop markets for indigenous crops and livestock, ensuring competitive pricing and value chain development to support climate-resilient farming. The County Government of Baringo should implement water harvesting and irrigation projects in drier areas like Kisanana and lower Emining to support sustainable farming. The County Government should also improve rural roads and storage facilities to enhance the transportation and preservation of indigenous agricultural products, ensuring food security.

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