Eastern African Journal of Humanities and Social Sciences
Vol. 2 No. 2 (2023): ISSN (Online): 2958-4558
DOI: https://doi.org/10.58721/eajhss.v2i2.318
Effects of Climate Change on Women's Food Security in Mwea East Sub-County, Kirinyaga County, Kenya

Effects of Climate Change on Women's Food Security in Mwea East Sub-County, Kirinyaga County, Kenya

Eva Mwai[1], Aloys Ojore[1] & Tobias Nyumba[2]
[1]*Tangaza University, Kenya;* [2]*Univerity of York, United Kingdom*

Article History
Received: 2023.09.01
Revised: 2023.09.26
Accepted: 2023.09.30
Published: 2023.10.06

Keywords
Climate change
Drought
Food security
Socio-economic development

How to cite:
Mwai, E., Ojore, A. & Nyumba, T. (2023). Effects of Climate Change on Women's Food Security in Mwea East Sub-County, Kirinyaga County, Kenya. *Eastern African Journal of Humanities and Social Sciences*, 2(2), 38-48.

Abstract
Climate change has had adverse impacts on people's lives and the economies of nations across the globe. This research examined effects of climate change on food security of women in Mwea East sub County, Kirinyaga County. The study was conducted in Ngucwi sub Location, Murinduko Ward and explored how climate change events continue to threaten food security among women. The study used descriptive research design and integrated qualitative and quantitative approaches. The researcher used purposive sampling to select Mwea East sub County which has experienced frequency and severity of climate change events of drought. Cluster sampling was used to divide the sample among the different villages and systematic random sampling to select households in each village. Out of the population of 38,734 women of ages 18 years to 69 years; a sample size of 449 was calculated. A semi-structured questionnaire was used to collect data and key informant interviews and focus group discussions were used to gather qualitative information. Quantitative data from questionnaires was analysed using descriptive statistics and regression analysis while thematic and content analysis was used to analyse qualitative data. The Statistical Package for the Social Sciences (SPSS) Version 25 was also used as a tool for analysing data. The study found that climate change was negatively related to food security, a relationship which was statistically significant. The study findings may provide policy and decision-makers with useful information to guide the design of appropriate socio-economic programmes, plans and policies to protect women from the adverse effects of climate change.

Introduction

Climate change is defined as the variations identifiable through statistical measurements (Santer *et al.*, 2009). Climate change and global warming have resulted to the rising of the sea level, retreating of glaciers and melting of high mountain ice caps. The current warming trend is brought about by a rise in carbon dioxide and other greenhouse gases in the atmosphere (Siddik *et al.*, 2021).

Sova, 2019 argues that climate change is a major threat to global food security with adverse effects on the economy, politics and social aspects of humanity. According to Gil (2019), if greenhouse gas emissions are not reduced and appropriate adaption measures not implemented, climate change

might severely affect the U.S. economy. The researcher continues to state that increased temperatures, together with elements like extreme weather and sea level rise, will harm property and critical infrastructure as well as industries like forestry, agriculture, fisheries, tourism and food security. Furthermore, even with moderate levels of warming, according to University of Chicago (2020), climate change will affect the American economy. Under a high emissions scenario, the U.S. economy could lose between 1% and 4% of GDP annually by the end of the century due to effects on labor, mortality, and the energy sector.

The IPCC (2014) observed that climate change in Europe had affected the distribution and abundance of animal, fish, and plant species, stagnated wheat yields in some sub-regions and caused forests to decline. The Asian Development Bank (ADB) (2017) estimates that Southeast Asia could experience worse losses due to climate change compared to most regions in the world; climate change, if unchecked, could reduce by 11 % the region's Gross Development Product (GDP) by the end of the century as it takes a toll on key sectors such as tourism, agriculture, fishing, human health and labor productivity. Additionally, the report indicates that women in the Asian and Pacific regions are extremely vulnerable to climate change impacts and acknowledges that unabated, global warming can significantly undo the gains of previous efforts and achievements made on economic development and the achievements made in improving living standards. Climate change would impact all social and economic sectors across the globe, but with more severity in small cities and rural communities (Kibria, 2016). These include food, water, public health, energy demand and livelihoods. Climate change results to cascading impact from physical features to people and therefore introduces social and economic consequences that affect livelihoods, food and nutrition security (Porzany, 2016).

The Commission on the Status of Women (CSW), the principal global inter-governmental body that exclusively promotes gender equality and the empowerment of women, has frequently reported on the problem of differential climate change impacts on men and women and the need for better information to support effective policy development. In its past sessional papers (50, 52, 53, 55, 57, 58, 60, and 61, the CSW, has specifically highlighted the dire climate change impacts on women (Dugard *et al.*, 2020).

All life on Earth is threatened or will be profoundly impacted by the global and unprecedented extent of the effects of climate change (Díaz *et al.*, 2019). For example, the production of food is endangered by altering weather patterns, the potential of catastrophic flooding is raised by rising sea levels, there are major forest fires raging, and there are strong heat waves and droughts. Women, world over, play a key role in food security. The impacts of climate change vary based on regional difference, age, gender and ethnicity. Climate change affects livelihoods of poor people causing risks of food security (Mbow et al., 2019).

Climate change has far-reaching consequences in regard to social development goals and economic development that include, food and nutrition security, poverty reduction, social equity, gender equality and health. A report by Tschakert & Machado, (2012) showed that women depicted higher vulnerability to climate change impacts compared to men. The report further explained that women were disproportionately exposed to risks such as increased loss of livelihoods, security, and even loss of lives, during and in the aftermath of climate related disasters. This is because women depend more on natural resources, social and cultural norms related to gender roles. Moreover, women suffer more from inequitable distribution of resources and land besides having limited access to decision-making and economic assets.

Climate change is already a reality in Africa, with a projected situation of increasing extreme drought showing a trend of projected Consecutive Dry Day (CDD) at a percentage change from 25.11% and 28.02% over West and 26.49% and 31.66% over East Africa (Besada & Sewankambo, 2009). These authors identified such downsides as the over-exploitation of the rain forests in equatorial Africa, flooding in western Africa, increased ocean acidity along the southern coast of Africa and prolonged and intensified droughts in Eastern Africa. Such disparities in weather patterns and unpredictable climatic seasons threaten food, health, education, water and energy security, in turn standing in the way of socio-economic development in Africa.

In Kenya, frequent and severe extreme weather events have been linked to climate change, leading to loss of lives, diminished livelihoods, damaged infrastructure, reduced crop and livestock production among other unfavorable impacts (Nyaruai, 2016). Climate change and associated natural disasters in Kenya have disrupted the socio-economic development of citizens (GoK, 2018). It is manifested in flooding seasons, concurrent drought seasons, and changes in rainfall and temperature patterns. The foregoing has had tremendous effects on socio-economic ramifications across the country with key economic pillars such as tourism, agriculture, mining and industrial sectors, affected negatively (Bargoria, 2022).

Other studies in Kenya demonstrated the impacts of climate change on the income of women who do not own resources such as land and livestock; They noted that the negative impacts such as drought and floods often led to more intense negative impacts on female-headed compared to male-headed households (Tongruksawattana & Wainaina, 2019). This compromises the progress towards the achievement of the Sustainable Development Goals (SDGs). Kirinyaga County, the locale of this study, is already adversely affected by the extreme weather changes affecting various parts of Kenya.

The sustainable development of Kenya is threatened by climate change related impacts (Nyika, 2022). The Kirinyaga County Integrated Development Plan (KCIDP) 2018-2022, states that sustainable development of the County is threatened by climate variability and extremes. Ideally, the climate should be favourable enough to enable crop production and adequate water resources resulting to food security. The study, therefore, attempts to provide information on the local level vulnerability of women to extreme effects of climate change especially drought. It delved into how climate change affects women's food security while also identifying their coping strategies to deal with these effects.

Empirical review

This research was underpinned by the Gender and Development (GAD) and Intersectionality theories. The theory of gender and development views issues concerning women more holistically, emerging from the recognition of gendered role and responsibility differences. The GAD perspective takes all aspects of women's lives into account, to bring gender analysis into the core of development policy (Fapohunda, 2012). The importance of the GAD perspective theory for this research is that it acknowledges that men and women often hold dissimilar positions, and their responsibilities and decision-making authorities at the household and community levels differ.

Critiques of the GAD theory opine that it gives prominence to social differences between men and women while disregarding the bonds between them and the likely changes in roles (Miller & Razavi, 1995). The intersectionality theory on the other hand demonstrates differential relationships between individuals and groups to climate change mediated by context-specific hierarchical power structures (Kaijser & Kronsell, 2014). The theory is the interaction among factors such as gender and race of individuals including social-cultural and institutional practices and ideologies and the power-related outcomes arising from these interactions (Davis, 2008). Critiques of the intersectionality theory argue

that it is too simplistic in its view of inequality attributing all inequality to systemic oppression. The theory of intersectionality is however important for this study as it identifies that any actions towards addressing women's vulnerability to climate change require different approaches, agencies, and knowledge from various disciplines to address this problem in the long term.

Severe impacts of climate change are felt on food security including availability, access, utilization and stability (Tanny & Rahman, 2016). Natural disasters such as the hurricanes Mitch and Stan in Mexico tend to affect men and women differently (Jungehülsing, 2010). In this study, men mostly suffered losses from remunerated work on farms, while women lost crops and livestock including fruits and chickens. The loss was quite devastating especially for women who previously obtained their daily food from their yards. This provides evidence to show that climate change indeed threatens food security in female headed households.

This trend has also been captured in Asia where studies have shown the precarious situation of women after a climate change event. In one such study in Bangladesh, household food security among 370 married women living at the coastline revealed low awareness of food security status and nutrition among women (Sharmin, 2014). Less than one-third of respondents had a good level of food security, and a smaller group were at an extreme level of food insecurity. Additionally, awareness of issues relating to climate change among coastal women was lacking. Nevertheless, the findings from the study were from respondents living in a coastline and there is need to establish if the results for the rural areas would be similar and thus the present study is conducted in a rural area of sub-Saharan Africa (SSA).

Further analysis on the climate change impact on agricultural production and food security in coastal regions was carried out in Bangladesh, (Hossain & Majumder, 2018). Upon scrutinizing the literature, it was established that vulnerability to climate change was ungendered and groups that were socio-economically underprivileged and marginalised were disproportionately affected. The majority of these groups were women. Evidence has pointed to the failure of the existing policies and adaptation measures to address the influence of powers on marginalized women and the growing trend in the feminization of food insecurity. The researchers identified that effects of climate change were different for men and women and this study therefore focuses specifically on the experiences of women during climate change events.

Findings from a study on gendered vulnerabilities of smallholder farmers to climate change in the Philippines revealed differential impacts of climate change between men and women, resulting in changing farming patterns and coping strategies (Chandra & Dalabajan's, 2017). Women were more disadvantaged, and as such, tended to farm in smaller plots, worked shorter hours or limited their farming routine to favour the cultivation of cash crops. The exposure to climate change disproportionately places women at a disadvantage due to the effect it has on their agricultural yields.

A reduction in agricultural yields led to an increase in food insecurity, which was markedly devastating to female-headed households. The correlation between climate vulnerability based on gender and food insecurity in Malawi was investigated, and the results established a clear difference in the exposure and sensitivity to climate risks between men and women (Kakota *et al.,* 2011). These findings imply that women-led households were likely to suffer and experience food insecurity on a larger scale compared to male-headed households.

Among the Maasai in Kenya, women were most vulnerable to climate change effects and bore greater responsibility for household food provision, as pointed out by (Wangu, 2014). In West Pokot County, it was established that there was a substantial rise in malnutrition levels, especially among women

and children; implying that women were predisposed to food insecurity (Obwocha, 2015). A dominant trend in food insecurity among female-headed households compared to male-headed households was observed in the Oloolua area of Kajiado County (Mayaka, 2018). Similar results were found in Kisii County that men were more well-nourished and obese in comparison to women (Samwel *et al.,* 2018). These studies elaborate on the significance of women in the continuity and survival of the household; the impacts, and dire consequences that climate change has on the ability of women to support their households has however lacked prominence in academic literature and research which this study has done.

Methodology

This study used descriptive research design as it fitted the motivation for the study which was to explore the interaction between climate change events and women's food security. The study aimed to assess the effects that climate change events had on women's food security. Specifically, it assessed whom the climate change affected, where and how the effects were experienced and when they were detected. The study used mixed methods design which entailed mixing both quantitative and qualitative research methods.

Women between the ages of 18 and 69 from households in the Mwea East sub County that had experienced climate change events made up the study's target population. 38,734 women overall in this age group were predicted to live in Mwea East sub County (KNBS, 2019).

The sampling frame was women in households in Mwea East sub County. The sampling frame for the study was developed with assistance from village elders, leaders of the "Nyumba Kumi" clusters and the assistant Chief in all the wards who were acquainted with the residents.

The study adopted cluster sampling where Mwea East sub County was divided into seven clusters representative of the administrative wards. This study used purposive sampling to select Murinduko Ward from the seven wards from which households were selected using systematic random sampling where the field team selected every 5th household to interview women aged between 18 to 69 years.

The sample size for the study was drawn from the 38,734 women aged between 18 years and 69 years who had experienced or had been directly affected by climate change events in Mwea East sub County. A sample size of 449 respondents was determined as adequate for statistical analysis using Yamane (1967) sampling formula explained below.

$$n = \frac{N}{1+N\,(e2)}$$

Where;

n = sample size

N = study population

e = Level of precision at 95% confidence level (0.05)

The study adopted both qualitative and quantitative approaches to data collection. In this regard, a structured and semi-structured questionnaire, Key Informant Interview (KII) guide and a Focus Group Discussion (FGD) guide were used to collect data from the two categories of respondents.

The data from the questionnaires were analyzed using the Statistical Package for the Social Sciences (SPSS) Version 25. Descriptive statistics were instrumental in analyzing the data and the mean,

frequency, and percentages which were exploited in this regard. Further, to establish the relationship between variables, regression analysis was conducted. For the qualitative information, the study used thematic analysis of the transcription done from the interviews to align information derived from the interviews with the research questions. The qualitative information was used to support the numerical data by highlighting explanations and personal stories and experiences on the climate change impacts on women's food security. The quantitative data was presented in tables and graphs and supported by narrations from the researcher.

Results

Out of the 449 questionnaires administered, the analysis was conducted using 446 questionnaires that were returned indicating a response rate of 99.3 %. The 0.7 % non-response relates to the questionnaires that were left at the homes of the respondents for completion but were not returned.

Respondents were asked for demographic data such as their age, education, and employment status. The findings indicated that most respondents were in the 45-54 years (21.5%) age group followed by those in the 25-34 years (21.3%) age group, 35-44 years (20.4%), 55-64 years (14.8%) and those over 65 years (13.0%).

Young people experience challenges in accessing employment opportunities especially in the agricultural sector due to brokers and other factors which may explain their limited participation in agricultural production and consequent movement to urban areas to seek for jobs (National Council of Population and Development [NCPD], 2017). Kagunda (2016), revealed that due to pressure on land, and the incapacity of the farmland to accommodate the excess labour force, majority of people from Kirinyaga County out-migrate in search of jobs, educational institutions and to accompany their husbands. This could explain why the study found only 9.0 % of the women between 18-24 years engaged in agricultural activities. At this age most of them are in school and colleges or starting to work. The few who remain in the rural areas engage in farming activities and casual jobs.

Furthermore, the results showed that 49.1% of the respondents had attained primary education, 31.4% had secondary education and 10.8% had no formal education. The results also showed that 4.7% of the respondents had a college education and 3.1% had vocational training. Only 0.9% had university education. The low level of education could affect their level of understanding of climate change effects on food security and hinder their ability to address the situation.

The main activity performed by the respondents was farming which accounted for 56.3% of the sample. 22.2% of the respondents were engaged in casual work, 13.5% in housework while 6.3% reared livestock. Other economic activities represented in the sample were mining, carpentry, and masonry. The fact that most respondents were engaged in farming, whose productivity was grossly affected by climate change, could lead to low socioeconomic status. Casual work, which most respondents resorted to when farming activities failed to generate income, also pays very little. The respondents would also most likely not have enough alternative opportunities due to their low level of education.

The KNBS (2023) statistics indicate that 25% of women own agricultural land; 3% own land alone, while 20% own land jointly with their spouse or partner only. This means that only a small margin of women can make decisions on land use. Due to lack of land ownership, 1,345 of women self-help groups are involved in agricultural activities and are funded by both government and donors and this contributes to women participation in agricultural production in Kirinyaga County (County Government of Kirinyaga, 2018).

63.5% of the respondents had their farms registered in the names of their spouses or their fathers-in-law Wanja (2019). According to Mwathi and Oluoch (2013), women in Kirinyaga County lacked access to sufficient resources, such as land and money, and as a result, they were unable to decide critically important issues pertaining to farming. Although modern farming techniques and technology have been incorporated, most women hardly ever use them. These factors are likely to have adverse effects on food security.

The study examined the impact of climate change on women's food security in the Mwea East sub-County. Respondents were asked to rate their level of agreement with the eight statements condensed in Table 1.0 to gauge this link. The majority of respondents strongly agreed that the high cost of food was the drought's most pervasive effect. Moreover, respondents strongly agreed that there was a decline in the volume of harvests during drought periods. It was unique to find respondents agreeing that households still had access to food from local markets during drought periods. This was attributed to food being transported to the local market from other regions though they were more expensive.

Table 1: Climate change and Food security

Food security	**N**	**Mean**	**Std. Deviation**
The household has access to food through own production during drought periods	446	2.57	1.287
The household has access to food bought from the local markets during drought periods	446	3.22	1.067
The household has access to quality and diversity for a nutritious diet during drought periods	446	2.91	0.993
Volume of harvest declines during drought periods	445	4.22	0.995
The prices of food increases during drought periods	446	4.39	0.840
I have an understanding and awareness of food preparation during drought periods	446	2.64	1.092
I have an understanding and awareness of food storage during drought periods	446	2.74	1.133

In addition to the food security issues already listed, FGD revealed that food security affected women in Ngucwi village. The effects included: poor harvest; buying food soon after harvesting; growing maize and beans as the main food crop; expensive fertilizers resulting in poor harvest and lack of support from the government. Other challenges included inability to maintain livestock for milk production and unavailability of extension officers who when found, demanded to be paid for services. The Chief of Murinduko location agreed with the sentiments of the respondents and reported that;

> *"Ngucwi residents experience food security problems. The area evidently receives low rainfall compared to the upper parts of the location. In fact, they barely produce enough food crops for consumption let alone for sale. This affects their livelihoods. The government mainly helps with education on the types of food crops to plant and the need to plant trees. You see, the residents in the upper parts have planted many trees and I think they help in bringing rainfall."*

The sentiments of the Chief were supported by the Assistant Commissioner, Mwea East sub County, who said,

> *"Though I have not worked in this place for long, I have noticed that rain is insufficient and the area is dry. Women suffer most because they have to ensure their children have food to eat. Lack of food security affects other aspects of life like education and health. These women mainly earn their livelihood from farming which is a real problem with the uncertainties caused by climate change."*

Regression Analysis

To further understand the influence of climate change on food security, bivariate regression analysis was used, as shown in Table 2.0. The model summary shows that climate change accounted for 6% of the variability in food security ($R^2 = 0.060$). This indicated a weak relationship between climate change and food security. Nevertheless, food security was negatively related with climate change ($\beta = -0.298$) and this relationship was found to be statistically significant ($p < .05$). It was therefore concluded that food security had a negative statistically significant relationship with climate change.

Table 2: Model Summary

Model	**R**	**R Square**	**Adjusted R Square**		**Std. Error of the Estimate**	
1	.246[a]	.060	.058		.67957	
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	Std. Error	Beta		
1	(Constant)	3.867	.181		21.416	.000
	Food Security	-.298	.056	-.246	-5.345	.000

Several studies have found that climate change had a negative effect on food security. This finding supports Mekonnen *et al.,* (2021) who found that climate change over the last three decades had a negative impact on the food security status of households. Crop production was constrained by poor rainfall, severe erosion and increases in temperature. This result was also found in Dasgupta and Robinson (2022) analysis which suggested that climate change was seen to reverse some of the improvements in food security that would otherwise have been realized; with Africa being the most affected. Likewise, Affoh *et al.,* (2022) established that an increase in temperature as an indicator of climate change was harmful to food availability and accessibility. The findings of this study reveal similar results.

The findings on climate change and food security showed that the harvest declined during drought periods, demonstrated by a mean score of 4.22 and 0.995 standard deviation. Similarly, according to the findings, food prices increased during drought seasons (M=4.39, SD=0.840). The findings further showed that the respondents lacked access to nutritious diets and did not understand proper food storage. The Focus Group Discussions (FDGs) showed that fertilizer was expensive and that there was lack of support from the government in form of technical advice on good agricultural practices. On the whole, the findings showed a negative, statistically significant relationship with climate change.

Conclusion

The study concludes that the volume of harvest declines and the prices of food increase during drought periods thereby affecting women's food security. Additionally, the study also concludes that households lacked diversity of food sources to maintain a nutritious diet. Overall, the study concludes that an increase in climate change resulted in a reduction in women's food security. The study recommends that the Ministry of Environment and Forestry creates awareness on the importance of tree planting and provides seedlings to farmers during the rainy season. The same information should be disseminated to school children who are likely to share the information with their parents. Trees prevent soil erosion and help to maintain the environmental conditions necessary for agricultural production.

The study further recommends that the Ministry of Agriculture reinstates agricultural extension services to guide farmers on the appropriate drought resistant food crops to grow during the drought season. The government should provide the extension services free of charge or offer subsidies to ensure affordability by the farmers. The study also recommends that the Ministry of Agriculture reinstates demonstration farms in various villages where farmers can learn appropriate farming methods in light of the prevailing climate alterations. The study further recommends that the leadership of Mwea East sub County partners with the private sector and Non-For-Profit organizations to create awareness on energy saving cooking methods in order to minimize the use of wood for fuel. This can be done through women groups in Ngucwi village.

It is recommended that the local administration lobbies the relevant ministries to establish water piping systems for irrigation so that the residents of Ngucwi village can engage in horticultural and agroforestry activities which seem to thrive in areas with accessibility to water schemes.

References

Affoh, R. Z., & Dissani, B. M. (2022). The Impact of Climate Variability and Change on Food Security in Sub-Saharan Africa: Perspective from Panel Data Analysis. *Sustainability*. doi:doi.org/10.3390/su14020759

Asian Development Bank (2017). *A Region at Risk: The Humanitarian Dimension of Climate Change in Asia and the Pacific.* Manila: Asian Development Bank.

Bargoria, F. K. (2022). *Implications of the closure of fluorspar mining company on community livelihood in Keiyo South Sub-County, Kenya.* Unpublished research project. Moi University. Eldoret. Kenya

Besada, H., & Sewankambo, K. N. (2009). *Climate Change in Africa: Adaptation, Mitigation and Governance Challenges.* Ontario: The Centre for Intenational Governance Innovation.

Chandra, A. M., & Dalabajan, D. (2017). Gendered vulnerabilities of smallholder farmers to climate change in conflict-prone areas: A case study from Mindanao, Philippines. *Journal of Rural Studies, 50*, 45-49.

County Government of Kirinyaga (2018). *Kirinyaga County Integrated Development Plan 2018-2022.* Nairobi: Government Press.

Dasgupta, S., & Robinson, E. J. (2022). Attributing changes in food insecurity to a changing climate. *Scientific reports, 12*(1), doi: 10.1038/s41598-022-08696-x

Díaz, S., Settele, J., Brondízio, E. S., Ngo, H. T., Agard, J., Arneth, A., ... & Zayas, C. N. (2019). Pervasive human-driven decline of life on Earth points to the need for transformative change. Science, 366(6471), doi:10.1126/science.aax3100

Dugard, J., Porter, B., Ikawa, D., & Chenwi, L. . (2020). Research Handbook on Economic, social and cultural rights as human rights. Cheltenham, UK: *Edward Elgar Publishing*.

Gil, J. D., Daioglou, V., van Ittersum, M., Reidsma, P., Doelman, J. C., van Middelaar, C. E., & van Vuuren, D. P. (2019). Reconciling global sustainability targets and local action for food production and climate change mitigation. Global Environmental Change, 59, 101983.

Hossain, M. S., & Majumder, A. K. (2018). Impact of Climate Change on Agricultural Production and Food Security: A Review on Coastal Regions of Bangladesh. *International journal of agricultural research, innovation and technology, 8*(1), 62-69.

IPCC. (2004). The Intergovernmental Panel on Climate Change (IPCC). World Meteorological Organization, IPCC Secr..

Jungehülsing, J. (2010). *Women who go, women who stay: Reactions to climate change. A case study.* Mexico: Heinrich Böll Stiftung.

Kagunda, R. (2016). Characteristics Of Out-Migrants From Nyeri, Murang'a And Kiambu Counties In Kenya. Unpublished research project. University of Nairobi. Nairobi. Kenya.

Kaijser, A., & Kronsell, A. (2014). Climate change through the lens of intersectionality. Environmental Politics, 23(3), 417-433.

Kakota, T., Nyariki, D., Mkwambisi, D., & Kogi-Makau, W. (2011). Gender vulnerability to climate variability and household food insecurity. *Climate and development, 3*(4), 298-309.

Kenya National Bureau of Statistics (2019). *2019 Kenya Population and Housing Census: Volume IV Distribution Of Population Socio-Economic Characteristics.* Nairobi: Kenya National Bureau of Statistics.

Kenya National Bureau of Statistics. (2023). Kenya Demographic Health Survey 2022 Key Indicators Report.

Kibria, G. (2016). *Climate Change and Social and Economic Impacts.* Melbourne: RMIT Unversity.

Mayaka, K. E. (2018). *Effects of Climate Variability on Food Security in Oloolua Area of Kajiado County, Kenya.* Kenyatta University. Nairobi. Kenya.

Mbow, C., & Rosenzweig, C. (2019). Food Security. Geneva: Inter-governmental Panel on Climate Change.

Mekonnen, A. T., & Haile, A. (2021). Climate change impacts on household food security and farmers adaptation strategies. *Journal of Agriculture and Food Research, 6*(2), 2-10.

National Council for Population and Development. (2017). *2015 Kenya National Adolescents And Youth Survey (NAYS).* Nairobi: National Council for Population and Development.

Nyaruai, M. A. (2016). The Potential Of Agroforestry As An Adaptation Strategy To Mitigate The Impacts Of Climate Change: A Case Study Of Kiine Community-Kirinyaga County (Doctoral dissertation, University of Nairobi).

Nyika, J. M. (2022). Climate change situation in Kenya and measures towards adaptive management in the water sector. Research Anthology on Environmental and Societal Impacts of Climate Change, 1857-1872.

Obwocha, E. B. (2015). *Assessment of Impacts of Climate Change and Variability on Food Security in West Pokot County, Kenya.* Unpublished research project. Nairobi: University of Nairobi.

Porzany, P. (2016). Understanding Climate Change as a Social Development Issue. Burmingham: University of Burmingham .

Samwel, M. P., Abutto, B. A., & Otieno, V. O. (2018). Assessing the Impact of Climate Variability on Food Security in Kenya: A Case Study of Kisii County. *Journal of Earth Science and Climatic Change, 9*(3), doi:10.4172/2157-7617.1000452

Santer, B. D., Taylor, K. E., Gleckler, P. J., Bonfils, C., Barnett, T. P., Pierce, D. W., ... & Wehner, M. F. (2009). incorporating model quality information in climate change detection and attribution studies. *proceedings of the national academy of sciences , 106*(35), 14778-14783

Sharmin, S. N. (2014). Microcredit, Food Security and Women Empowerment in Bangladesh. Unpublished thesis. Lund University. Sweden.

Siddik, M., Islam, M., Zaman, A., & Hasan, M. (2021). Current status and correlation of fossil fuels consumption and greenhouse gas emissions. *Int. J. Energy Environ. Econ*, *28*, 103-119.

Sova, C. (2019). Climate change and food security: A test of US leadership in a fragile world.

Tanny, N. Z., & Rahman, M. W. (2016). Climate Change Vulnerabilities of Woman in Bangladesh. The Agriculturists, 14(2), 113-123.

Tschakert, P., & Machado, M. (2012). Gender justice and rights in climate change adaptation: Opportunities and pitfalls. Ethics and Social Welfare, 6(3), 275-289.

Tongruksawattana, S., & Wainaina, P. (2019). Climate shock adaptation for Kenyan maize-legume farmers: Choice, complementarities and substitutions between strategies. *Climate and Development*, *11*(8), 710-722.

Wangu, E. E. (2014). Gender, livelihoods and the construction of climate change among Maasai pastoralists. In A. Oberhauser, & I. Johnston-Anumonwo, *Global Perspectives on Gender and Space: Engaging Feminism and Development.* (p. 18). New York, NY: Routledge.

Wanja, J. (2019). *Perceptions of empowerment among Women involved in Coffee farming in Kirinyaga East Sub-county, Kirinyaga County.* University of Nairobi. Nairobi. Kenya.

Yamane, T. (1967). *Statistics: An Introductory Analysis.* (2nd ed.). New York, NY: Harper and Row.