Is there a Mismatch between Perceptions of Climate Change Variability and Adaptation Practices amongst Smallholder Farmers in Mount Kenya Region?

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Abstract

According to demographic predictions, mountainous environments are found in over half of the world's countries. According to the Food and Agriculture Organization of the United Nations, mountain ecosystems are home to over 850 million people and supply critical ecosystem services such as water for domestic use, agriculture, industry, and power generation to more than half of the world's population. The objective of the study was to understand the perceptions of climate change variability and adaptation practices amongst smallholder farmers in the Mount Kenya region. The research presents an overview of smallholder farmers' perception of climate change where items were used to measure the concept of climate change variability among 453 smallholder farmers in Mt Kenya west. The test items carried two thematic issues which were temperature and rainfall. The items were used to construct an index for climate change using Principal Component Analysis (PCA). The ANOVA test results indicated ($p<0.05$) confirmed that there is a statistically significant difference in smallholder farmers perception of climate change across the three forest blocks, gender, and Socioeconomic Status (SES). Further, the study established a significant level of awareness of climate change among smallholder farmers and a relatively stagnant approach to the utilization of non-timber forest products (NTFPs). This confirms the disparities among smallholder farmers' perceptions on climate change and adaptation practices. The study recommends the formulation of the consultative, pragmatic, and responsive policy framework that balances forest conservation and forest adjacent community's user rights.

Keywords: Climate change, forest adjacent communities, mountain ecosystems, variability, vulnerability, community development

1.0 Introduction

Mountainous Forest ecosystems are internationally significant biodiversity hotspots, but they face a slew of human-caused problems, including climate change (Guo et al., 2017), which has been more severe in Sub-Saharan Africa due to the rapid increase in the human population (Brandt et al., 2017), exerting pressure on the forests. Climate change has been identified as a primary driver of global biological diversity change, alongside changes in land use. African countries face a few environmental concerns that might stymie their economies' economic and industrial development. (Serdeczny et al., 2017). There is now a large body of evidence that the perception of communities living in the neighbourhood of mountainous forests on climate change is a critical element in considering sustainable forest policy options (Babcock et al., 2019; Dwire et al., 2018; Eisenbarth et al., 2021). Despite the availability of such evidence, there is limited empirical research on local mountainous forest ecosystems in the East Africa region, particularly in Kenya. Further still, there is limited research evidence to show community understanding of the link between climate change and immediate natural resources such as a forest. It is against this background that this study was conducted to provide local evidence on the connection between perception and adaptation practices.

1.1 Research objectives

To establish whether there is a mismatch between perceptions of climate change variability and adaptation practices amongst smallholder farmers in the Mount Kenya region the study focuses on addressing the following objectives:

i. To find out smallholder farmers' perception on changing temperature patterns in Mt. Kenya west in the past fifteen years.
ii. To establish smallholder farmers' perception of changing rainfall patterns in Mt. Kenya west in the past fifteen years.
iii. To determine smallholder farmers' perception of changing weather patterns in Mt. Kenya west in the past fifteen years.

1.2 Research questions

Accordingly, the study answers the following research questions

i. What is the state of smallholder farmers' perception of changing temperature patterns in Mt Kenya west in the past fifteen years?
ii. What is the state of smallholder farmers' perception of changing rainfall patterns in Mt Kenya west in the past fifteen years?
iii. What is the state of smallholder farmers' perception of changing weather patterns in Mt Kenya west in the past fifteen years?

2.0 Literature Review

According to a study by Savo et al. (2016) based on 10,660 observations from 2,230 locations in 137 countries show that warming and seasonal changes and rainfall patterns are widespread in about 70% of countries (Savo et al., 2016). The international practice of forest conservation as a strategy to reduce climate change is based on Participatory Forest Management (PFM), a framework that gives access to protected forests (Senganimalunje et al., 2016). Theoretically, PFM considers forest communities to regard forests as an important natural source of livelihood instead of income (Luswaga & Nuppenau, 2020). It is for this reason that public perception of climate change is critical in changing the demands of forest resources.

Mt Kenya is the second highest peak in Africa and one of the most impressive landscapes in East Africa and listed by UNESCO as a world heritage site. There is a set of sound legislation provided by the Wildlife Act (2014), Environment Management and Coordination Act (1999), the Water Act (2002), and the Forest Act (2005) that are deemed to provide adequate protection to the Mt Kenya forest conservancy. Institutions such as Kenya Wildlife Service (KWS) and Kenya Forest Service (KFS) among others work in coordination to manage Mt Kenya forest conservancy. The formation of Community Forestry Associations (CFAs) and the preparation of operational forest management plans and related agreements between KFS and the CFAs have aided in the more sustainable management of diverse portions of the forest. However, according to the Mount Kenya Forest Reserve and National Park MKFRNP (2010), there are threats and challenges faced by community-based approaches in different mountain protected wildlife parks and reserves in Kenya. Some of the threats and challenges cited in the management plan include encroachment, marijuana cultivation, accidental forest fires, poaching of wild animals, illegal logging, destruction of young trees (MKFRNP, 2010).

Understanding the local contexts of vulnerability is important for the development of effective adaptation policies in developing countries such as Kenya which face numerous vulnerabilities concerning natural resources. The importance of public awareness and perception of climate change variability has attracted scholars to numerous studies on the same in Mt Kenya forest conservancy and other protected forests in Kenya such as Mau, Cherangani, Kakamega forest among others. Farmer's perceptions studies of climate change show that farmers have observed changes in climatic patterns in recent years, especially in terms of rainfall and temperature (Kisiwa et al., 2020; Kong'ani et al., 2018; Wetiba et al., 2021). A study of climatic controls and climate proxy potential of Lewis Glacier (Prinz et al., 2016) found that there were perceptions concerning frequency instances of lack of rain in the recent past.

Research evidence suggests that most forest adjacent smallholder farmers in Sub-Saharan Africa including Kenya are vulnerable to policy shock such as occasional forest access ban by the government. The long-standing vulnerabilities of smallholder farmers are more often attributable to limited risk adaptation strategies but do not link them to climate change. Despite a large body of research evidence confirming that climate is changing on a global scale (Alfonso et al., 2021; Change, 2018; Miles-Novelo & Anderson, 2019), there remains considerable uncertainty about the local and regional environmental consequences such as it is the case in Mt Kenya. This knowledge gap is further exacerbated by inadequate understanding of the perception of forest adjacent communities on climate change. Hasan and Nursey-Bray (2018) argue that understanding forest adjacent communities' perceptions provides ideas for how to form appropriate climate responses at local levels in developing countries.

3.0 Research Methodology

This study used a cross-sectional-descriptive research design. The target population of this study were 1,530 smallholder farmers living adjacent to Chehe, Hombe and Kahurura forest blocks and involved in Non-timber Forest Products (NTFPs). While Mt Kenya conservancy has more than 7 distinct forest ecosystems, the three forest blocks were identified for the study because they had reasonably proper documentation on user rights utilization including documentation of user rights groups from which a reliable sampling frame was drawn. According to Orodho (2013), when the study population is less than 10,000, a sample size of between 10% and 30% is a good representation of the target population, hence in this study, 30% of the target population was selected (1,530 x 30% = 459). To draw a random sample of 459 from a list of 1,530 subjects, a 3-digit random table were used and was made proportional to the forest block total population to ensure representation. Primary data was collected from 453 smallholder farmers out of the targeted 459 respondents using a structured questionnaire. This study used a questionnaire with 11 test items. The test items were developed by the researcher modelling climatological parameters for measuring climate change, temperature, and precipitation (Cess, 1976) while taking cognizance of contextual limitations of the target population. In this regard, the test items were structured in a conversational format with a 5-point Likert Scale of each item where 1=Not observed or experienced this at all, 2=Observed a little of this 3=Not Sure, 4=Increased somehow and 5=Increased a lot. The climate change perception index for every respondent was computed using Principal Component Analysis (PCA) based on the 11 test items of the questionnaire.

Eigenvalues vectors and eigenvalues were computed using the PCA extraction method and results are presented in Table 1. This is a dimensionality reduction technique that combines several test items to create new uncorrelated variables ‘Component’. As shown in Table 1, 11 principal components are created, each corresponding to the initial test item. To determine the optimal number of principal components that can be used to make inference without losing much information, the criteria is based on eigenvalues greater than 1. The 3 principal components cumulatively would explain 62.54% of the variation in the original data.

Table 1: PCA Extraction of Eigenvalues Vectors and Eigenvalues

Principal Component	**Initial Eigenvalues**			**Extraction Sums of Squared Loadings**		
	Total Score	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	3.83	34.85	34.85	3.83	34.85	34.85
2	1.91	17.34	52.20	1.91	17.34	52.20
3	1.14	10.34	62.54	1.14	10.34	62.54
4	0.87	7.91	70.45			
5	0.77	7.04	77.49			
6	0.64	5.84	83.32			
7	0.57	5.13	88.45			
8	0.48	4.36	92.81			
9	0.36	3.26	96.07			
10	0.27	2.48	98.55			
11	0.16	1.45	100.00			

Source: Author’s survey data (2019)

The three principal components correspond to arbitrary uncorrelated constructs within the data. The component matrix approach was used to identify the factor loadings of each test item on the three components. The total score of each of the three principal components was multiplied by the individual principal component score and summed to obtain the climate change perception index. The climate change perception index was ranked from lowest score to the highest score and classified into 5 categories where 1=No climate change observed, 2=Some climate change observed, 3=Not sure about climate change, 4=Significant climate change observed and 5=Serious climate change observed. A critical analysis of component matrix with respective factor loadings in the context of theoretical climatological parameters resulted in the creation of three operationally defined variables as (1) changing temperature patterns, (2) changing rainfall patterns and (3) changing weather patterns.

Table 2: Reliability Analysis for three Aspects of Changing Climate

Construct	No of test items used	Cronbach's Alpha
Changing Temperature Patterns	4	0.773
Changing Rainfall Patterns	3	0.753
Changing Weather Patterns	4	0.742

Source: Author's survey data (2019)

The reliability scale shown by Cronbach's alpha of *0.773 > 0.7* on changing temperature patterns, *0.753 > 0.7* for changing rainfall patterns and *0.742 > 0.7* on changing weather patterns. According to Taber (2018) Cronbach's alpha greater than 0.7 is a sufficient guarantee of a reliable scale, thus, the test items used in this study are reliable in measuring the three aspects of changing climate in Mt Kenya West region.

2.2.1 Study Area

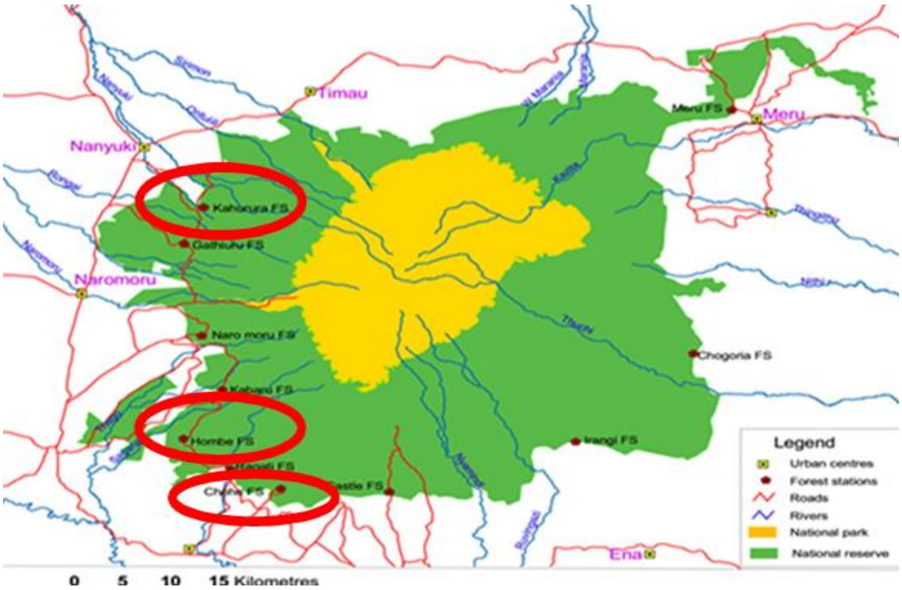


Figure 1: The Courtesy of Kenya Forest Working Group, East African Wildlife Society (2014)

4.0 Results and Discussion

4.1 Demographic and Socio-Economic Status (SES) Analysis

The results of this study are based on analysis of empirical data gathered from 453 smallholder farmers in Mt Kenya west accounting for 98% of the target sample, 61% of whom were male and 39% were female. Smallholder farmers who participated in the study were aged between 20 and 83 years as follows; 12% were below 35 years, 69% between 30 and 60 years while 19% were above 60 years. This suggests that youth (Below 35 years) were the least represented in the study. This is expected because Mt Kenya CFAs as user groups registers household heads, most of whom are unlikely to be young people. The sample distribution across the three forest blocks was fairly distributed with 33% from Chehe, 34% from Hombe and 33% from Kahurura.

In terms of marital status, the study found that majority of respondents at 82% were married, 8% were single and 9% were widowed. In terms of highest educational attainment, the study established that 8% had no formal education, 44% had primary education level, 39% had secondary education and only 8% had post-secondary or tertiary education level. Based on analysis of household income, expenditure, and assets such as ownership of zero-grazing units, milking facilities, cow shade, production of own fodder, and water troughs, farmers were classified into three distinct wealth quintiles (socio-economic status). The study established that 36% had poorer socio-economic status, 31% were poor while 33% could be described as not poor.

4.2 Smallholder Farmers Perception on changing temperature patterns

Results presented in frequency Table 3 below summarize the perception of smallholder farmers on changing temperature patterns in the past 15 years. The majority of respondents at 68% and 67% reported having observed a significant increase in daytime temperature and the number of hot days respectively. It was also observed that almost half (47%) of respondents reported that the degree of coldness during the cold season had increased significantly. Only 28% of respondents reported having witnessed a significant increase in the number of warm nights with 34% reported to have observed a little increase in the number of warm nights.

Table 3: Frequency Table of Perception on Changing Temperature patterns

Statement	1	2	3	4	5
1. Day time temperature has increased during the last fifteen years	0%	6%	1%	25%	68%
2. The number of warm nights has increased during the last fifteen years	4%	34%	9%	25%	28%
3. The number of hot days has increased during the last fifteen years	0%	3%	3%	27%	67%
4. The degree of the coldness of cold seasons has increased during the last fifteen years	1%	21%	4%	27%	47%

Source: Author's survey data (2019)

1 = Not observed or experienced this at all, 2 = Observed a little of this, 3=Not Sure, 4=Increased somehow and 5 = Increased a lot.

Comparative analysis reveals that over 83% of smallholder farmers who observed a significant increase in daytime temperature also reported an increased number of hot days. Similarly, it was found that at least 82% of smallholder farmers who reported observing a significant increase in either daytime temperature or increased number of hot days also reported a significant increase in the degree of coldness during the cold season. This consistency in smallholder farmers perception regarding the changes in temperature in their region shows a reasonable awareness of the concept of climate change, however, the farmers may not be able to link this to the protected forests in their neighbourhood. Previous studies in other parts of the world show similar results of increasing temperature over time. For instance, research by Arnell et al. (2019) on climate change at different levels of global temperature increase found that the global average chance of a major heatwave increases from 5% in 1981–2010 to 28% at 1.5 °C and 92% at 4 °C. The study, therefore, provides evidence of the local perception of the community of changing temperature patterns which seem to conform to general global trends of global warming. Reich et al. (2019) argue that desertification assessment is based on information on soils, climate, and land resource stressors.

4.3 Smallholder Farmers' Perception on Changing Rainfall Patterns

Results presented in frequency Table 4 below summarize the perception of smallholder farmers on changing rainfall patterns in the past 15 years. The majority of respondents at 64% and 60% reported having observed a significant decrease in the amount of rainfall and reduction in the number of rainy days. Only 21% reported having seen a significant reduction in the intensity of rainfall in the region.

Table 4: Frequency Table of Perception on changing rainfall patterns

Statement	1	2	3	4	5
1. The amount of rainfall has decreased during the last fifteen years	2%	16%	3%	15%	64%
2. The number of rainy days has decreased during the last fifteen years	0%	16%	1%	23%	60%
3. The intensity of rainfall has increased during the last fifteen years	12%	31%	7%	28%	21%

Source: Author's survey data (2019)

1 = Not observed or experienced this at all, 2 = Observed a little of this, 3=Not Sure, 4=Increased somehow and 5 = Increased a lot.

Comparative analysis reveals that at least 78% of those who reported having observed a significant reduction in the number of rainy days also reported having observed a significant reduction in the amount of rainfall. Further, at least 83% of those who reported having observed significant changes in rainfall intensity also reported having observed a significant reduction in the amount of rainfall and reduction in the number of rainy days. The consistency in reporting of these results suggests a reasonable understanding of rain as an indicator of climate change among smallholder farmers in Mt Kenya. These results lead to a logical conclusion there is evidence of the decline in the amount, duration, and intensity of rainfall in the Mt Kenya region.

The smallholder farmers awareness of changing rainfall patterns as demonstrated in this study synchronises well with the situation in Africa and most parts of the world as reported by earlier studies. For instance, Manatsa et al. (2011) observed that dipole rainfall seems to be diminishing gradually as from the early 1990s. Most of the smallholder farmers rely on rainfall for their agricultural activities such as fodder production. This implied that with the reduction in the amount, duration and intensity of rainfall received in Mt Kenya west in the past 15 years, agricultural production will be affected negatively unless farmers adapted new ways to mitigate vulnerabilities. Viljoen (2013) made similar conclusions, stating that rain-fed agriculture production is especially vulnerable to the effects of climate change due to changes in rainfall patterns and rising temperatures. Climate change threatens important economic drivers such as water resources, agriculture, energy, transportation, health, forestry, wildlife, land and infrastructure, and catastrophe risk management, among others, on the African continent (Viljoen, 2013). Water stress and shortage, food insecurity, reduced hydropower generating capacity, loss of biodiversity and ecosystem degradation, increased disease burden, infrastructure devastation, and high disaster management costs are some of the consequences (Manatsa et al., 2011; Viljoen, 2013).

4.4 Smallholder Farmers' Perception of changing weather patterns

Results presented in frequency Table 5 below summarize the perception of smallholder farmers on changing weather patterns in the past 15 years. While the construct of weather pattern is not conventionally defined within the conventional climatological parameters of measuring climate change, this study identified that individual perception of the frequency of temperature and precipitation illicit a new dynamic in the way individuals perceive variability of climate change. Table 5 below presents the four climate change evaluation indicators concerning the frequency of precipitation.

Table 5: Frequency Table of Perception on changing weather patterns

Statement	1	2	3	4	5
1. The frequency of occurrence of droughts has increased during the last fifteen years	8%	38%	1%	7%	46%
2. The occurrence of untimely rainfall has increased during the last fifteen years	1%	17%	2%	22%	58%
3. The onset of rainfall has become more and more unpredictable during the last fifteen years	0%	15%	3%	18%	64%
4. The cessation of rainfall has become more and more unpredictable during the last fifteen years	1%	17%	14%	20%	49%

Source: Author's survey data (2019)

1 = Not observed or experienced this at all, 2 = Observed a little of this, 3=Not Sure, 4=Increased somehow and 5 = Increased a lot.

The results show that about 46% of smallholder farmers reported having observed a significant increase in the frequency of drought in the region and 38% said they have observed a little of this. Drought is characterised by the reduced amount of precipitation in the region which previous researchers have identified as a reliable indicator of changing climate. Since almost half of the respondents identify the increased occurrence of drought as a climate issue, we can conclude that the level of awareness about climate is reasonably high among this population. Previous studies have identified the occurrence of drought as an indicator of changing climatic conditions globally and locally. For instance, research by Arnell et al. (2019) on climate change at different levels of global temperature increase found that the global average chance of an agricultural drought increases from 9 to 24% at 1.5 °C and 61% at 4 °C. More than half of respondents at 58% reported that the occurrence of untimely rainfall had increased significantly, 64% said the onset of rainfall had become more unpredictable while almost half (49%) reported that cessation of rainfall had become more unpredictable over time. Rainfall cessation also means the scanty few days of rainfall that may occasionally occur, a real sign of climate change.

4.5 Overall Descriptive Analysis and ANOVA of Climate Change Variability

Table 6 presents descriptive summaries (group mean, standard deviation and sub-sample) of climate change perception index across forest block, gender, age, education level and socioeconomic status. Group mean shows the average perception score for a sub-sample, the smaller group mean relative to another group indicates a more conservative perception about climate change. The bigger group mean relative to another indicates a strong perception about changing climatic variations. Table 7 presents ANOVA results whose interpretation provides more statistical inferences of Table 6 results of the group mean.

Table 6: Descriptive summaries of Group mean of Climate Change Perception Index

Demographic	Group Mean	Std Dev	Sub-Sample (n)
Forest Block			
Chehe	-0.075	3.016	151
Hombe	-2.502	4.800	153
Kahurura	2.645	3.683	149
Gender			
Male	0.425	4.201	276
Female	-0.663	4.704	177
Age (years)			
Below 35	1.253	3.831	54
30-60	-0.218	4.345	314
Above 60	0.011	4.985	85
Education Level			
No formal education	0.173	5.519	38
Primary	0.287	4.696	200
Secondary	-0.361	4.075	177
Post-secondary	-0.003	3.272	38
Socio-Economic Status			
Poorer	1.242	4.513	162
Poor	-1.680	4.465	140
Not Poor	0.225	3.806	151

Source: Author's survey data (2019)

From Table 6, the results show that smallholder farmers from Kahurura forest block had the stronger perception of drastically changing climatic conditions, followed by those from Chehe while only a few from Chehe perceive that there are serious climatic changes. The ANOVA results in Table 7 with p-value ($p=0.001<0.05$) on perception index across forest block suggests that these variations in perception among forest blocks are statistically significant. On gender, results from Table 8 shows that male respondents perceived changing climatic conditions compared to their female counterparts who held a conservative view. The ANOVA results in Table 7 with p-value ($p=0.011<0.05$) on perception index across gender suggests that the differences in perception between males and females are statistically significant. This implies that more male respondents observed changes in climatic conditions compared to female respondents. A similar trend is observed concerning SES ($p=0.001<0.05$) which according to results presented in Table 8, poorer farmers tend to report that they observed serious climatic changes compared to wealthier farmers.

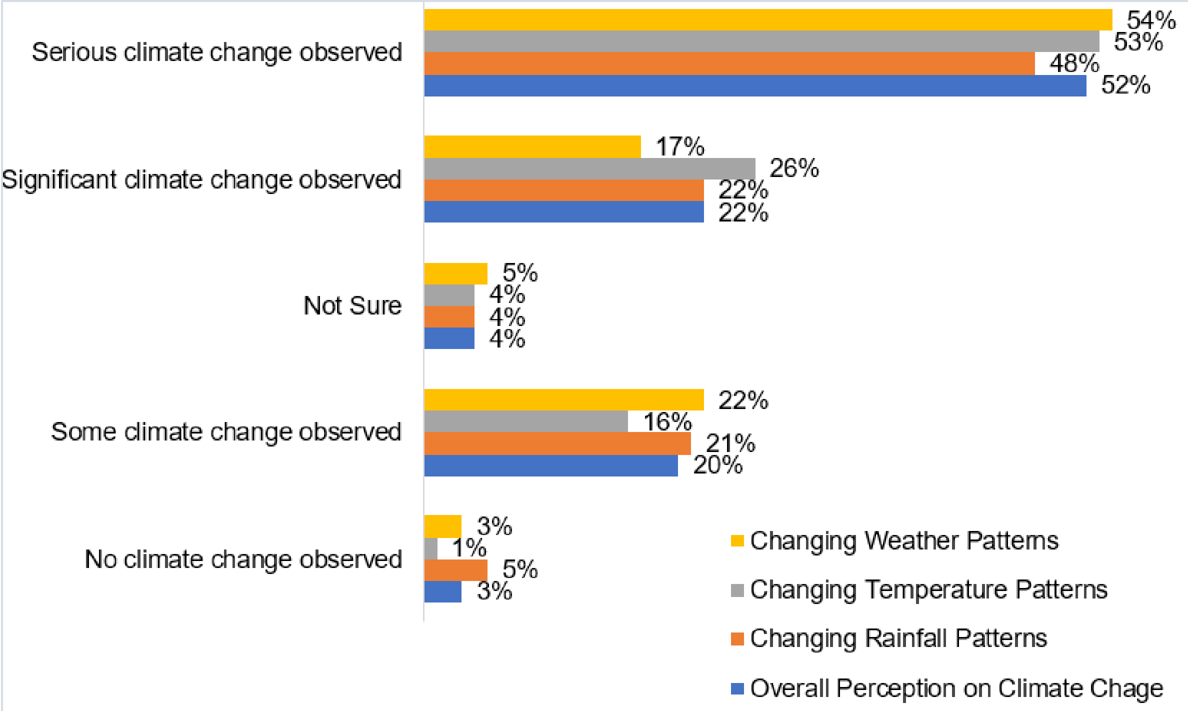
In terms of age, results in Table 6 shows that the majority of respondents aged below 35 years observed serious climatic changes followed by those above 60 years while those aged between 30 and 60 years seemed to suggest only minor climatic changes had been observed. However, the ANOVA results in Table 7 with p-value (*p=0.079>0.05*) on perception index across different age categories suggests that the differences in perception across age groups are not statistically significant. This implies that on average, smallholder perception of climate change remains relatively the same across different age groups. A similar trend is observed with education level (*p=0.558>0.05*) where the perception does not vary significantly with individual education attainment.

Table 7: Analysis of Variance (ANOVA) Table of Climate Change Perception Index

Source of Variation	Degrees of freedom	Sum of Squares	Mean Sum of Squares	F-value	P-value
Forest Block	2	2,001	1,000.500	65.497	0.001
Residuals	450	6,874	15.276		
Gender	1	128	128.000	6.600	0.011
Residuals	451	8,747	19.395		
Age	2	100	50.000	2.564	0.079
Residuals	450	8,775	19.500		
Education Level	3	41	13.667	0.695	0.558
Residuals	449	8,834	19.675		
SES	2	652	326.000	17.840	0.001
Residuals	450	8,223	18.273		

Source: Author's survey data (2019)

Perception of smallholder farmers climate change variability is described in terms of changing rainfall patterns, temperature patterns and overall weather patterns. Figure 2 below presents a descriptive summary of the overall perception of climate variation among smallholder farmers in Mt Kenya west with a focus on the three parameters of climate change on a 5-point Likert scale of climate change index.



Source: Author's survey data (2019)

Figure 2: Perception of Temperature, Rainfall and Weather Patterns Changes

The results show that 54% of respondents reported having observed serious changes in weather patterns, 53% regarding drastic temperature changes, 48% regarding drastic changes in the amount, duration, and intensity of rainfall. This implies that slightly more than half (52%) of respondents perceive that there have been serious climate changes in the region in the past 15 years. Further, 22% reported that significant climate changes have been observed, 4% were not sure, 20% said some climate change had been observed while only 4% were not sure and 3% said no climate change had been observed. This study shows evidence that most smallholder farmers perceive that there is drastic to the reasonably gradual change in climatic variations in Mt Kenya west.

5.0 Conclusion

Climate change poses a severe challenge to sustainable environmental and socioeconomic wellbeing in emerging countries. Due to overreliance on climate-sensitive natural resources, such as rain-fed agriculture, for economic growth and development, trade, and food security, this is especially true for African countries. Rural communities' perceptions of climate change are based on observations of temperature and rainfall patterns, which are reinforced by scientists' observations and projections of climate shifts in the form of higher temperatures and scant rainfall. Despite this realization of changing climatic conditions by forest adjacent communities, most of them fail to link this to their utilization of natural resources. As such, little is done to change their past and current behaviour such as overgrazing in the protected forests.

Changes in temperature and rainfall patterns are interpreted as climate change in the study. There has been a significant increase in temperature over the last 15 years, which smallholder farmers believe is to blame for excessively hot and exceptionally cold seasons. Despite this, the study found little evidence about smallholder farmers being aware of the link between the changing climatic conditions and the utilization of protected forests. This implies that smallholder farmers are unlikely to adopt new strategies for their livelihood sustainability. This study finds that the perception of climate change among smallholder farmers in Mt Kenya varies depending on the different socio-economic status and demographic dimensions such as geographic region (forest block), gender, and household-socio-economic status (SES). Smallholder farmers who heavily rely on the forest for subsistence tend to notice changing climatic variations compared to their relatively wealthier counterparts. Nonetheless, it was clear that a significant proportion of smallholder farmers in the region had not changed their approaches in the utilization of non-timber forest products (NTFPs) from the protected forests. This conflicting evidence about awareness of changing climate and tendency to resist change in the utilization of NTFPs is showing a potential mismatch between climate change variability and adaptation practices among smallholder farmers in Mt. Kenya west.

The study provides sight to the current strong policy demand for locally and empirically generated and documented research evidence on risk factors to climate change. The extreme temperature variations experienced in Mt Kenya west as reported in this study is evidence of a gradually changing climate. It is conventional knowledge that extreme temperature variations characterize most deserts across the globe. This study concludes that while NTFPs are core aspects of PFM, the changing demand for forest conservation may call for differentiation and profiling of socio-economic activities of forest adjacent communities to make them sustainable. The study further confirms the disparities among smallholder farmers perceptions of climate change. These findings have implications on adaptive community development practices aimed at promoting rural resilience amongst mountain communities.

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