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IMPACT OF CLIMATE CHANGE ON WATER RESOURCE AVAILABILITY AND AGRICULTURAL PRODUCTIVITY IN SAMBAN GIDA, KWOI, JABA LOCAL GOVERNMENT AREA OF KADUNA STATE, NIGERIA

Emmanuel Handan Umaru[1], Moses Simon[2], Shaiki Ayetop Micah[3]

[1,2]Department Of Environment Management, Kaduna State University, Nigeria.

[3]Department Of Environmental Resource Management, Nasarawa State University Keffi.

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ABSTRACT

This study was carried out on the Impact of Climate Change on Water Resource Availability and Agricultural Productivity in Samban Gida, Kwoi, Jaba Local Government Area of Kaduna State, Nigeria. To achieve this objective, the researcher developed and administered a questionnaire on one hundred and twenty selected individuals within the case study. The Chi-square was used in testing the null hypothesis. From the study, the analysis indicates a strong awareness among farmers in Samban Gida that climate change reduces water availability for farming activities, which has serious implications for agricultural productivity, livelihoods, and local food security. The result demonstrates that climate change, through its effect on rainfall patterns, poses a major threat to sustainable agriculture and farmer livelihoods in the study area. the finding underscores the direct link between climate change, water scarcity, and agricultural output, emphasizing that without intervention, food security and farmers' livelihoods will remain under serious threat. These findings align with existing literature, where climate change has been linked to increasing temperature variability, reduced rainfall, and prolonged dry spells in Sub-Saharan Africa, including Northern Nigeria (IPCC, 2021; NEMA, 2023). the results emphasize that climate change is a pressing agricultural challenge in Samban Gida, threatening food security, household income, and rural livelihoods. The findings reveal that the majority of farmers believe that climate change, manifested in rising temperatures and irregular rainfall, has a direct negative impact on crop yield and farm productivity. This finding aligns with existing studies which highlight that smallholder farmers in Nigeria are among the most vulnerable to climate change due to their dependence on rainfall and traditional farming systems (Ifejika-Speranza, 2010; Nzeadibe et al., 2011). the result strongly supports the assertion that climate change is a key driver of rising agricultural production costs in the community, which could negatively affect farmers' profitability and long-term sustainability if adaptive measures are not strengthened. The study recommends, Encourage adoption of conservation agriculture, mulching, crop rotation, agroforestry, and drought-tolerant crop varieties to increase resilience and maintain yields under changing rainfall patterns. Support construction of rooftop rainwater harvesting, communal micro-dams, sand-dams and farm ponds to capture seasonal rains and buffer water supply during dry spells. Promote low-cost, water-efficient irrigation technologies (drip, treadle pumps, lined furrows) and training on irrigation scheduling to maximize water productivity and reduce waste. Provide farmers timely, localized weather forecasts, seasonal outlooks and planting advisories (via SMS, community radio, extension workers) to help adjust planting dates and input use. Advocate microcredit, input vouchers, and insurance pilot schemes (indexed weather insurance) tailored to smallholders so farmers can afford drought-resistant seeds, inputs and adaptation investments. Set up community participatory monitoring of rainfall, streamflow and crop performance and recommend follow-up studies (e.g., groundwater assessments, socioeconomic vulnerability mapping) to refine interventions over time.

Keyword: Climate Change, Water Resource Availability, Drought, Rainfall Variability, Surface Water, Adaptation.

1. INTRODUCTION

Climate change is reshaping hydro-climatic patterns globally, with profound implications for freshwater availability and rain-fed agriculture—the twin pillars of rural livelihoods across Sub-Saharan Africa [17 and 18] Nigeria is not exempt: observed warming, shifting rainfall regimes, and more frequent climate extremes are already altering surface and groundwater balances, shortening reliable growing seasons, and depressing yields [19 and 22]. These pressures are particularly consequential in agrarian localities such as Samban Gida (Kwoi), situated in Jaba Local Government Area (LGA) of Kaduna State, where smallholder farmers dominate production and depend heavily on seasonal rains for both water supply and crop performance [10, 11 and 5]

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At continental and regional scales, the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) concludes with high confidence that Africa's water cycle has already intensified, manifesting as greater intra- and inter-annual rainfall variability, longer dry spells, and heavier downpours when rain does occur [17 and 18]. Such shifts increase hydrological volatility: soils experience both moisture deficits during prolonged dry periods and erosion or waterlogging during high-intensity rainfall events—each detrimental to crop establishment and yields. In Nigeria, recent assessments and reportage point to growing water stress and yield instability linked to erratic rains, surface water decline, and heat stress, amplifying food security risks in predominantly rain-fed systems [2 and 22].

Kaduna State, which spans the Guinea- and Sudan-savanna ecotones, illustrates these dynamics. Long-term analyses using rain-gauge and gridded datasets (1952–2022) show statistically significant downward trends in annual rainfall at multiple locations, high concentration of precipitation within a few months, and documented episodes of meteorological drought—especially during the 1970s–1990s—with continuing variability in recent decades [1]. Complementary basin-scale research for the Kaduna River catchment reports significant warming trends and evolving precipitation extremes, with implications for runoff generation, evapotranspiration, and the reliability of both surface and shallow groundwater resources [19]. In practice, this translates into more uncertain planting dates, elevated crop water requirements under higher temperatures, and greater risk of intra-seasonal dry spells that can compromise rain-fed crop performance even when seasonal totals seem adequate.

Jaba LGA—and communities such as Samban Gida around Kwoi—are emblematic of southern Kaduna's smallholder economy. Households rely on mixed cropping systems (e.g., cereals, legumes, and the area's signature cash crop, ginger), typically on plots under three hectares, with limited irrigation infrastructure [5; and 11]. Empirical work in Jaba LGA shows that rainfall variability is closely tied to ginger output and farmer perceptions of production risk, underscoring the sensitivity of local livelihoods to hydro-climatic fluctuations [3]. Socio-economic studies further characterize production as predominantly small-scale and rain-dependent, with modest capital buffers to absorb climate shocks [6 and 13]. Where water infrastructure exists, it is typically boreholes or shallow wells for domestic supply; few farmers can afford supplemental irrigation, making seasonal rainfall timing and distribution decisive for yields.

Against this backdrop, two interlinked problem streams emerge for Samban Gida and environs. First, water resource availability is becoming less predictable. Concentrated rainfall intensifies runoff and erosion while reducing infiltration, degrading soil water storage and affecting streamflow seasonality; conversely, longer dry spells elevate evapotranspiration and deplete shallow aquifers [18; 19; 1] Second, agricultural productivity—already constrained by input access, finance, and extension gaps—is increasingly mediated by climate variability, with heat stress and moisture deficits during critical phenological stages (germination, tasseling, tuberization/rhizome expansion) leading to yield penalties [17, 3]. Taken together, these trends threaten household incomes, food security, and broader rural development goals.

The national significance is clear. Agriculture remains a major employer and contributor to Nigeria's GDP, with a large share of households engaged in subsistence or semi-commercial farming and highly exposed to climate-related water risks [11, 10; 5]. Recent seasons marked by water scarcity and hydrological extremes have contributed to falling outputs and heightened food insecurity, illustrating how climate-water-agriculture linkages scale from local to national outcomes [2]. For Kaduna State, where most farm households still rely on rain-fed production, establishing a robust evidence base on how changing climate affects water resources and crop performance at community scale is therefore a practical imperative [1].

This study focuses on Samban Gida (Kwoi) in Jaba LGA to: (i) situate observed and perceived climate signals within state and basin-level trends; (ii) assess how climate-driven water availability (rainfall timing, intensity, dry-spell frequency) influences agricultural productivity in predominant crops; and (iii) identify local exposure and adaptation gaps among smallholders. By grounding analysis in a specific community with documented climate sensitivity (e.g., to rainfall variability in ginger systems), the study aims to generate actionable insights for climate-smart water and farm management—such as improved rainwater harvesting, soil-moisture conservation, drought-tolerant varieties, and better seasonal decision support [3; 17; 18, 4]. Ultimately, evidence from Samban Gida can inform Kaduna State and national strategies seeking to stabilize yields and safeguard livelihoods under a warming, more variable climate.

2. LITERATURE REVIEW

2.1 CONCEPT OF CLIMATE CHANGE

Climate change refers to long-term alterations in average weather patterns—such as temperature, precipitation, and wind—occurring over decades to centuries. While the Earth's climate has changed naturally through geological time, the contemporary usage of "climate change" emphasises the observed and projected shifts driven largely by human

activities since the mid-20th century, especially the rapid increase in greenhouse gas (GHG) concentrations from fossil fuel combustion, deforestation, and certain agricultural practices [24; 15 and 16]. In other words, climate change is the cumulative effect of changes in atmospheric composition and land use that modify Earth's energy balance, producing sustained warming (and associated changes) at regional and global scales [15 and 16].

Two related concepts help clarify meaning. "Climate variability" denotes shorter-term fluctuations around a mean climate (for example, seasonal variability, El Niño–Southern Oscillation events), whereas "climate change" denotes persistent shifts in those long-term averages or in the frequency and intensity of extreme events [15 and 16]. Importantly for applied research, climate change is not just a change in mean conditions but also an alteration in the distribution of weather extremes — more frequent heatwaves, altered rainfall seasonality, longer dry spells, or more intense storms — all of which have outsized effects on water resources and agriculture even when mean changes appear moderate [21; 7, 8].

Observed indicators of modern climate change include rising global mean surface temperatures, melting glaciers and ice sheets, sea-level rise, changes in precipitation patterns, and shifts in the timing of seasonal biological events (phenology). These indicators are measurable and have been linked to increases in atmospheric concentrations of carbon dioxide and other greenhouse gases [15 and 16]. For water resources, a changing climate can alter runoff regimes, reduce groundwater recharge in some regions, increase evaporation losses, and change the timing of streamflow — all of which affect water availability for irrigation, domestic use, and ecosystems [7 and 8]. For agriculture, climate change affects crop phenology, yields, pest and disease dynamics, and soil moisture — with outcomes that vary by crop type, management, and local conditions; in many tropical and subtropical regions, projected warming and altered rainfall threaten to reduce yields of staple cereals without adaptation [15, 16, 7, 8].

Framing climate change as both a physical and socio-ecological problem is essential for this study. Physically, climate drivers determine the biophysical baseline for water and crop growth; socially, human vulnerability and adaptive capacity (land management, irrigation infrastructure, institutional support) shape whether and how climate impacts translate into livelihood and food-security outcomes. Thus, understanding the "concept of climate change" for Samban Gida — Kwoi, Jaba LGA requires combining physical climate evidence (trends in temperature and rainfall, seasonality, extreme events) with an assessment of how local water systems and farming practices are sensitive to those changes [15, 16, 7, 8].

2.2 CLIMATE CHANGE AND WATER RESOURCE AVAILABILITY

Climate change alters the quantity, timing, quality, and spatial distribution of water resources, with direct consequences for communities that depend on rainfed and irrigated agriculture [15, 16,] .In semi-humid to sub-humid regions of West Africa — including southern Kaduna State where Samban Gida (Kwoi), Jaba Local Government Area is located — projected changes in temperature and rainfall patterns increase hydrological variability: more frequent and intense short-term heavy rainfall events, longer dry spells, and shifts in the onset and cessation of the rainy season [15, 16, 9] . These hydrological changes reduce the reliability of surface water and shallow groundwater supplies that smallholder farmers use for crop production, livestock and household needs, thereby tightening the link between climate stress and agricultural productivity.

2.3 CLIMATE CHANGE AND AGRICULTURAL PRODUCTIVITY

Climate change affects agricultural productivity through multiple, interacting physical and biological pathways. Rising mean temperatures, changes in rainfall amount and seasonality, increased frequency and intensity of extreme events (droughts, floods, heat waves), and shifts in pest and disease dynamics alter crop growth, yields, and the stability of production over time [14, 15, 16]. For rainfed smallholder systems such as those that predominate in Samban Gida, Kwoi (Jaba LGA), the sensitivity of crop yields to these climatic drivers is particularly high because farmers depend directly on the timing and amount of seasonal rains and typically have limited access to irrigation, inputs, or risk-spreading markets.

Temperature effects. Higher temperatures accelerate crop development, which can shorten the grain-filling period and reduce final yields for temperature-sensitive cereals (e.g., maize, millet, sorghum). Heat stress around sensitive phenological stages (flowering and grain set) can cause large yield losses even where average temperatures increase only modestly [20]. In tropical and sub-tropical zones a small rise in mean temperature often pushes crops closer to or beyond physiological thresholds, amplifying negative impacts relative to temperate regions [15, 16].

Rainfall variability and water availability. Changes in the onset, duration and intra-seasonal distribution of rainfall increase uncertainty for planting and crop maturation. Longer dry spells and more intense but shorter rainfall events reduce effective soil moisture for crops, increase runoff and erosion, and impede timely field operations [7, 8]. For

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communities in Jaba LGA relying on single seasonal rains, even modest increases in intra-seasonal variability can translate into major reductions in productivity and higher post-harvest losses.

Extreme events and shocks. Increased frequency of droughts and heavy storms disrupt cropping cycles, damage infrastructure (e.g., small-scale irrigation, farm roads), and erode soil fertility through erosion and nutrient loss. Repeated shocks undermine farmers' capacity to recover by depleting savings, livestock, and seed reserves, thereby reducing long-term productivity and increasing vulnerability [14].

Pests, diseases and weed dynamics. Climate change alters the range, life cycle, and reproduction rates of pests, pathogens and invasive weeds. Warmer and wetter conditions in some seasons favor certain insect pests and fungal diseases, increasing crop losses and the need for pest control measures that many smallholders cannot afford [25].

CO_2 fertilization and nutrient limitations. Elevated atmospheric CO_2 can increase photosynthesis and water-use efficiency in some C_3 crops (e.g., beans), offering a potential partial offset to temperature and water stresses. However, CO_2 fertilization benefits are constrained by nutrient availability, pest pressure, and the negative effects of high temperatures; thus net gains are often limited in smallholder contexts where soils are nutrient-poor (14; 20].

Socio-economic and management pathways. Climate impacts on productivity are mediated by farmers' access to adapted seed varieties, irrigation, credit, extension services, and markets. Poorer households, women, and landless laborers typically face greater barriers to adaptation, so climatic shocks translate more directly into food insecurity and livelihood losses for these groups [7, 8]. In Samban Gida, where mixed cropping, limited input use, and dependence on seasonal rainfall are common, adaptive capacity is a central determinant of whether productivity declines are temporary or persistent.

Regional implications for Samban Gida, Kwoi. Although global and continental assessments provide the mechanistic basis described above, local impacts depend on micro-climates, soil types, cropping systems, and existing socio-economic conditions. For Samban Gida smallholders cultivating staples (e.g., millet, sorghum, maize, legumes), projected increases in temperature and variability of the rainy season are likely to reduce yield levels and increase inter-annual variability unless adaptation measures (improved varieties, soil and water conservation, adjusted planting dates, small-scale irrigation) are adopted and scaled [14; 7, 8].

Adaptation considerations. Improving local resilience requires integrated approaches: promoting climate-resilient crop varieties, water-harvesting and small irrigation schemes, agronomic practices that conserve soil moisture and organic matter (e.g., mulching, intercropping, conservation tillage), and strengthening extension and market linkages so farmers can access inputs and sell surplus. Monitoring and early warning systems, alongside social safety nets, reduce vulnerability to extremes and help stabilize productivity across seasons [14; 7, 8].

In summary, climate change affects agricultural productivity in Samban Gida through direct biophysical impacts (temperature, water stress, pests/diseases) and indirectly through socio-economic constraints that limit adaptive capacity. Addressing these effects requires both on-farm management changes and supportive institutional interventions to enable farmers to adapt and maintain productive, resilient livelihoods.

3. RESULTS AND DISCUSSION

1. Climate change has reduced the availability of water for farming activities in Samban Gida.

Table 3.1: Climate change has reduced the availability of water for farming activities in Samban Gida.

Climate change has reduced the availability of water for farming activities in Samban Gida.	**SA**	**A**	**N**	**DA**	**SD**	**TOTAL**
No. of Response	75	30	10	5	0	120
Percentage of Response	63%	25%	8%	4%	0%	100%
Source: Field Survey 2025						

From the data collected, a total of 120 respondents participated in answering the question on whether climate change has reduced the availability of water for farming activities in Samban Gida. The breakdown is as follows:

Strongly Agree (SA): 75 respondents, representing 63%. Agree (A): 30 respondents, representing 25%. Neutral (N): 10 respondents, representing 8%. Disagree (DA): 5 respondents, representing 4%. Strongly Disagree (SD): 0 respondents, representing 0%.

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The results clearly indicate that a vast majority of the respondents (88%) either strongly agreed or agreed that climate change has indeed reduced the availability of water for farming activities in the area. Only a small fraction (4%) disagreed, while 8% maintained a neutral stance.

The findings reveal that climate change is perceived as a significant threat to water availability for farming in Samban Gida. The fact that over six out of every ten respondents (63%) strongly agreed suggests that the community has observed tangible impacts such as:

Reduced rainfall patterns leading to declining surface water availability. Increased frequency of droughts, which affects irrigation and rain-fed farming. Drying of local streams and wells, forcing farmers to adapt by seeking alternative water sources.

The additional 25% who agreed reinforces the general consensus, showing that the majority of farmers recognize the negative effects of climate variability on their agricultural productivity. The neutral group (8%) may consist of individuals who have not directly experienced water shortages or who are uncertain about attributing the problem solely to climate change. The 4% who disagreed could represent those who believe other factors—such as poor water management, deforestation, or population pressure—are more responsible than climate change.

Notably, no respondents strongly disagreed, which underscores that denial of climate change's impact on water resources is virtually absent within the community.

These findings align with broader studies in Nigeria and Sub-Saharan Africa which confirm that climate change exacerbates water scarcity, reduces farming efficiency, and threatens food security [15. 16].

In summary, the analysis indicates a strong awareness among farmers in Samban Gida that climate change reduces water availability for farming activities, which has serious implications for agricultural productivity, livelihoods, and local food security.

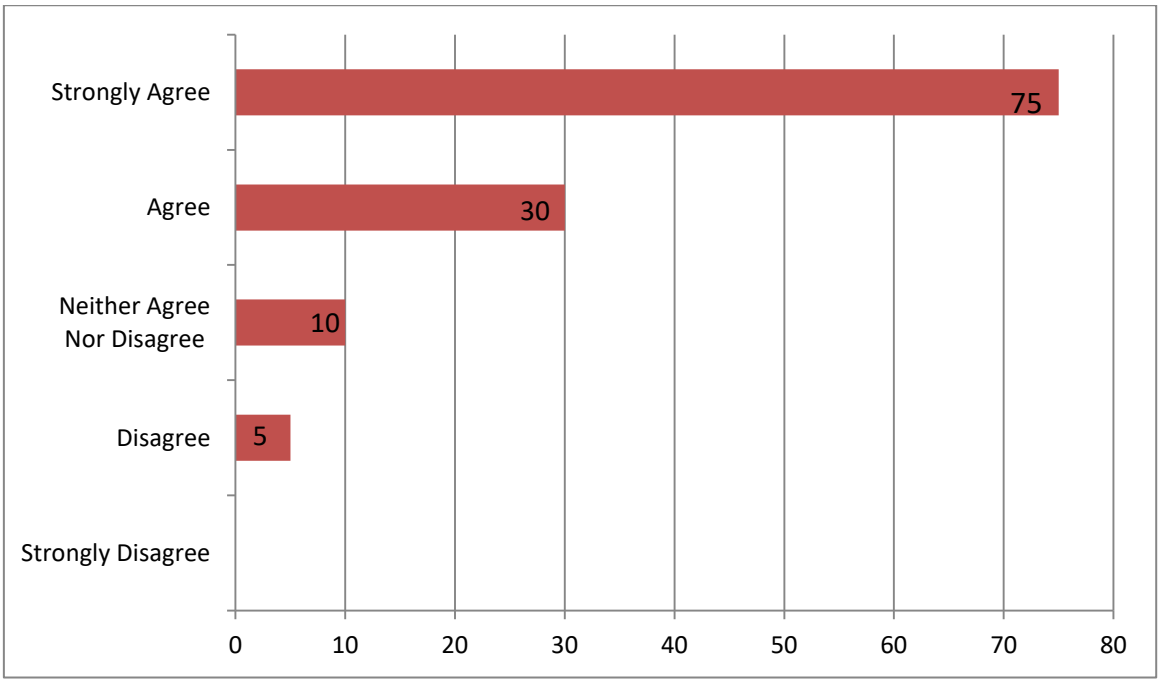

Chart 3.1:

2. Changes in rainfall patterns have affected the timing and reliability of water supply for agriculture.

Table 3.2: Changes in rainfall patterns have affected the timing and reliability of water supply for agriculture.

Changes in rainfall patterns have affected the timing and reliability of water supply for agriculture.	SA	A	N	DA	SD	TOTAL
No. of Response	75	30	10	5	0	120
Percentage of Response	63%	25%	8%	4%	0%	100
Source: Field Survey 2025						

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Table shows respondents' opinions on the statement: "Changes in rainfall patterns have affected the timing and reliability of water supply for agriculture." Out of the total 120 respondents, 75 (63%) strongly agreed and 30 (25%) agreed, making a combined 88% agreement. This indicates that the majority of farmers strongly perceive changes in rainfall patterns as a significant challenge to agricultural water supply. Meanwhile, 10 respondents (8%) were neutral, 5 respondents (4%) disagreed, and none strongly disagreed.

The high proportion of agreement suggests that farmers in the study area have experienced irregularities in rainfall patterns, which directly influence agricultural productivity.

The findings reveal that climate variability, particularly changing rainfall patterns, has disrupted the timing and reliability of water supply for farming activities. This agrees with earlier studies (e.g., [15, 16] which emphasized that unpredictable rainfall patterns negatively affect planting schedules, irrigation, and crop yields in sub-Saharan Africa.

The result shows that only a few respondents (12%) were either neutral or in disagreement, which could mean they have alternative water sources (e.g., irrigation, boreholes) or are engaged in crops less dependent on rainfall. However, the overwhelming majority confirm that rain-fed agriculture is highly vulnerable to inconsistent rainfall.

This finding underscores the need for adaptation strategies such as: Promotion of climate-smart agriculture, Water harvesting and storage technologies, and Government support for irrigation infrastructure to cushion farmers against rainfall unpredictability.

Overall, the result demonstrates that climate change, through its effect on rainfall patterns, poses a major threat to sustainable agriculture and farmer livelihoods in the study area.

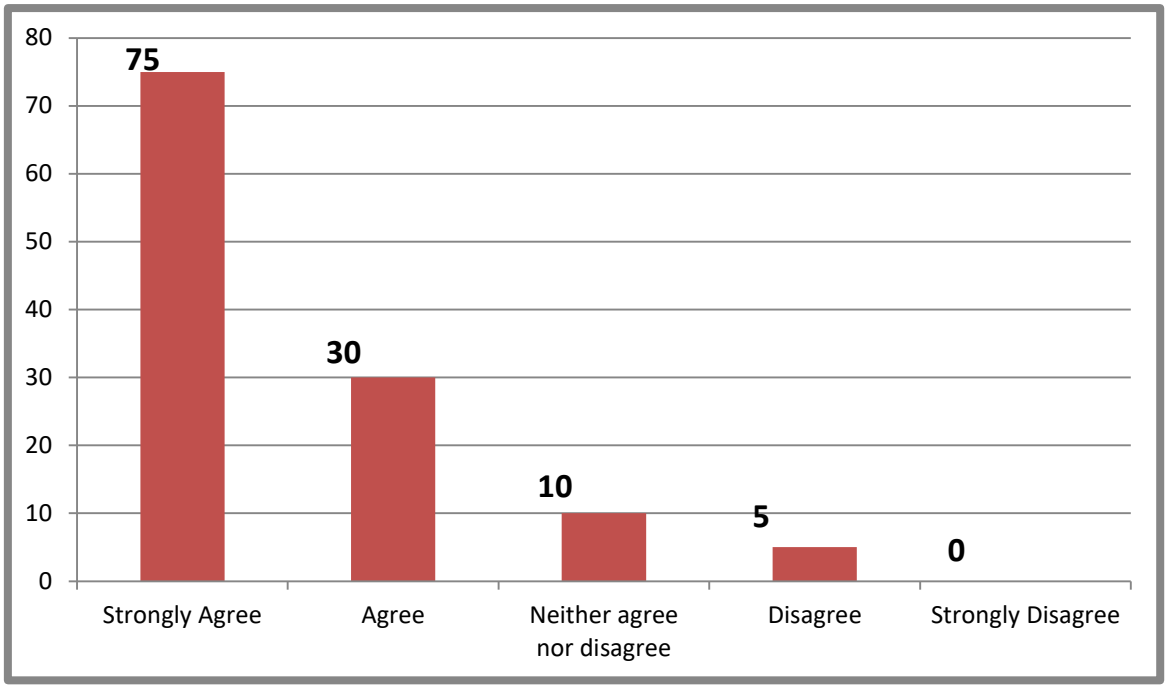

Chart 3.2:

3. Water scarcity caused by climate change has led to reduced irrigation and farming outputs.

Table 3.3: Water scarcity caused by climate change has led to reduced irrigation and farming outputs.

Water scarcity caused by climate change has led to reduced irrigation and farming outputs.	**SA**	**A**	**N**	**DA**	**SD**	**TOTAL**
No. of Response	75	30	10	5	0	120
Percentage of Response	63%	25%	8%	4%	0%	100
Source: Field Survey 2025						

From the table, out of 120 respondents: 75 respondents (63%) strongly agreed that water scarcity caused by climate change has led to reduced irrigation and farming outputs. 30 respondents (25%) agreed with the statement. 10 respondents (8%) were neutral.5 respondents (4%) disagreed. 0 respondents (0%) strongly disagreed.

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This implies that a total of 105 respondents (88%) either strongly agreed or agreed, showing overwhelming consensus that water scarcity due to climate change is adversely affecting irrigation and farming outputs. Only 4% disagreed, while no one strongly disagreed, indicating very limited opposition to the claim.

The result clearly demonstrates that the majority of respondents perceive climate change–induced water scarcity as a critical factor contributing to reduced agricultural productivity. The fact that almost nine out of ten respondents (88%) supported the statement suggests that water availability is a significant determinant of farming success in the study area.

This aligns with studies such as [10 and 26], which highlight that reduced rainfall patterns, rising temperatures, and increased frequency of droughts significantly disrupt irrigation systems and agricultural yields, especially in semi-arid and tropical regions like Northern Nigeria. The relatively small percentage of neutral respondents (8%) may reflect individuals who are either not directly engaged in farming or lack sufficient awareness of climate-related impacts on agriculture.

Furthermore, the very low percentage of disagreement (4%) indicates that the problem of water scarcity is widely experienced, leaving little room for contrary opinion. This confirms the vulnerability of farming communities to climate change and the urgent need for adaptation strategies such as rainwater harvesting, improved irrigation techniques, and drought-resistant crops.

In summary, the finding underscores the direct link between climate change, water scarcity, and agricultural output, emphasizing that without intervention, food security and farmers' livelihoods will remain under serious threat.

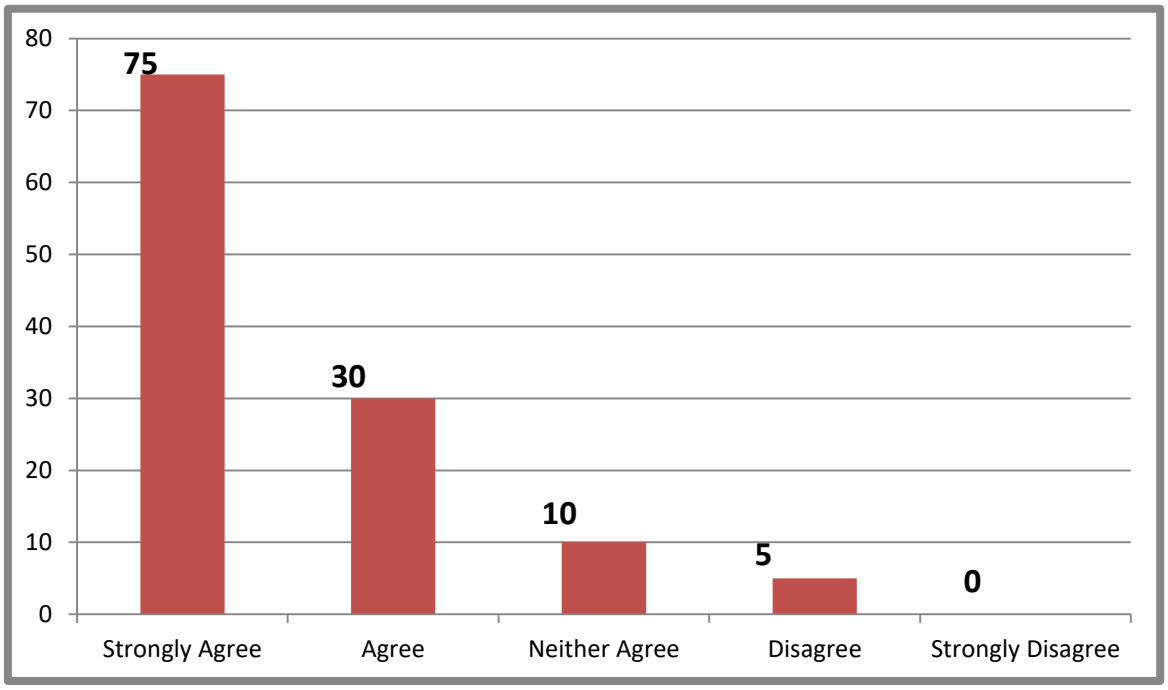

Chart 3.3:

4. The community experiences more frequent droughts compared to previous years due to climate change.

Table 3.4: The community experiences more frequent droughts compared to previous years due to climate change.

The community experiences more frequent droughts compared to previous years due to climate change.	SA	A	N	DA	SD	TOTAL
No. of Response	75	30	10	5	0	120
Percentage of Response	63%	25%	8%	4%	0%	100
Source: Field Survey 2025						

From the field survey (2025), responses to the statement "The community experiences more frequent droughts compared to previous years due to climate change" show that: 75 respondents (63%) strongly agreed (SA). 30 respondents (25%) agreed (A). 10 respondents (8%) were neutral (N). 5 respondents (4%) disagreed (DA). None (0%) strongly disagreed (SD). This implies that 105 out of 120 respondents (88%) agreed (either strongly or

moderately) with the statement, while only 5 respondents (4%) disagreed. A small proportion (8%) remained undecided.

The findings clearly indicate that the majority of community members perceive an increase in the frequency of droughts compared to previous years, and they largely attribute this change to the effects of climate change. This high level of agreement (88%) suggests a strong awareness and lived experience of environmental changes at the community level.

The small percentage of neutral responses (8%) may reflect individuals who are either uncertain about long-term climatic trends or less informed about the scientific link between climate change and drought occurrence. The minimal disagreement (4%) suggests that very few people reject the idea that climate change is driving more frequent droughts, which reinforces the consensus perception within the community.

These findings align with existing literature, where climate change has been linked to increasing temperature variability, reduced rainfall, and prolonged dry spells in Sub-Saharan Africa, including Northern Nigeria [15, 16]. The perception from the respondents is therefore consistent with observed meteorological data showing that climate change intensifies drought frequency and severity, directly impacting agricultural productivity, water availability, and livelihoods. Overall, the result demonstrates that climate change is not just a global phenomenon but a local reality recognized by the community. This awareness can serve as a foundation for promoting adaptation strategies, such as drought-resistant crops, water conservation, and sustainable farming practices.

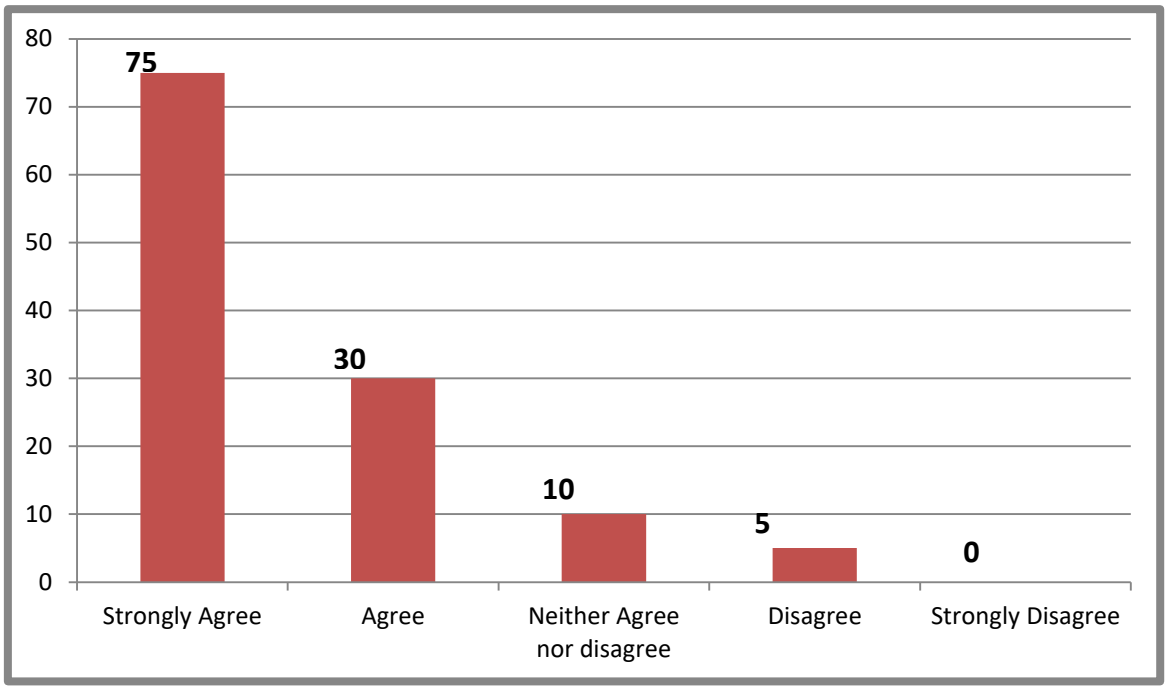

Chart 3.4:

5. Climate change has negatively affected crop yields in Samban Gida.

Table 3.5: Climate change has negatively affected crop yields in Samban Gida.

Climate change has negatively affected crop yields in Samban Gida.	SA	A	N	DA	SD	TOTAL
No. of Response	75	30	10	5	0	120
Percentage of Response	63%	25%	8%	4%	0%	100
Source: Field Survey 2025						

From the data presented: Strongly Agree (SA): 75 respondents (63%) Agree (A): 30 respondents (25%) Neutral (N): 10 respondents (8%) Disagree (DA): 5 respondents (4%) Strongly Disagree (SD): 0 respondents (0%)

This shows that 105 out of 120 respondents (88%) either strongly agreed or agreed that climate change has negatively affected crop yields in Samban Gida. Only a very small proportion (4%) disagreed, while 8% remained neutral.

The findings clearly reveal a dominant perception among respondents that climate change has adversely impacted agricultural productivity in Samban Gida. The overwhelming majority (88%) acknowledging this effect suggests that farmers and residents are directly experiencing the consequences of changing weather patterns.

This outcome aligns with studies such as [26 and 10], which have documented that erratic rainfall, rising temperatures, droughts, and flooding reduce crop yields in Sub-Saharan Africa. In Samban Gida, these effects may manifest in shorter growing seasons, reduced soil fertility, pest infestations, and poor harvest outcomes.

The small percentage (4%) who disagreed may represent individuals with alternative coping strategies such as irrigation, access to improved crop varieties, or other livelihood options that buffer them from climate impacts. Meanwhile, the 8% neutral response could be due to limited awareness of the direct link between climate change and reduced yields or uncertainty about attributing poor harvests solely to climate factors.

Overall, the results emphasize that climate change is a pressing agricultural challenge in Samban Gida, threatening food security, household income, and rural livelihoods. These findings underscore the urgent need for adaptation measures such as climate-smart farming practices, improved seed varieties, and government interventions to mitigate risks associated with changing climatic conditions.

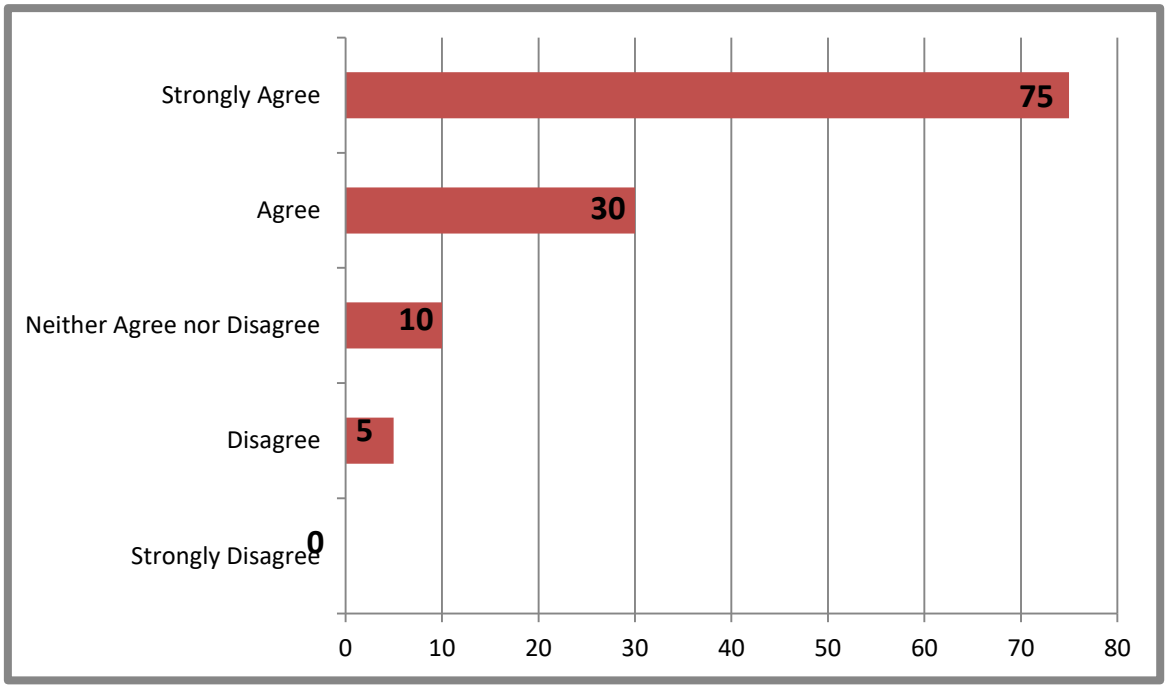

Chart 3.5:

6. Rising temperatures and unpredictable rainfall patterns have reduced farm productivity.

Table 3.6: Rising temperatures and unpredictable rainfall patterns have reduced farm productivity.

Rising temperatures and unpredictable rainfall patterns have reduced farm productivity.	SA	A	N	DA	SD	TOTAL
No. of Response	65	20	12	10	13	120
Percentage of Response	54%	17%	10%	8%	11%	100
Source: Field Survey2025						

From the table, 65 respondents (54%) strongly agreed (SA) that rising temperatures and unpredictable rainfall patterns have reduced farm productivity. 20 respondents (17%) agreed (A), while 12 respondents (10%) were neutral (N). On the other hand, 10 respondents (8%) disagreed (DA), and 13 respondents (11%) strongly disagreed (SD).

This shows that a majority of 85 respondents (71%) agreed (SA + A) with the statement, indicating a strong perception that climatic factors negatively affect farm productivity. Only 23 respondents (19%) disagreed, while a small proportion (12 respondents, 10%) remained undecided.

The findings reveal that the majority of farmers believe that climate change, manifested in rising temperatures and irregular rainfall, has a direct negative impact on crop yield and farm productivity. This aligns with the reports of [15, 16], which indicate that climate variability is one of the greatest threats to sustainable agriculture in sub-Saharan Africa.

The high proportion of agreement (71%) suggests that farmers in the study area are already experiencing the practical consequences of climate change, such as delayed planting, crop failure, pest outbreaks, and reduced harvest. The

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minority (19%) who disagreed may be those who have adopted climate adaptation strategies (e.g., irrigation, drought-resistant seeds, or early planting) and therefore perceive less impact. The neutral responses (10%) could reflect uncertainty or lack of awareness about the link between climate change and agricultural productivity.

Overall, this result underscores the urgent need for climate-smart agricultural practices, extension services, and government interventions to support farmers in mitigating the adverse effects of rising temperatures and rainfall variability.

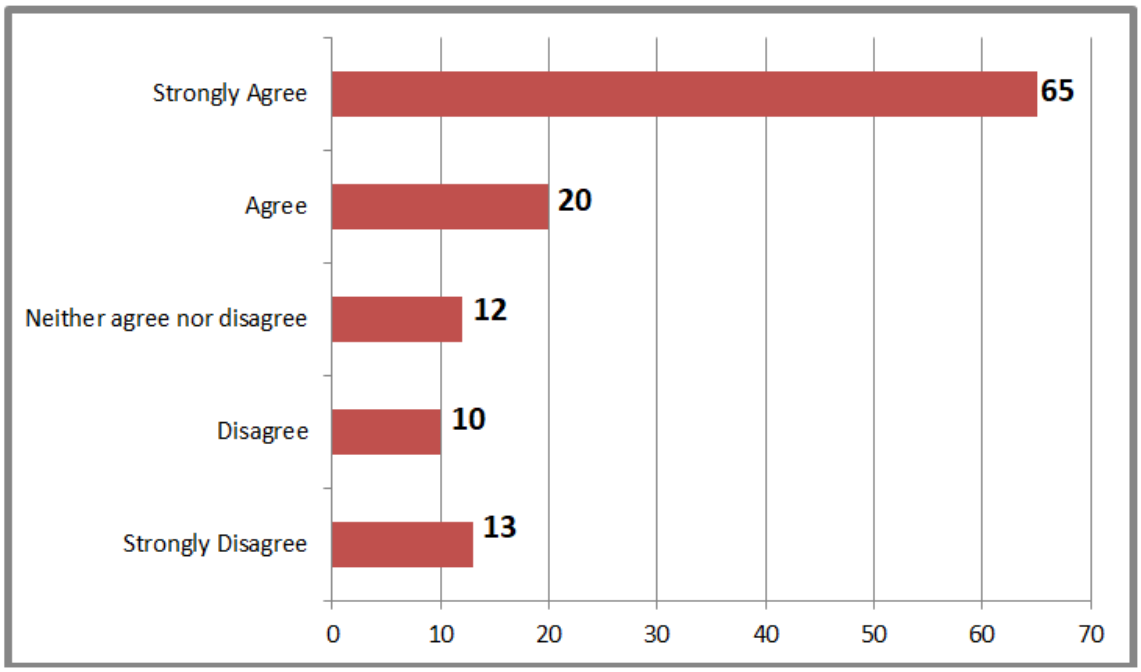

Chart 3.6:

7. Farmers in Samban Gida have had to change their farming practices due to the effects of climate change.

Table 3.7: Farmers in Samban Gida have had to change their farming practices due to the effects of climate change.

Farmers in Samban Gida have had to change their farming practices due to the effects of climate change.	**SA**	**A**	**N**	**DA**	**SD**	**TOTAL**
No. of Response	65	20	12	10	13	120
Percentage of Response	54%	17%	10%	8%	11%	100
Source: Field Survey2025						

Out of the 120 respondents: 65 (54%) strongly agreed (SA), 20 (17%) agreed (A), 12 (10%) were neutral (N), 10 (8%) disagreed (DA), 13 (11%) strongly disagreed (SD).

This shows that a combined 71% (SA + A) of the respondents acknowledged that climate change has forced them to modify their farming practices. Only 19% (DA + SD) denied experiencing such changes, while 10% remained undecided.

The results reveal that the majority of farmers in Samban Gida perceive climate change as a significant factor influencing their agricultural activities. The high percentage of respondents who strongly agreed or agreed (71%) suggests that farmers are already adapting their farming methods in response to climate variability. These adjustments may include shifting planting dates, adopting drought-resistant crops, diversifying into mixed farming, or practicing water conservation techniques.

The 10% neutral response may represent farmers who are aware of climate change but have not observed or implemented substantial changes in their farming practices. Meanwhile, the 19% who disagreed or strongly disagreed might be farmers less exposed to the impacts of climate change, or those who rely on traditional practices and perceive current challenges as normal seasonal variations rather than climate-related issues.

This finding aligns with existing studies which highlight that smallholder farmers in Nigeria are among the most vulnerable to climate change due to their dependence on rainfall and traditional farming systems [12, 23]. It also

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underscores the reality that adaptation strategies are already being practiced at the grassroots level, though not uniformly across all farmers.

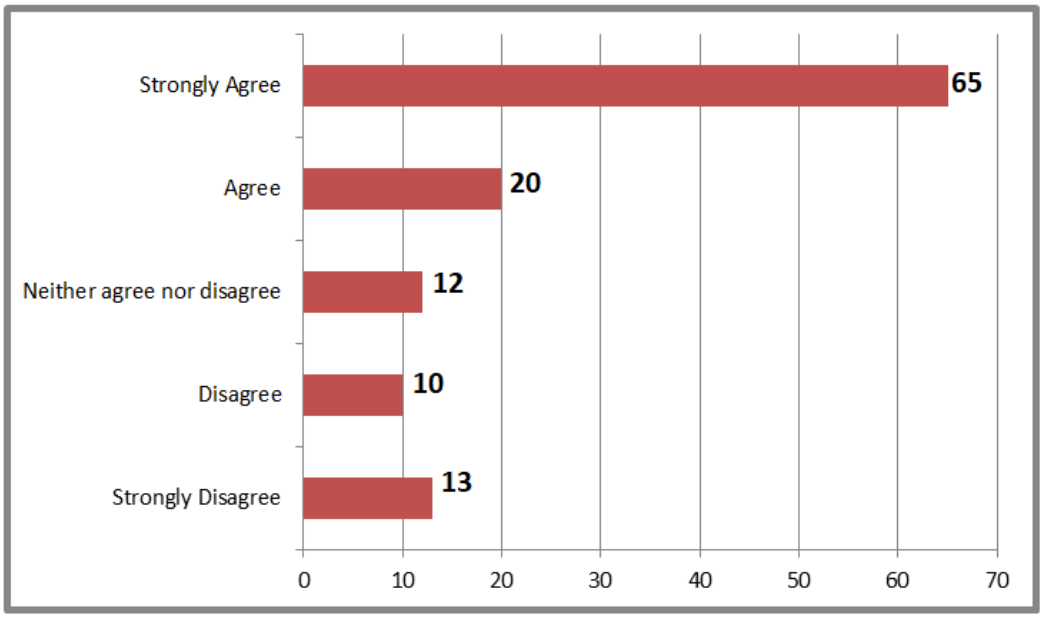

Chart 3.7:

8. Climate change has increased the cost of agricultural production in the community.

Table 3.8: Farmers in Samban Gida have had to change their farming practices due to the effects of climate change.

Climate change has increased the cost of agricultural production in the community.	SA	A	N	DA	SD	TOTAL
No. of Response	65	20	12	10	13	120
Percentage of Response	54%	17%	10%	8%	11%	100
Source: Field Survey2025						

From the table above, out of the 120 respondents: 65 respondents (54%) strongly agreed (SA) that climate change has increased the cost of agricultural production in the community. 20 respondents (17%) agreed (A), supporting the same view. 12 respondents (10%) were neutral (N), indicating uncertainty or indifference. 10 respondents (8%) disagreed (DA), while 13 respondents (11%) strongly disagreed (SD) with the statement.

This shows that 85 respondents (71%) (SA + A) affirmed that climate change has increased the cost of agricultural production, compared to 23 respondents (19%) (DA + SD) who opposed it. Only 12 respondents (10%) remained undecided.

The findings indicate that the majority of farmers in the community recognize the impact of climate change on agricultural production costs. The 71% agreement rate suggests that unpredictable weather patterns, increased incidence of pests and diseases, irregular rainfall, and the need for adaptive measures (such as irrigation, improved seedlings, fertilizers, and pest control chemicals) have collectively driven up production costs.

The 10% neutrality may reflect respondents who are either less affected by climate change (possibly due to the scale of their farming) or lack awareness of its economic impact. Meanwhile, the 19% disagreement might come from farmers who rely on traditional farming practices with minimal investment or those who attribute rising production costs to other factors such as inflation, poor government support, or market dynamics rather than climate change.

Overall, the result strongly supports the assertion that climate change is a key driver of rising agricultural production costs in the community, which could negatively affect farmers' profitability and long-term sustainability if adaptive measures are not strengthened.

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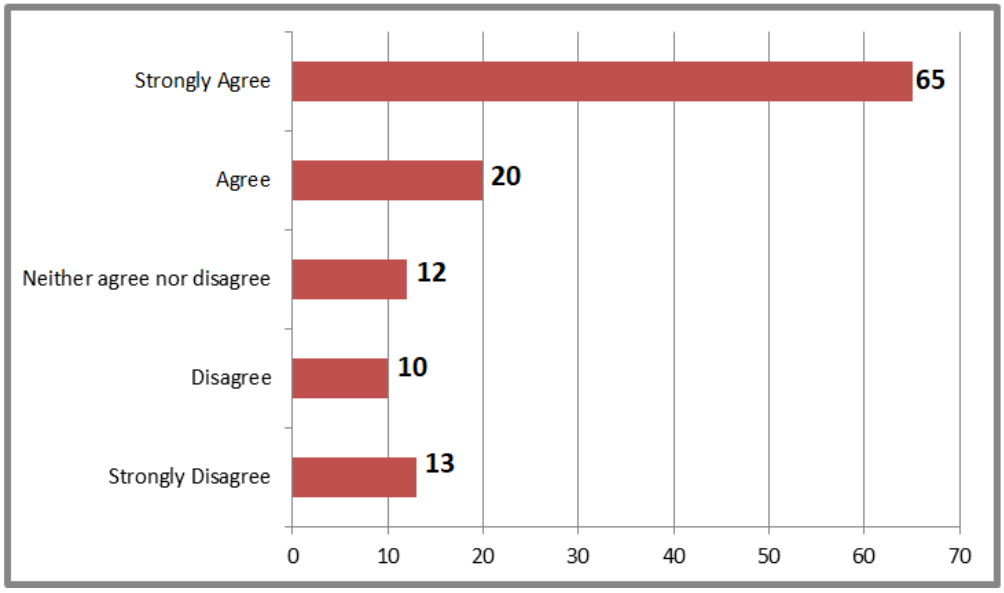

Chart 3.8:

4. CONCLUSION

This study examined the Impact of Climate Change on Water Resource Availability and Agricultural Productivity in Samban Gida, Kwoi, Jaba Local Government Area of Kaduna State, Nigeria. The findings revealed that climate change has significantly altered rainfall patterns, temperature levels, and seasonal cycles in the area. These changes have led to reduced water availability, increasing pressure on streams, rivers, and underground water sources that serve both domestic and agricultural purposes.

Furthermore, the research established that agricultural productivity has been adversely affected by prolonged dry spells, unpredictable rainfall, soil degradation, and increased incidence of pests and diseases. Farmers in Samban Gida reported declining yields of staple crops such as maize, beans, and yam, which are critical for food security and livelihood in the community. The lack of adequate irrigation systems, coupled with reliance on rain-fed agriculture, has worsened the vulnerability of farmers to climate variability.

The study also confirmed that the socio-economic well-being of farming households is being threatened, as reduced productivity directly impacts income, food availability, and the overall standard of living. Importantly, it was observed that while some adaptive strategies such as crop diversification and shifting planting periods are being adopted, these measures remain insufficient without institutional support, access to technology, and effective government policies.

In conclusion, climate change poses a real and pressing challenge to water resource availability and agricultural productivity in Samban Gida. Addressing these issues requires urgent interventions in the areas of water management, sustainable agricultural practices, climate-smart technologies, and community sensitization. Without such measures, the sustainability of agriculture and food security in the study area will continue to be at risk.

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