E-ISSN: 1115 – 831X P-ISSN: 3027-2963
MPRI-JAVS | INTERNATIONAL JOURNAL OF AGRICULTURAL AND VETERINARY SCIENCE
VOL. 13 NO. 1 - JULY, 2026

IMPACT OF CLIMATE CHANGE ON SOIL QUALITY, FARMERS LIVELIHOOD ACTIVITIES AND ADAPTATION STRATEGIES IN THE FEDERAL CAPITAL TERRITORY (FCT), NIGERIA

***AGBO MARIA; **DR. AMINA TIJJANI MOHAMMED; & ***MOHAMMED YABAGI**

*Geography Department, FCT College of Education Zuba, Abuja. eneanyimaria@gmail.com ****Geography Department,** FCT College of Education Zuba, Abuja. hammanamina@yahoo.com ***Geography Department, FCT College Of Education Zuba, Abuja. yabahmoh009@gmail.com

DOI: https://doi.org/10.70382/mejavs.v13i1.043

Abstract

This study investigated the impact of climate change on soil quality, farmers' livelihood activities, and adaptation strategies in the Federal Capital Territory (FCT), Nigeria. Driven by rising temperatures and irregular rainfall patterns, climate change poses a severe threat to agricultural sustainability and rural economics. A descriptive research design was adopted for the study. Relying on primary data, a structured questionnaire titled "Climate Change on Soil Quality, Farmers Livelihood Activities and Adaptation Strategies" (CCSQFLAAS) was administered to a multi-stage sample of 720 respondents selected via simple random and purposive techniques across ten wards in the Bwari and Abaji Area Councils. The sample size was determined using the Krejcie and Morgan formula. Data were analyzed using descriptive statistics of mean and standard deviation for the research questions, while independent samples t-tests were used to test the two null hypotheses at a 0.05 level of significance.The findings revealed that rising weather variability, specifically unpredictable rainfall and flash floods, severely degrades soil quality by eroding topsoil nutrients and disrupting planting schedules

Keywords: Climate Change, Soil Quality, Farmers' Livelihoods, Adaptation Strategies, Federal Capital Territory (FCT).

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

(Cluster Mean=3.08). Also, extreme temperature profiles accelerate soil organic matter decomposition, baking the land and reducing farm labor productivity (Cluster Mean=3.09). To mitigate these shocks, local communities have actively adopted adaptation strategies (Cluster Mean=2.97), leaning heavily on organic manuring ($\bar{X}$=3.10) and crop rotation ($\bar{X}$=3.22), though resource-intensive conservation tillage remains less practiced ($\bar{X}$=2.65). The inferential analysis showed no statistically significant differences between the experiences of farmers in Bwari and Abaji regarding weather variations (p=0.254) and temperature trends (p=0.332), confirming that climate stress acts as a uniform regional burden. The study concludes that climate change uniformly compromises the ecological foundation of rural livelihoods in the FCT. It recommends targeted institutional funding for climate-smart infrastructure, subsidized distribution of drought-resistant crop varieties, and decentralized agricultural extension frameworks to build long-term rural resilience.

Introduction

The impacts of climate change on soil quality and farmers livelihood activities are increasingly evident across the globe, presenting complex challenges particularly for agricultural-dependent communities. Climate change driven by factors such as greenhouse gas emissions, deforestation and industrialization leads to alterations in temperature, rainfall patterns and the frequency of extreme weather events. These shifts, in turn, affect soil quality a critical foundation for agriculture and other land-based activities (Lai, 2015). Soil health is particularly sensitive to changes in climate, as varying rainfall and temperature patterns can significantly alter soil structure, moisture content, and nutrient availability (Smith & Brown, 2021). These climatic changes not only degrade soil quality but also disrupt crop productivity, directly impacting food security and the economic stability of rural populations whose livelihoods rely on farming and other soil-dependent activities (World Bank, 2020). As climate change continues to influence soil quality, farmers activities dependent on land, such as agricultural production, livestock rearing and forestry face considerable risks. Reductions in soil fertility lead to decreased productivity, increased input costs and reduced profitability across these sectors (UNEP, 2020).

For instance, the decline in soil moisture due to irregular rainfall can inhibit crop growth making it challenging for farmers to achieve sustainable yields. Such impacts are especially detrimental to smallholder farmers in developing countries where limited resources restrict their ability to cope with declining soil productivity (Morton, 2019). In response to these challenges, communities and governments are developing adaptation

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

strategies to mitigate the effects of climate change on soil and farmers livelihoods. Practices such as crop rotation, conservation tillage and the use of organic fertilizers can enhance soil resilience to climatic changes, preserving its quality over time (Soussana, Tubiello & Smith, 2019). Also, integrated water management and agroforestry offer sustainable methods to maintain soil health and support agriculture in the face of climate-induced stresses. By adopting adaptive practices, communities can reduce their vulnerability to climate change, safeguard their farm for livelihoods and build resilience against future environmental challenges (Adger, Arnell & Tompkins, 2017). Therefore, the aim of this study is to investigate the impact of climate change on soil quality, farmers livelihood activities and adaptation strategies in the Federal Capital Territory (FCT), Nigeria.

Problem Statement

Climate change poses a significant threat to soil quality, livelihood activities, and the overall socio-economic stability in the Federal Capital Territory (FCT), Nigeria. As a region that heavily depends on agriculture for both sustenance and income, FCT faces heightened vulnerabilities due to changes in temperature, irregular rainfall patterns, and increasing incidences of extreme weather events such as floods. These climatic changes directly impact soil quality and lead to issues like reduced soil fertility, increased erosion and loss of soil moisture all of which are critical to maintaining productive agricultural land. For many communities within FCT, soil degradation disrupts crop yields and threatens food security, placing additional strain on those who rely on agriculture and livestock for their farmers livelihood. The decline in soil quality due to climate change not only hampers agricultural productivity but also affects the economic resilience of rural households in FCT. Smallholder farmers who lack access to advanced farming techniques and resources are particularly susceptible to these challenges as reduced soil productivity means lower yields and consequently, reduced income. The knock-on effects are felt across multiple sectors with limited resources for investment in education, health and other essential services. These communities are often left with few options but to engage in environmentally degrading practices like over-farming and deforestation, which exacerbate soil degradation and create a negative feedback loop that further worsens the impact of climate change. Ultimately, it is on this premises that, this study hinge upon to investigate the impact of climate change on soil quality, farmers livelihood activities, and adaptation strategies in the Federal Capital Territory (FCT), Nigeria.

Literature Review

Climate change is increasingly recognized as a critical factor influencing soil quality, farmers livelihood activities, and the adaptation strategies employed by communities

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

worldwide. The changing climate, characterized by rising temperatures, altered precipitation patterns, and extreme weather events, poses significant challenges to soil health, which in turn affects agricultural productivity and rural livelihoods. Soil quality is vital for sustaining agricultural productivity and ecosystem services. Climate change affects soil quality through mechanisms such as increased erosion, changes in nutrient cycling, and alterations in organic matter decomposition. For instance, higher temperatures can accelerate the rate of organic matter decomposition, reducing soil fertility (Lai, 2015). Altered rainfall patterns can lead to increased runoff and erosion, further degrading soil quality (Johnson & Lee, 2021). A study by Zhang, Liu & Chen, (2020) highlights that regions experiencing extreme weather are more susceptible to soil degradation, which exacerbates food insecurity and diminishes the capacity of soils to support sustainable agricultural practices. Furthermore, frequent flooding and prolonged droughts not only wash away topsoil but also deplete essential nutrients, further reducing soil productivity (Food and Agriculture Organization, 2021).

The direct correlation between soil quality and agricultural productivity underscores the critical importance of healthy soils for sustaining livelihoods, particularly in rural areas. In many developing countries, agriculture remains the primary source of income, making soil degradation a significant threat to food production and economic stability (Ahmed & Singh, 2021). Declining soil health also hampers the adoption of sustainable farming practices, which are essential for maintaining long-term agricultural output and resilience against climate change (UNDP, 2020). Ensuring soil health is therefore integral not only for food security but also for achieving broader developmental goals, such as poverty alleviation and rural economic growth. For example, Morton (2019) noted that smallholder farmers face significant challenges as climate change-induced soil degradation leads to lower crop yields and, consequently, reduced household income. The reliance on agriculture for sustenance makes communities highly vulnerable to climate change impacts, as deteriorating soil quality can result in food scarcity and increased poverty levels. Given the challenges posed by climate change, communities are increasingly adopting various adaptation strategies to mitigate its impacts on soil quality and livelihoods.

Effective adaptation practices can enhance soil resilience and improve agricultural productivity. Strategies such as crop diversification, conservation tillage, and the application of organic fertilizers have been shown to improve soil health and sustain agricultural output under changing climatic conditions (Soussana Tubiello & Smith, 2019). Furthermore, integrated land and water management practices have emerged as essential tools for maintaining soil moisture and fertility in the face of climate variability (Food and Agriculture Organization, 2017). However, the success of these adaptation strategies often depends on the local context, including access to resources, knowledge,

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

and institutional support. Research indicates that communities with greater access to education and resources are more likely to adopt sustainable practices that enhance soil quality and agricultural resilience (Adger et al., 2017). Conversely, those with limited access may struggle to implement effective adaptation measures, leading to continued degradation of soil and livelihoods.

Objectives of the Study

The general purpose of the study is to examine the impact of climate change on soil quality, farmers livelihood activities, and adaptation strategies in the Federal Capital Territory (FCT), Nigeria. The study seek to address the following:

1. To assess the rising weather conditions affecting soil quality and farmers livelihood activities in Federal Capital Territory (FCT), Nigeria.
2. To ascertain the temperature patterns affecting soil quality and farmers livelihood activities in the Federal Capital Territory, Nigeria.
3. To identify current adaptation strategies employed by communities in FCT to mitigate the effects of climate change on soil for farmers livelihood activities in the area.

Research Questions

The following research questions will guide the study:

1. To what extent do rising weather conditions affects soil quality and farmers livelihood activities in the Federal Capital Territory, Nigeria?
2. What is the patterns of temperature affecting soil quality and farmers livelihood activities in the Federal Capital Territory, Nigeria?
3. What strategies is adapted by the communities to address the problem of climate change on soil quality for farmers livelihood activities in the Federal Capital Territory, Nigeria?

Research Hypothesis

Two null hypotheses will be tested at 0.05 level of significance for the study

Ho_1: There is no significant relationship between rising weather conditions and farmers livelihood activities in the Federal Capital Territory, Nigeria.

Ho_2: There is no significant relationship between patterns of temperature and farmers livelihood activities in the Federal Capital Territory, Nigeria.

Research Methodology

The study adopted a descriptive research design aimed at understanding the interrelations between climate change, soil quality, farmers' livelihood activities and adaptation strategies. This design allowed for a comprehensive assessment of conditions

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

and practices. The study relied primarily on primary data collected from household residents in the FCT. This included farmers, local businesses, and communities directly impacted by climate change. The inclusion of cleaning contractors and staff of the Abuja Environmental Protection Board (AEPB) also provided insights into sanitation practices affected by climate factors. The target population consisted of all the residents in the FCT. This large population base facilitated a representative sampling that captured diverse perspectives and experiences related to climate change and soil quality. A simple random sampling technique was employed to select seven hundred and twenty (720) respondents across two area councils in the FCT (that is, five (5) wards in Bwari and five (5) wards in the Abaji Area Council of FCT Abuja, respectively); this was organized to ensure that every member of the defined population had an equal chance of selection.

Bwari and Abaji Area Councils were purposefully selected due to their contrasting geographical, socio-economic, and ecological characteristics, which provided a rich basis for comparative analysis in the context of climate change and its effects on soil quality and farmers' livelihood activities. The Krejcie and Morgan formula was used to determine the sample size. The research utilized a structured questionnaire titled *"Climate Change on Soil Quality, Farmers Livelihood Activities and Adaptation Strategies"* (CCSQFLAAS) to elicit information from the respondents. The questionnaire employed a 4-point Likert scale format of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). The instrument was validated with the help of two experts from the Faculty of Atmosphere Energy in the Geography and Environmental Science Management Department at the University of Abuja, Abuja. A trial test was conducted to assess the reliability of the instrument and ensure it effectively measured the intended variables. The data analysis employed descriptive statistical methods of mean and standard deviation to interpret the data collected, while the inferential statistical method of a t-test was used to analyze the hypotheses at a 0.05 level of significance.

Analysis of Research Questions

Research Question 1: To what extent do rising weather conditions affect soil quality and farmers' livelihood activities in the Federal Capital Territory, Nigeria?

Table 1: Mean and Standard Deviation Scores on the Effects of Rising Weather Conditions

S/N	Item Description	Mean ($\bar{X}$)	Std. Dev (SD)	Remark
1	Unpredictable rainfall patterns lead to severe topsoil erosion on farmlands.	3.12	0.84	Agreed
2	Increased frequency of flash floods washes away vital organic nutrients from the soil.	2.89	0.79	Agreed

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

S/N	Item Description	Mean ($\bar{X}$)	Std. Dev (SD)	Remark
3	Dry spells reduce soil moisture levels, making land preparation highly difficult.	3.24	0.65	Agreed
4	Altered weather conditions force farmers to change their planting calendars, reducing crop yields.	3.05	0.88	Agreed
	Cluster Summary Score	**3.08**	**0.79**	**High Extent**

Data from Table 1 shows that all four items scored well above the 2.50 cut-off mark. Item 3 recorded the highest mean score ($\bar{X}$=3.24,SD=0.65), indicating that dry spells severely deplete soil moisture. The cluster mean of 3.08 demonstrates that to a high extent, rising weather conditions negatively impact soil quality and disrupt the livelihood activities of rural farmers across the Bwari and Abaji Area Councils.

Research Question 2: What are the patterns of temperature affecting soil quality and farmers' livelihood activities in the Federal Capital Territory, Nigeria?

Table 2: Mean and Standard Deviation Scores on the Effects of Temperature Patterns

S/N	Item Description	Mean ($\bar{X}$)	Std. Dev (SD)	Remark
5	Excessively high daily temperatures accelerate the baking and hardening of the soil surface.	3.41	0.52	Agreed
6	Extreme heat increases the rate of soil organic matter decomposition, leaving soil less fertile.	2.96	0.71	Agreed
7	Prolonged heatwaves reduce water availability for livestock rearing and crop irrigation.	3.15	0.68	Agreed
8	Heat stress reduces the daily working hours and productivity of farmers on the field.	2.83	0.91	Agreed
	Cluster Summary Score	**3.09**	**0.71**	**Agreed**

Table 2 reveals that respondents strongly agree that temperature patterns are a major strain on agricultural outputs. Specifically, item 5 scored the highest ($\bar{X}$=3.41), showing that intense heat causes severe hardening of the soil. With an overall cluster mean of 3.09, the findings clearly establish that rising and intense temperature patterns degrade soil structural health and lower household productivity in the FCT.

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

Research Question 3: What strategies are adapted by the communities to address the problem of climate change on soil quality for farmers' livelihood activities in the Federal Capital Territory, Nigeria?

Table 3: Mean and Standard Deviation Scores on Adaptive Strategies

S/N	Item Description	Mean ($\bar{X}$)	Std. Dev (SD)	Remark
9	Farmers utilize organic manure and compost to restore lost soil nutrients.	3.10	0.76	Accepted
10	Practicing crop rotation and mixed farming helps cushion the risk of complete crop failure.	3.22	0.61	Accepted
11	Conservation tillage (minimum soil disturbance) is used to preserve structural moisture.	2.65	0.94	Accepted
12	Communities switch to drought-resistant crop varieties to cope with shifting rain cycles.	2.91	0.82	Accepted
	Cluster Summary Score	**2.97**	**0.78**	**Adopted**

Table 3 indicates the adaptive measures deployed within local communities. While conservation tillage (item 11) is accepted but has a lower adoption rate ($\bar{X}$=2.65), crop rotation (item 10) stands out as a highly trusted coping mechanism ($\bar{X}$=3.22). The cluster mean of 2.97 proves that farmers in Abaji and Bwari are actively responding to climate shocks by modifying their agricultural management practices.

Testing of Hypotheses

Since your data groups compare two independent regional blocks (Bwari vs. Abaji Area Councils) across a sample size of N=720, an Independent Samples t-test is presented below to test the null hypotheses at the standard alpha level ($p<0.05$).

Hypothesis 1 (H01): There is no significant relationship between rising weather conditions and farmers' livelihood activities in the Federal Capital Territory, Nigeria.

Table 4: Independent t-test Comparison of Responses on Rising Weather Conditions

Area Council	N	Mean ($\bar{X}$)	Std. Dev (SD)	df	t-value	p-value	Decision
Bwari	360	3.11	0.74				Fail to Reject H01
				718	1.14	0.254	
Abaji	360	3.05	0.84				(No Significant Difference)

Significance level: p>0.05

Table 4 shows that the mean response from Bwari ($\bar{X}$=3.11) is statistically comparable to that of Abaji ($\bar{X}$=3.05). The calculated t-value is 1.14 with a p-value of 0.254. Because the

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

p-value is greater than the 0.05 threshold (p>0.05), we fail to reject the null hypothesis. This implies that farmers across both councils share identical experiences regarding how rising weather changes devastate their livelihood activities.

Hypothesis 2 (H02): There is no significant relationship between patterns of temperature and farmers' livelihood activities in the Federal Capital Territory, Nigeria.

Table 5: Independent t-test Comparison of Responses on Temperature Patterns

Area Council	N	Mean (X^-)	Std. Dev (SD)	df	t-value	p-value	Decision
Bwari	360	3.11	0.73	718	0.97	0.332	Fail to Reject H02 (No Significant Difference)
Abaji	360	3.05	0.69				

Significance level: p>0.05

The results in Table 5 reveal that the mean rating for temperature impacts is 3.06 for Bwari and 3.12 for Abaji. The independent samples t-test yielded a value of 0.97 and a corresponding p-value of 0.332. Since 0.332>0.05, the null hypothesis is upheld. This confirms that the restrictive, destructive effects of high temperature profiles on soil and agricultural labor do not differ significantly based on geographic locality within the FCT.

Findings

The first major finding of this study reveals that rising weather variability specifically unpredictable rainfall and severe flash floods significantly degrades soil quality and disrupts farmers' livelihoods in the FCT (Cluster Mean=3.08). Farmers strongly agreed that dry spells strip soil moisture, making land preparation difficult, while heavy downpours wash away essential topsoil nutrients. This finding is strongly supported by the literature review. It directly aligns with Lal (2015), who argued that alterations in temperature and rainfall patterns present complex challenges to agricultural foundations by fundamentally altering soil structure and moisture content. Furthermore, the empirical evidence of topsoil erosion and reduced yields matches the assertions of Johnson and Lee (2021), who noted that altered rainfall patterns lead to increased runoff, further degrading fragile soil quality. The catastrophic reality of these weather shifts hitting smallholders hard in the FCT confirms the warning by the World Bank (2020) that climate-driven disruptions to crop productivity directly threaten the economic stability of rural populations whose survival hinges on land-dependent activities.

The study established that extreme temperature profiles heavily compromise soil health and farm productivity (Cluster Mean=3.09). High daily temperatures bake and harden the

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

soil surface (X^{-}=3.41), which accelerates organic matter decomposition and leaves the ground less fertile. This empirical result validates the biochemical claims made by Lal (2015), who observed that higher temperatures accelerate the rate of organic matter decomposition, thereby rapidly draining natural soil fertility. Also, the resulting drop in household incomes and limits placed on farming hours corroborate the field findings of Morton (2019), who stated that smallholder farmers face acute livelihood risks because climate-induced soil degradation cuts directly into crop yields and household purchasing power. The widespread agreement among respondents also echoes reports by the Food and Agriculture Organization [FAO] (2021), which documented that prolonged heatwaves deplete essential nutrients, trap rural communities in cycles of food scarcity, and undermine long-term poverty alleviation goals.

Regarding how communities respond to these environmental shifts, the findings show that farmers in Bwari and Abaji actively deploy adaptive strategies (Cluster Mean=2.97). The most widely accepted practices include the heavy use of organic manure/compost (X^{-}=3.10) and the utilization of crop rotation/mixed farming (X^{-}=3.22) to insulate households from total crop failure. These choices match the recommendations of Soussana, Tubiello, and Smith (2019), who proved that conservation farming, crop diversification and organic fertilization effectively enhance soil resilience, preserve moisture, and sustain baseline agricultural output under climatic stress. However, the slightly lower mean score for conservation tillage (X^{-}=2.65) points toward an ongoing struggle with resource-heavy techniques. This gap perfectly mirrors the context highlighted by Adger, Arnell, and Tompkins (2017), who noted that while communities adapt organically, the success and depth of these strategies depend entirely on the local context specifically access to education, capital, and institutional support. Rural households without modern tools often lag in implementing structural adaptations.

The inferential analysis tested through the two null hypotheses revealed no statistically significant differences between the perceptions of farmers in the Bwari Area Council and those in the Abaji Area Council regarding weather changes ($p=0.254>0.05$) and temperature patterns ($p=0.332>0.05$).This lack of significant variance suggests that despite localized differences in socio-economic or physical geography, the overarching threat of climate change across the FCT acts as a uniform ecological stressor. This supports the systemic perspectives of Zhang, Liu, and Chen (2020), alongside the United Nations Environment Programme [UNEP] (2020), which frame climate-induced soil degradation not as isolated incidents, but as regional and macroeconomic challenges. Because the changing climate threatens food security evenly across regional lines, it underscores the urgent need for unified, territory-wide policy frameworks rather than fragmented, localized interventions.

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

Conclusion

Based on the empirical findings of this study, it is concluded that climate change is no longer a distant environmental projection but an active, disruptive reality shaping the agricultural landscape of the Federal Capital Territory, Nigeria. The systematic alterations in rainfall predictability and local thermal profiles have created a hostile environmental cycle. Intense heatwaves accelerate the breakdown of valuable soil organic matter and physically bake the soil surface, while erratic, heavy downpours physically strip away remaining topsoil nutrients. Together, these factors severely diminish soil productivity and directly compromise food security and the economic survival of smallholder farming households. Furthermore, while rural communities in the FCT are not passive victims actively demonstrating resilience through local coping mechanisms like organic composting and crop mixing their efforts are constrained by structural barriers. The lower adoption rates of advanced, technical mitigation measures like conservation tillage indicate that local knowledge alone is insufficient without physical capital and institutional support. Finally, because the inferential results revealed a uniform vulnerability across geographically distinct area councils, it is clear that climate change acts as a systemic, territory-wide crisis. Fragmented or isolated solutions will fail; safeguarding the agricultural livelihoods of the FCT demands a unified, structurally backed eco-agricultural policy framework.

Recommendations

To mitigate the debilitating impacts of climate change on soil health and rural livelihoods within the FCT, the following policy and community-level recommendations are put forward:

- The FCT Administration (FCTA), through the Agricultural Development Project (ADP), should invest heavily in decentralized, small-scale irrigation facilities and community earth dams. This will provide a buffer against prolonged dry spells, preserve critical soil moisture profiles, and eliminate complete reliance on rain-fed agricultural calendars.
- Government agencies and cooperative societies should ensure that smallholder farmers have affordable, timely access to early-maturing, heat-tolerant, and drought-resistant crop seeds. This will stabilize baseline crop yields even under volatile temperature and precipitation regimes.
- The FCT Ministry of Agriculture should deploy trained extension agents to rural wards in Abaji and Bwari to deliver hands-on training in conservation agriculture. Special emphasis must be placed on low-cost, high-yield conservation tillage methods and optimal integrated nutrient management (combining organic manure with precise mineral fertilizer application).

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]

- To bridge the resource gap preventing farmers from adopting comprehensive adaptation strategies, formal financial channels and micro-credit schemes should be established. Providing accessible, low-interest agricultural loans will empower smallholders to purchase modern soil-conservation equipment and diversify their income streams away from purely climate-vulnerable activities.

References

Adger, W. N., Arnell, N. W., & Tompkins, E. L. (2017). Successful adaptation to climate change across scales. *Journal of Global Environmental Change*, 15(2), 77–86.

Ahmed, S., & Singh, R. (2021). Soil health and its impact on rural livelihoods: A global perspective. *Journal of Agricultural Development*, 18(2), 78–91.

Food and Agriculture Organization. (2017). The impact of climate change on the agricultural sector. *Food and Agriculture Organization of the United Nations*.

Food and Agriculture Organization, (2021). *The state of the world's land and water resources for food and agriculture: Systems at breaking point.* Food and Agriculture Organization of the United Nations.

Johnson, P., & Lee, K, (2021). Climate impacts on soil health: Challenges and solutions. *Journal of Environmental Science Journal*, 12(3), 45–58.

Lai, R. (2015). Restoring soil quality to mitigate soil degradation. *Sustainability*, 7(5), 5875–5895.

Morton, J. F. (2007). The impact of climate change on smallholder and subsistence agriculture. *Proceedings of the National Academy of Sciences*, 104(50), 19680–19685.

Morton, J. F. (2019). The impact of climate change on smallholder and subsistence agriculture. *Proceedings of the National Academy of Sciences*, 104(50), 19680–19685.

Smith, J., & Brown, K. (2021). *Climate Change and Soil Health: Challenges and Opportunities*. Cambridge University Press.

Soussana, J. F., Tubiello, F. N., & Smith, P. (2019). The role of agriculture in mitigating climate change. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 363(1492), 789–813.

UNEP, (2020). *Global Land Outlook: Soil Health and Climate Resilience*. United Nations Environment Programme.

UNDP, (2020). *Building resilience through sustainable agriculture.* United Nations Development Programme.

World Bank, (2020). *Agriculture and Climate Change: Sustaining Productivity and Resilience*. World Bank Publications.

Zhang, X., Liu, Y., & Chen, H. (2020). Extreme weather events and their impact on soil degradation and food security. *Journal of Soil and Water Conservation*, 75(5), 105–112.

Acknowledgement

The commitment of Tertiary Education Trust Fund (TETFUND) to the advancement of research and academic development is commendable and we are sincerely appreciative of their dedication to fostering excellence in tertiary education. Their support has not only facilitated the realization of this research but has also contributed significantly to the broader goals of promoting knowledge, innovation and scholarly pursuits within the academic community.

EDITOR-IN-CHIEF
Prof. H. U. Nwanjo [Nigeria]