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Analysis of Socioeconomic Characteristic and Coping Strategies Adopted by Soybean Farmers in Response to Climate Change in North East Nigeria.

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Abstract

The study was conducted to analyze the socioeconomic characteristic of soybean farmers in response to signs of climate change in north east Nigeria. Multi-stage random sampling technique was used to sample respondents while primary and secondary data were used for the study. A well-structured questionnaire was used to collect data from 450 soybean farmers. Descriptive statistic, and likert type scale was used to analyzed the data. The socioeconomic characteristics of the farmers indicated that majority (67.3%) were male and are between 41-50 years of age, majority (66.9%) are married with a household size of between 1-5 persons and a farming experience of 16 years and above. Most of the farmers has one form of formal education or another, while 57.8% of the farmers cultivate between 6-10 hectares of farm land. Majority (60.0%) of the farmers belong to one agricultural association or another and many (61.8%) have access to extension agents. Signs of climate change were measured using Likert scale which revealed that gradual reduction of vegetation (53.1%), increase temperature (38.2%), and increase rainstorm (32.9%) were major signs of climate change noticed by soybean farmers. it is recommended that Federal government of Nigeria should take climate change challenges very seriously and formulate policies that can assist the farmers overcome its effect and build infrastructures in rural communities that can support the farmers efforts in the delivery of goods and services.

Key Words: Analysis, Socioeconomic, Soybean, Farmers, Climate, Change,

Introduction: Agriculture is still a cornerstone of global economy and rural livelihoods, contributing about 4% of the world Gross Domestic Product (GDP) and employing nearly 27% of the global workforce equivalent to about 873 million people in 2021 (World Bank, 2021; FAO, 2023). More than one third of Africans already live in drought/flood-prone areas and that 220 million are exposed to drought each year and numerous variables may make the effects of the existing climate variability in Africa, and Nigeria in particular, worse, which could negatively affect the ability of the continent to adapt to and withstand climate change (Abdulkadir, Maryam and Muhammed, 2017). The effects could range from poverty to illiteracy and a lack of skilled workers to weak institutions, poor infrastructure, a lack of technology and knowledge, poor access to resources, poor managerial abilities, and armed conflicts. The misuse of natural resources for human activities including population expansion, desertification, and land degradation brings new issues and hazards to Africa, particularly Nigeria. In the Sahara and the Sahel, people's quality of life, agriculture, and health suffer greatly from dust, heat, and sand storms (Nzeh, Uke, Attamah, Nzeh, and Agu, 2016) Climate change is causing increasing temperatures, desertification, sea level rise, droughts, low precipitation, flooding, land degradation, extreme weather events frequently, and dwindling freshwater resources. These issues are currently plaguing Africa, particularly Nigeria (Elisha, Sawa, Ejeh and Lawrence, 2017). Due to climate change, farmers can no longer predict the lengths and intensities of rainfall, and considerable runoff and flooding occur in various areas of Nigeria. A decrease in rainfall in Nigeria is leading to an increased frequency of severe droughts that affect both people and animals (Olaniyi, 2019). Adaptation strategies are longer-term (beyond a single rainfall season) strategies that would be required to respond to a new set of change in the climate conditions that they have not previously experienced, coping strategies have developed over time as a result of farmers' long experience dealing with the current known and understood natural variation in weather that they expect both within and between seasons. Farm practices must be modified in response to various stimuli and conditions, both climatic and non-climatic, as part of adaptations to climate change. These alterations go beyond simple technological fixes. The term "climate change adaptation" describes how management strategies are modified to account for actual or predicted climatic conditions and their consequences in order to minimize risks or take advantage of possibilities. The collection of quick reactions to possible effects that can be successfully used seasonally or annually to preserve a resource, way of life, etc. is known as coping responses. Certain coping mechanisms are specifically anticipatory and include things

like insurance policies and emergency planning. The term "adaptive responses" describes how people, homes, and communities alter their productive pursuits and adjust laws and institutions to reduce the risk to their assets and means of subsistence. Coping strategies, adaptive strategies, or both may be used, depending on the frequency, duration, and abruptness of stress events as well as the system's resilience. As climate circumstances change over time, coping methods may eventually become insufficient and must be replaced with adaptive responses. (Taylor, Harris, and Ehrhart, 2010). Agriculture remains central to economic growth and food security in Nigeria, because it created employment for most of the rural labour force and contribute over one-fifth of National GDP (NBS, 2023). In spite of its importance, the sector continues to experience low productivity, persistent food insecurity and weak resilience to climate shocks. Soybean production in North East Nigeria, as in many other parts of Nigeria, continues to be threatened by the increasingly unpredictable character of rainfall and temperature, which directly affects critical farming decisions such as land preparation, planting dates and the timing of fertilizer application. Climate change, expressed through erratic rainfall and rising temperatures, continues to pose a significant threat to soybean yields in Nigeria, with attendant implications for household food security and farm income (Omotoso, 2025; Adeagbo *et al.*, 2021). Despite this growing threat, the extent to which soybean farmers in the study area accurately perceive these changes, and the manner in which such perceptions translate into deliberate adaptive action, remains poorly documented. In addition, farmers attempting to adopt new or improved adaptation strategies frequently encounter constraints such as the high cost of farm inputs, inadequate access to credit and climate information, weak extension service coverage and unfavorable attitudes toward innovation (Aduaka *et al.*, 2026). Without a clear understanding of the specific problems confronting soybean farmers in the study Area, policy and extension interventions designed to support climate change adaptation in the area risk being generic, and ultimately ineffective. It is this gap in location-specific empirical evidence that this study seeks to address by analyzing the socioeconomic characteristic of soybean farmers in response to signs of climate change in north east Nigeria.describe the socioeconomic characteristic of soybean farmers in the study area; examine soybean farmers level of awareness of the signs of climate change in the study area, and examine the coping strategies adopted by soybean farmers in the study area

The Study Area: The North East (often hyphenated to the North-East) is the one of the six geopolitical zones of Nigeria representing both a geographic and political region of the country's northeast. It comprises six State-Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe.The study will be carried out in Adamawa, Bauchi and Taraba State Nigeria. Adamawa is one of the largest states of Nigeria and occupies about 36,917 square kilometers. The Physical Setting of Adamawa State lies between latitudes **70 281-100 561 N and longitudes 110 301 - 130 751E.** It shares its borders with Borno to the northwest, Gombe to the west, and Taraba to the southwest. To the east, it serves as the national eastern boundary with Cameroon. The Humidity and Temperature of Adamawa state, especially dry season, begins in November with a very hot period. The Harmattan period is experienced between December - February every year. Topographically, it is a mountainous land crossed by the large river valleys –Benue, Gongola, and Yedsarem. Population of Adamawa State as of 2006 was 3,178,950 and population projection as of 2016 was 4,248,436 (National Population Commission and National Bureau of Statistics Estimates 2016). In recent years, climate change in Adamawa State has begun to be more evident. Tropical wet and dry weather prevails in Adamawa State. The wet season lasts from April to October, whereas the dry season lasts for at least five months (November to March) yearly. An upsurge in rainfall in September in recent years is usually accompanied by floods with many people losing their life and properties due to both discharge of water from the Lagoo Dam in Cameroon and severe rainfall. The primary livelihood of the local population centers around agriculture, evident in their distinct vegetational regions, namely the sub-Sudan and Northern Guinea Savannah zones. They cultivate cash crops like Cotton and Groundnuts, alongside food staples such as Maize, Yam, Cassava, Guinea Corn, Soybean, Millet, and Rice. Communities residing along riverbanks are involved in fishing, and the Fulani people are known for cattle herding. The state boasts an extensive road network that connects its various regions with the rest of the country. Taraba state was created out of the former Gongola State on 27 August 1991, by the military government of General Ibrahim Babangida. Taraba state is bounded in the west by Nasarawa State and Benue State, northwest by Plateau State, north by Bauchi State and Gombe State, northeast by Adamawa State, and south by Northwest Region in Cameroon. **Taraba State has** an estimated land area of about 54,428 sq. km, lies between coordinates latitude 9º 3′ 32 ″E to 11º 55′ 3 ″E and longitude 6º 24′ 30 ″N to 9º 41′ 32 ″N Taraba State is in the Northeast geopolitical zone of Nigeria and lies largely within the tropical zone with a vegetation of low forest in the southern part and grassland in the northern part. Population of Taraba State as of 2006 was 2,294,800 and population projection as of 2016 was 3,066,834 (National Population Commission and National Bureau of Statistics Estimates 2016). The Benue, Donga, Taraba and Ibi are the main rivers in the state. They rise from the Cameroonian mountains, straining almost the entire length of the state in the North and South directions to link up with the river Niger The climate of Taraba state is marked by an annual average Temperature of 33^0C but high level of cold in January and an increased rainfall in August. The percentage of rainfall in Taraba state is 40.35% with 54.98% relative humidity. The state is usually very warm in March with 40.44^0C, and an average wind of 8.84kmh | 5.94mph. The major occupation of the people of Taraba state is Agriculture. Cash crops produced in the state include coffee, tea, groundnut and cotton. Crops such as maize, rice, sorghum, millet, cassava and yam are also produced in commercial quantity. In addition, cattle, sheep and goats are reared in large numbers, especially on the Mambilla Plateau, and along the Benue and Taraba valleys. Similarly, the people of Taraba state undertake

other livestock production activities like poultry production, rabbit breeding and pigs farming in fairly large scale. Communities living on the banks of River Benue, River Taraba, River Donga and Ibi, engage in fishing all year round. Other occupational activities such as pottery, cloth-weaving, dyeing, mat-making, carving, embroidery and blacksmithing are also carried out in various parts of the state. Bauchi State is located between latitudes 9° 3′ and 12° 3′ north of the equator with a total land area of 49,119 km² representing about 5.3% of Nigeria's total land mass. The state is bordered by seven states; namely Kano and Jigawa to the north, Taraba and Plateau to the south, Gombe and Yobe to the east and Kaduna to the west. Bauchi is a city in northeast Nigeria, the capital of Bauchi State, of the Bauchi Local Government Area within that State, and of the traditional Bauchi Emirate. It is located on the northern edge of the Jos Plateau, at an elevation of 616 m. Population of Bauchi State as of 2006 was 4,653,066 and population projection as of 2016 was 6,537,314 (National Population Commission and National Bureau of Statistics Estimates 2016). The Local Government Area covers an area of 3,687 km2 and had a population of 6,537,314 at the time of the 2016 population estimations. With the creation of Bauchi state in 1976, then comprising present Bauchi and Gombe states, it included 16 Local Government Areas. The number of Local Government Areas in the then Bauchi State was increased to 20 and later to 23. However, in 1997 when Gombe state was created out of Bauchi and additional local governments were created in the country, Bauchi State was left with 20 Local Government Areas. With a population about 5 million according to the 2006 census, Bauchi State has gone through a tremendous transformation since it was created. During the colonial era up to independence, it formed part of the Bauchi-Plateau of the then Northern Region, until the 1967 state creation exercise, when the Bauchi, Borno, and Adamawa provinces constituted the former North-Eastern State. Bauchi state has two distinctive vegetation zones, namely, the Sudan Savannah and the Sahel Savannah. Sudan savannah vegetation covers the southern part of Bauchi state where the vegetation gets richer and richer towards the south, especially along water sources or rivers, but generally, the vegetation is less uniform and grasses are shorter than what grows even farther south, that is, in the forest zone of the middle belt. Sahel type of the savannah, which is also known as the semi-desert vegetation, becomes manifest from the middle of the state as one move from the state's south to its north. This type of vegetation comprises isolated stands of thorny shrubs. On the other hand, the southwestern part of the state is mountainous as a result of the continuation of the Jos Plateau, while the northern part is generally sandy. Bauchi state is a heterogeneous state, with predominant tribes like, Hausa, Fulani, Jarawa, Tangale, Waja, Balewa, Sayawa and Tarewa. It is made up of 20 local government areas, namely: Bauchi, Tafawa Balewa, Bogoro, Katagum, Alkaleri, Dambam, Giade, Ganjuwa, Darazo, Dass, Ningi, Shira, Gamawa, Itas/Gadau, Jam'are, Kirfi, Toro, Warji, Zaki, Misau. Bauchi state is an agricultural state. Its vast fertile soil is an added advantage for agricultural products, which include maize, rice, millet, groundnut, soybean and guinea corn. Irrigation farming is practiced and supported by the use of dams like Balanga dam, etc. Cattle and other livestock are also reared in the state. The state has industries like the Bazamri PVC – Wire Limited, Kuda Nails Factory, Yankari Natural Water Company, Zaki Flour Mills and Arewa Ceramic Industry and others.

Sampling Techniques and Sample Size: Multi-stage sampling technique was used to select the respondents for the study. In the first stage: three states were purposefully selected based on the intensity of soybean production in the area. The research work makes use of Agricultural Development Project (ADP) structure in the selected states. In the second stage: three agricultural zones were purposefully selected from each state given a total of twelve agricultural zones. The third stage: one agricultural block was randomly selected from each zone resulting in twelve zones. The fourth stage: two agricultural cells were randomly selected from each of the blocks. From the agricultural cells 150 soybean farmers were randomly selected from each cell to make a total of 450 respondents from the three states

Data Collection and Analysis : Data collected for the study were arranged, coded and analyzed through the use of Statistical Product and Service Solution (SPSS) and STATA computer programs. Both descriptive and inferential statistical tools were utilized to analyze the data. **Objective 1** which is to describe the socio-economic characteristics of the soybean farmers in the study area were analyzed using simple descriptive statistics like mean, frequency and percentage. **Objective 2** which has to do with to examine soybean farmers level of awareness of the signs of climate change in the study area. The signs of climate change were measured as: Strongly Agreed (4), Agreed (3), Neutral (2), Disagreed (1), Strongly Disagreed (0) and were analyzed using simple descriptive statistics like mean, frequency and percentage. **Objective 3** which have to do with to examine the coping strategies adopted by soybean farmers in the study area, were measured as: Yes (1) or No (0) and were analyzed using simple descriptive statistics like mean, frequency and percentage.

Results and Discussions: Socioeconomic Characteristics of the Soybean Farmers: Table 1.1 shows the distribution of respondents by their socioeconomic characteristics among soybean farmers in the study area. The table revealed that most (33.8%) of the respondents where between the age group of 41-50 years, while 29.6% of the respondents fell between age group of 31-40 years. Only 15.8% of respondents are 51 years and above. This implies that majority of the soybean farmers in the study area are within the active and productive age group and were young, strong and agile and economically active, thus capable of coping with many activities to make a living. This result correlate with Alim *et al.,* (2022) who stated that farming population with such age group are better risk manager and has the ability to cope in the face of hash weather condition. Alim *et al.,* (2022), further stated that age of farmers can significantly affect they productivity. The gender (sex) of the soybean farmers in the study area revealed that majority (67.3%) of the respondent were male while 32.7% were female. The nature of soybean production makes it male dominated in the study area, because it is capital intensive, energy demand, and physical and emotional stability

including high ability to adopt to climate change. Climate change adaptation strategies like multiple crop varieties, land fragmentation, multiple planting dates, crop diversification, off-farm employment and cover cropping are majorly managed by the male farmers. Also, Osman *et al.* (2018) state that soybean farming in Northern Region of Ghana is majorly dominated by male farmers due to the drudgery nature of the crop. Ayalew, Bekele and Mazengla (2018) reported that most soybean farmers in Pawe District North Western Ethiopia are male headed households who have the strength to withstand climate change indicators The result of marital status of soybean farmers presented in table 1.1 indicate that majority (66.9%) of the respondents were married, 22. 7% were single, 6.0% were divorced and only 4.4% were widows/widowers. The implication of the finding is that majority of the soybean farmers in the study area might prefers to cultivate soybean as married person due to the energy intensive nature of cultivating and harvesting soybean because family members will provide extra work force when compare to single farmers who may be working alone. The finding is almost in consonance with that of Tony, *et al.* (2022) who revealed that agricultural adaptation strategies to climate change impacts in Africa required responsible farmers who are matured and responsible enough to take serious decisions concerning their crop productivity and survival. Also, Upev *et al.* (2015) stated that majority of farmers who are young and married has a high impact on the productivity and yield of the farm products.

Table 1.1 revealed the household size distribution of soybean farmers in North East Region of Nigeria. The results shows that majority (62.9%) had a household size of 1-5 persons while most (36.7%) had a household size of 6-10 persons and few (0.4%) had household size of 11 and above persons. Coping with climate change is often difficult in underdeveloped countries because socioeconomic, geographical, and meteorological variables influence adaptability (Omerkhil *et al*., 2020). Farmers in the study area are not so much depending on family labor alone to cultivate soybean because there have few immediate households' family's sizes. The youths have left the rural area to urban area in search of white-collar jobs and a better life. This result is in disconformity with the opinion by Ayalew, Bekele and Mazengla (2018) who reported that large family size is meant to support family farming activities.

The formal education status of soybean farmers indicated that 36.2 % had OND, and NCE qualification, 34.4 % had secondary school qualification, 15.3% had BSc and HND qualification while 10.7 % and 3.3 % had primary school qualification and no school at all respectively. The above result shows that majority of the soybeans farmers can read and write and this is an advantage to the adoption of coping strategies pose by climate change variation in the study area. Information comprehension and risk management will be easy because of the farmer's ability to read and understand information quickly. Extension message should be package and delivered to the farmers in the best method that farmers can understand and adopt. Most information in this age is packaged either in soft copy or hard copy that will require the receiver to read and interprets for him-self. Vulnerability assessments must take into account and address a number of important issues. These problems include the insufficiency of current assessments in terms of supporting decision-making, the ambiguity surrounding the operationalization of the vulnerability, the lack of standardization in vulnerability measures, and the inadequate consideration given to indigenous knowledge and experience (Onyeneke, *et al.,* 2020).

The farm size cultivated by soybean farmers in the study area as shown in table 41.1 indicated that 57.8% of the respondents cultivate between 6-10 hectares of farm land while 42.2 % of the respondents cultivate between 1-5 hectares of farm land. This result shown in table 4.1indicated that farmers in the North East are small scale farmers who rarely practice large scale agricultural production of soybean because of access to credit facilities, machines, cost and unpredicted climate change in the area. Insurance facility and government assistances is hard to secure by majority of the farmers in the study area, as such investing, they little capital in large scale agriculture is a risk too had to bear by the rural farmers. The result in table 1.1 agreed with Federal Ministry of Environment (2015); Gabriel, (2023) that farmers may be raising their yields by cultivating larger areas of land, but doing so indirectly increases the amount of land used for agricultural purposes, which raises their risks and exposes them to the effects of climate change. Food security will remain at a subsistence level and this can result in hunger and starvation in the area and the nation at large. There is need for the government to encourage the farmers in the area by providing physical security, machines, and other farm equipment that will made the farmers engage in large scale farming. Years of practicing soybean production is the number of years each farmer has invested into cultivating soybean in the study area. The result in table 1.1 indicated that 51.6% of the respondents had 16 years and above in cultivating soybean, 28.0 % of the respondents had between 5-10 years of experience while 20.4 % of the respondents had between 11-15 years of farming experience. The result is supported by Dossah and Mohammed (2016) who stated that the more time and years an individual spent on a given assignment or business the better the individual will or may become on that given assignment. The soybean farmers have indigenous knowledge due to the many years of cultivating this particular crop Membership of cooperative society shown in table 1.1 revealed that majority (60.0%) of the respondents belong to one form of agricultural cooperative or another. While many (40%) of the respondents are non- members of agricultural cooperative. Belonging to an agricultural cooperative as a farmer has great advantage because it makes it easy for information circulation, access to government intervention, access to loan, and training and leadership skills. Many interventions by non-government organization and other stakeholders mostly pass through cooperative societies and association. So as a member you stand a chance to benefit from such project and programs. Access to extension agents result in table 1.1 indicated that majority (61.8%) has access to extension agents while few (38.2%) had no access to extension agent in the study area. Farmers having access to extension agents is a great advantage because it enables the farmers to interact with the agents and get current information on innovation and technology relevant to the growth and production of agricultural products. It also gives

opportunity to the farmers to inform the extension agents on any problems faced in his or her farming activities especially as it relates to soybean production. The result is in consonant with Ajayi (2015) who stated that extension agents create awareness on the effect of climate change on arable crops in rural area of Kaduna State Nigeria. The important of extension agents can-not be over emphasized in the overall activities in agriculture. Rural farmers will keep suffering in ignorance and poor knowledge on the current innovation and technology available in agricultural without good extension activities. It is therefore remarkable for the majority of farmers in the study area who have access to extension agents. Access to credit facilities in the study area shown in table 1.1 revealed that majority (65.1%) had no access to credit facility while only few (34.9%) had access to credit facility. This has a great implication on soybean production in the study area knowing fully that soybean production required much capital at every stage of production. The small-scale soybean farmers in the study area are not finding cultivation easy because the cost of inputs and labor is very high. The farmers in the study area are suffering a lot because apart from cost of production of agricultural products and activities, the farmers have to also bear the cost of security and the activities of herders. Expansion of farm land and increase in production of goods and services become very difficult since the farmers can-not access credit facility of any kind like the bank, and cooperative society etc. the result agreed with Aminu *et al.,* (2019) who stated that major constraints of rural farmers is access to loan and financial risk management in agricultural productivity. Farmers are incapacitated in carrying out major or minor agricultural production or activities when they lack finances to do such.

Credit collected or borrowed by the soybean farmers in a given farming season shows that majority (72.2%) of the soybean farmers did not collect any credit facility, 10.4% of the soybean farmers collected or borrowed between 301,000 and above while 8.9% and 8.4% of the soybean farmers collected or borrowed between 101,000-200,000 and 201,000-300,000 respectively. When farmers have no access to loan and other financial assistance expansion of farm production become very difficult. It makes the rural farmers remain at the level of small-scale farming and production without been able to reach their capacity. Even the very few that were able to borrowed money they were not given so much money that can really expand productivity. Sources of credit facility of the soybean farmers is presented in table 1.1. The result revealed that 47.8% of the respondents got credit facility from self (personal) saving, 25.3% of the respondents got credit facility from cooperative societies, 19.6% of the respondents got credit facility from family members, 5.3% of the respondents got credit facility from financial banks and institutions and 2.0% got credit facility from neighbors. This result could explain the fact that the farmers in the study area are small scale farmers who has no collateral to use in accessing loan from banks and other financial institutions to boost agricultural production. Also, banks interest rate is mostly too high for any small-scale farmers to collect and be able to engage in serious agricultural business and make profits. The finding is in line with the finding of Hagos and Bekele (2018) who found that most rural farmers sources of credits are mostly personal saving, and cooperative societies and not from banks in Assosa Zone of Benishangul-Gumuz region. This results also shows that soybean farmers in the study area will not be able to increase production capacity to meet the market demand and to export because of lack of access to credit. Table 1.1 indicate farmers access to land for soybean production. Majority (50.0%) of the soybean farmers inherited the farm land they currently used for soybean production, few (14.2%) of the soybean farmers uses family land for soybean production, while others (12.0%, 9.3%, 8.7% and 5.8%) got they farm land from government allocation, leased (rent) land, purchased their farm land and uses communal land respectively. The land tenure system in operation in the study area can be responsible for the ways soybean farmers access land for cultivation. Lands are owned by the government in most part of the communities in Nigeria and allocation of such land for farming activities required the approval of the state government. The limitation faced by soybean farmers in the case of land availability can be as a result of government not allocating enough land for agricultural activities. The finding of Alim *et al.,* (2022) who stated that risk coping strategies among small scale soybean farmers in Kaduna State, Nigeria is so much that the bureaucracy involved in land allocation weight most farmers down from seeking approval for government land. Signing of certificate of occupancy of land in the state can take government two to three years because of political interest and other reasons which are not in favor of small-scale farmers in the communities.

Analysis of Signs of Climate Change by Soybean Farmers The results in table 2.1 below showed that farmers in the study area strongly agreed that gradual reduction of vegetation (53.1%), increase temperature (38.2%), and increase rainstorm (32.9%) are some of the signs noticed as a result of climate change. On the other hand, majority of the respondents agreed that the weather is becoming drier every year (49.8%), there has been increased incidents of floods during the rainy season (46.2%), total rainfall is increasing every year (48.7%), yearly rainfall ends early (49.1%), yearly rainfall begins early (43.6%), increase drought (36.9%), there is a gradual drying of water sources (rivers, streams, lakes, FADAMA lands, wells) (36.0%), Early or late onset of hamattan (47.1%), and Yearly rainfall begins late (49.1%). The signs of climate change were measured by employing Likert type scale with response categories ranging from strongly agreed to strongly disagree. The soybean farmers indicated which of the statement best described their opinion as regards to signs of climate change noticed over a period of time. The farmers were very observant and conscious of the happening in their environment especially as it relates to what affect their sources of livelihood and occupation. The farmers might not have been able to directly relate the changes as impact of climate change on the agricultural environment but as the researcher sum-up the farmers responses it become very clear that climate change signs are what the farmers are complaining about. This assertion was confirmed by Ajayi (2015) who stated that majority of farmers in Ikara local government area of Kaduna State, Nigeria are aware of climate change because farmers viewed climate change as a change in weather, mainly in terms of increase in temperature and incessant rainfall. Also, in the advent of

drought in the area, farmers prefer to cultivate millet because it adopts better to dry infertile soils, high temperature, low precipitation and poor water holding capacity than other crops. Majority of the farmers in the study area are young adults who can read and understand information as it relates to, their farm in terms of innovation, technology and weather condition. This made it easier for the farmers to understand signs affecting their agricultural activities due to climate change or weather condition which have not happened before. Tologbonse, *et al.,* (2015) stated that farmers were fully aware of the effect of climate change and possible coping strategies such as the need for agricultural insurance, planting of drought and flood tolerant varieties and reduction of water loss through practices such as mulching and rearing of heat tolerant livestock. Generally, climate change has cause increases in the rate of sickness/infection, reduces family income and that frequency of flood and drought has increased.

Coping Strategies Adopted by Soybean Farmers: The farmers ability to employ coping system that will enable him or her overcome new climate change challenges in a given farming season is what farmers in the study area are adopting in their agricultural activities. The collection of quick actions or reactions to possible effects that can be successfully used seasonally or annually to preserve farmer's agricultural livelihood, way of life, and income etc. is known as coping strategies. Certain coping mechanisms are specifically anticipatory and include things like off-farm activities and emergency implementation of programs that can reduced the effect of climate change. The result in figure 4.1 revealed that small scale soybean farmers in the study area adopted different coping strategies to be able to keep soybean production activities. 56.2% participated in government intervention program that provides fertilizer and improved soybean seed to farmers, 54.9% participated in crop insurance against natural disaster, 89.1% increase the use of organic manure, 85.8% use of credit facility to increase soybean production, 93.3% plant pests and disease resistant/tolerant soybean varieties, 90.7% plant other crops on the same farm land with soybean (multi-crop agriculture), 89.1% decrease the use of chemical fertilizer on their soybean crop, 85.3% plant drought resistant/tolerant soybean varieties, 81.8% use of irrigation facilities, 53.3% migration of soybean farmers to another community due to climate change effect, 72.7% regular contact with extension agents for information, 78.0% change planting dates of soybean, 78.9% drainage construction around the farm for free flow of rain water, 80.4% engaged in off-farm activities, 89.6% practiced shifting cultivation method of agriculture as soybean farmer, 93.6% change plant spacing of soybean, and 90.4% adapted different methods of coping strategies. This result revealed that farmers in the study area were able to adopt some coping strategies in the face of climate change to help them improve soybean production. The above assertion is in line with Enete *et al.* (2015) who stated that crop diversification, mixed cropping, change planting dates and harvesting, and drought-resistant cultivars are coping strategies adopted by so many farmers in Nigeria. Majority of the respondents in this study area increased the use of organic manure in place of chemical manure and many other agronomic practices to increase soybean yield. Government and other agricultural stakeholder should partner with rural farmers in relevant area that can help overcome the challenges of climate change. Programs and interventions in area of input and labor that can reduced the boarding of changed in weather condition of the farm area or communities. Also, Sime and Anne, (2019) stated that to deal with rainfall unpredictability, farmers frequently practice crop rotation on the farm annually, plant crops at the appropriate time based on rainfall intensity, combine crop species, and use crop that are adaptive to the changing climatic condition. Planting drought resistant/tolerant soybean varieties, and use of irrigation facilities by many soybean farmers in the study area show how they are adopting coping strategies to enlarge crop productivity and they standard of living.According to Akintonde and Shuaib (2016), the government and other non-governmental organizations in Nigeria are helping farmers to better adapt to the effects of climate change by providing them with relevant information and other resources. Agricultural extension services can also provide pertinent weather-related information and skill development that can raise productivity. Though the techniques for adaption are limited by the current irregularity of extension services in Nigeria. The system of information sharing among the extension agents and farmers need to improve from the top-down approach to bottom-top approach because so many programs, information and support sent to the rural soybean farmers may not be what they really need to improve agricultural productivity. As such extension agents and government should learn to listen to the request and needs of the farmers by so doing programs and information packaged by government and other stakeholder will meet the needs and request of the farmers. Also, Aminu *et al.,* (2023) stated that farm size is among the socioeconomic characteristics that influence farmers vulnerability to climate change. This result implies that the soybean farmers in the study area had good experience that can help to increase soybean production efficiency because of accumulated skills, knowledge, and mastering of the climatic condition of the area.

Conclusion: The soybean farmers were young and in their productive age, majority had formal education with the ability to read and write. They were married with an average family size and majority belong to farmers association that enable them have access to extension agents. Most of the soybean farmers have been involved in soybean production for so many years therefore they are very experience in agricultural activities. The sources of financing their agricultural production are through personal saving and the source of farm land is through inheritance with no access credit facility.

Also, soybean production in the study area was profitable because the farmers were able to notice signs of climate change that affect their production. The major sources of information available to the soybean farmers in the study area include extension agents, radio, television, WhatsApp, internet/emails and fellow farmers/relative.

Recommendations: Federal government of Nigeria should take climate change challenges very seriously and formulate policies that can assist the farmers overcome its effect and build infrastructures in rural communities that can support

the farmers efforts in the delivery of goods and services. The government should collaborate with traditional rulers, youths and other stakeholders in the community to provide adequate security of life and properties. Farmers should be adequately protected both they farm land, family and communities, in that ways production of agricultural products and food security can be guarantee. Irrigation facilities and other farm inputs like fertilizers should be subsidize by the government so that the rural farmers can afford it and cultivate soybean all year round.

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Table 1.1. Distribution of Respondents by their Socio-economic Characteristics

Socioeconomic Variables	Frequency	Percent
Age		
20-30	94	20.9
31-40	133	29.6
41-50	152	33.8
51 above	71	15.8
Gender		
Female	147	32.7
Male	303	67.3
Marital Status		

Single	102	22.7
Married	301	66.9
Divorced	27	6.0
Widow	20	4.4
Household Size		
1-5	283	62.9
6-10	165	36.7
11 above	2	.4
Educational Level		
No School at all	15	3.3
Primary School	48	10.7
Secondary School	155	34.4
HSC/OND/NCE	163	36.2
BSc/HND	69	15.3
Farm Size		
1-5	190	42.2
6-10	260	57.8
Years of Practicing Soybean Production		
5-10	126	28.0
11-15	92	20.4
16 above	232	51.6
Membership of cooperative Society		
Non-Members	180	40.0
Members	270	60.0
Access to Extension Agents		
No-Access	172	38.2
Access	278	61.8
Access to Credit Facility		
No Access to Credit	293	65.1
Access to Credit	157	34.9
Credit Collected for a Farming Season		
No Credit Collected	325	72.2
100,000-200,000	38	8.4
201,000-300,000	40	8.9
301,000- above	47	10.4
Sources of Credit Facility		
Self	215	47.8
Bank	24	5.3
Family	88	19.6
Cooperative Society	114	25.3
Neighbor	9	2.0
Source of Land for Soybean Production		
Purchased the Land	39	8.7
Inherited Land	225	50.0
Communal Land	26	5.8
Leased (Rent) Land	42	9.3
Government Land Allocation	54	12.0
Family Land	64	14.2
Total	**450**	**100.0**

Source: Computed from field Data 2024

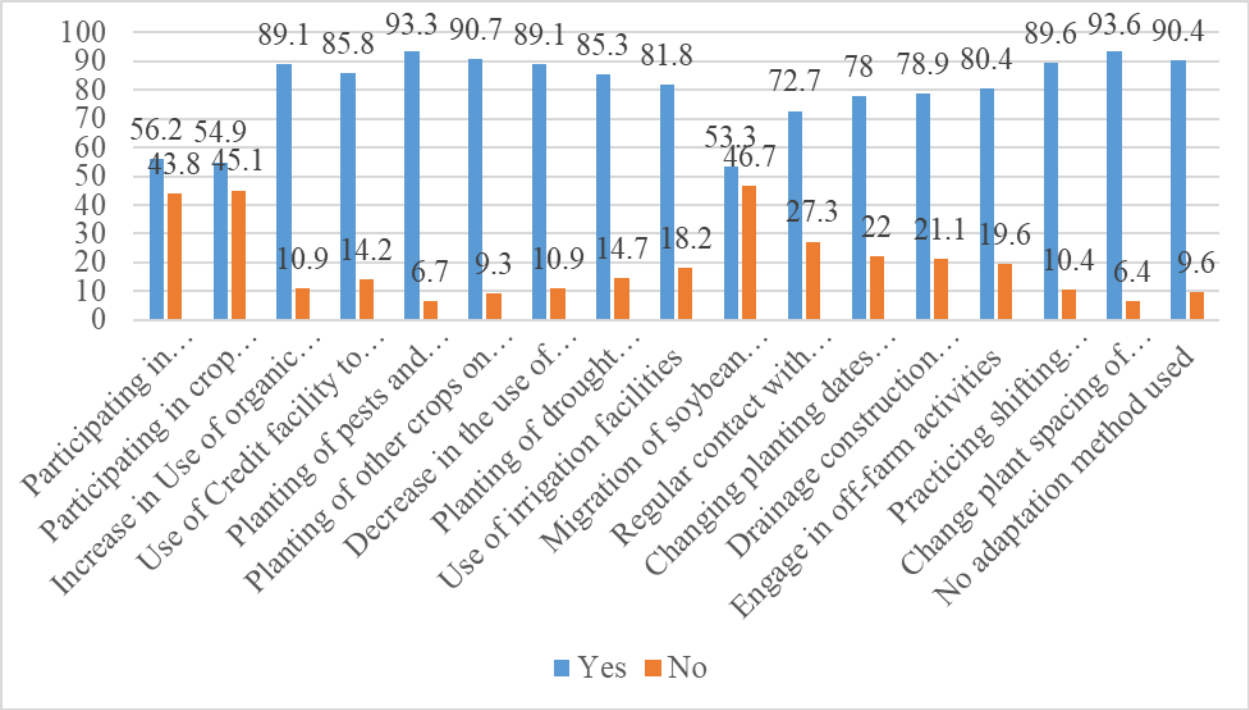
Table 2.1. Signs of Climate Change

Signs of Climate change	SA (%)	A (%)	N (%)	D (%)	SD (%)	Mean	S/D
There is a gradual reduction of vegetation cover	239 (53.1)	178 (39.6)	23 (5.1)	7 (1.6)	3 (0.7)	4.43	.722
The weather is becoming drier every year	182 (40.4)	224 (49.8)	25 (5.6)	7 (1.6)	12 (2.7)	4.24	.841
There has been increase incidences of floods during the rainy season	166 (36.9)	208 (46.2)	63 (14.0)	5 (1.1)	8 (1.8)	4.15	.831
Total rainfall is increasing every year	144 (32.0)	219 (48.7)	55 (12.2)	25 (5.6)	7 (1.6)	4.04	.897
Yearly rainfall ends early	173 (38.4)	221 (49.1)	25 (5.6)	15 (3.3)	16 (3.6)	4.16	.933
Yearly rainfall begins early	140 (31.1)	196 (43.6)	67 (14.9)	33 (7.3)	14 (3.1)	3.92	1.015
Increased temperature	172 (38.2)	171 (38.0)	73 (16.2)	20 (4.4)	14 (3.1)	4.04	1.002
Increased draught	160 (35.6)	166 (36.9)	83 (18.4)	25 (5.6)	15 (3.3)	3.96	1.035
Increase rainstorm	148 (32.9)	143 (31.8)	123 (27.3)	19 (4.2)	17 (3.8)	3.86	1.046
There is a gradual drying of water sources (rivers, streams, lakes, FADAMA lands, wells)	158 (35.1)	162 (36.0)	87 (19.3)	24 (5.3)	19 (4.2)	3.92	1.065
Early or late onset of hamattan	147 (32.7)	212 (47.1)	55 (12.2)	20 (4.4)	16 (3.6)	4.01	.974
Yearly rainfall begins late	145 (32.2)	221 (49.1)	47 (10.4)	16 (3.6)	21 (4.7)	4.01	.996

Note: N=450, SA=Strongly Agreed, A=Agreed, N=Neutral, D=Disagreed, SD=Strongly Disagreed. Weighted Average=48.74/12=4.06

Source: Computed from Field Data 2024

Figure 4.1. Coping Strategies Adopted by Soybean Farmers



Source: Computed from Field Data 2024

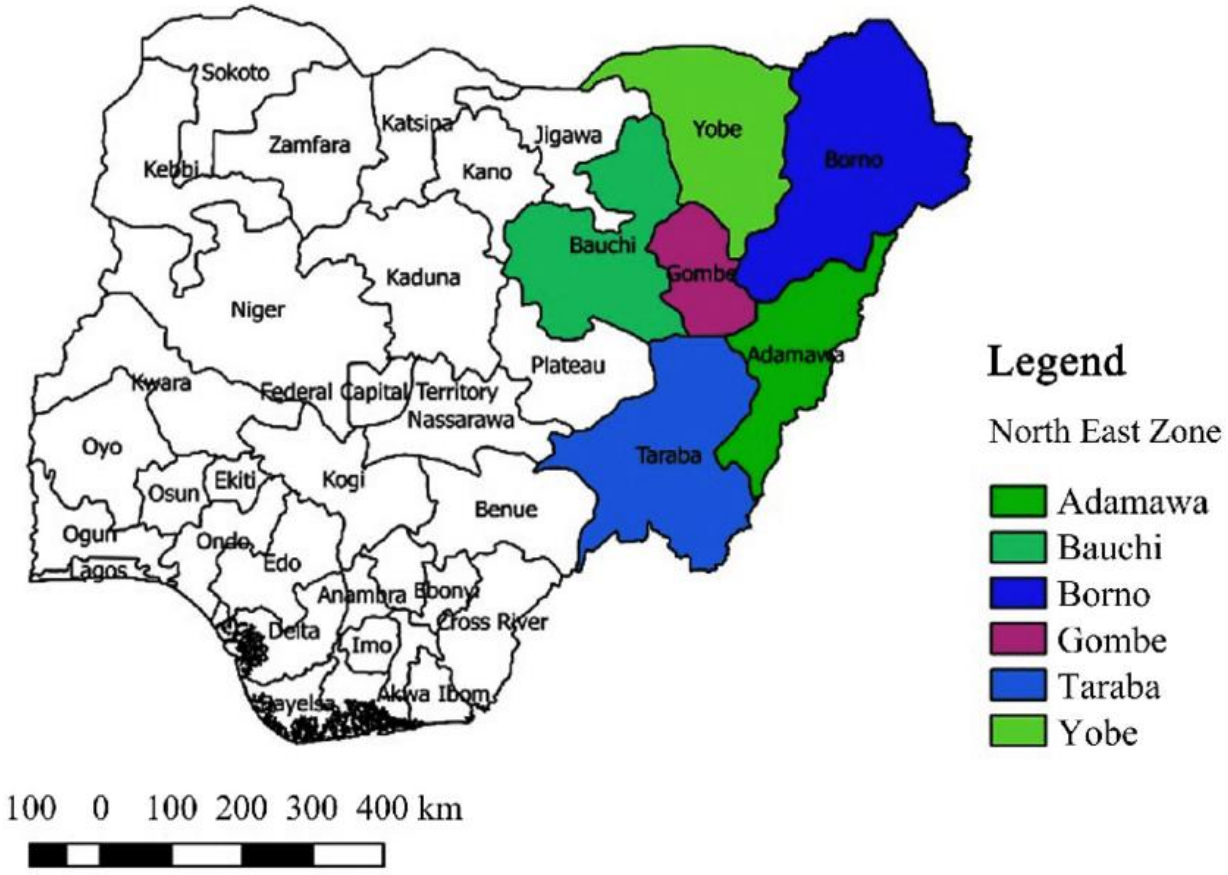


Figure 3.1: Map of Nigeria Showing North East