

Adaptive Capacity to Climate Change in the Nigerian Savannah

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Abstract

This study is based on the premise that the adaptive capacity of people and places is closely related to their demographic and socioeconomic characteristics which in turn determine their resilience. The study therefore examined the demographic and socioeconomic dimensions of selected agricultural communities in the Nigerian savanna with a view to assessing their adaptive capacity to climate change. The Nigerian savannah has been largely altered by human related activities which have reduced its capacity to support the teeming rural farming communities and the livelihood systems in the region. Livelihood systems in the region are closely associated with terrestrial ecosystems, and changes in global climate could exacerbate the conditions of the rural farmers. The methodology for the study was based on the multistage random sampling technique and Rural Rapid Appraisal (RPP) of eleven communities across ten Local Government Areas (LGAs) in two states of the southwest and north central Nigeria. Household survey, Key Informant Interview of traditional rulers and Government officials were carried out while an intensive Focused Group Discussion among all the actors was done. Both ex-ante and ex-post factors of gender, local knowledge and experience, education, income from farm and off-farm sources, ability to diversify, willingness to adapt, proportion of savings, and local adaptation mechanisms were identified and used to understand adaptive capacity of the local communities to climate change in the region. These factors provide an understanding of existing local actions which could point to future-coping and adaption strategies given emerging challenges of climate change. By upscaling the local adaptive capacity it is possible to evolve regional and national policies for improving the resilience of rural agricultural communities.

Introduction

The reality of climate change and the projected colossal impact on natural ecosystems and rural livelihood systems calls for urgent need for adaptation strategies at the community levels. Since rural communities are generally dependent on natural resources, which are sensitive to climate change, there is need for local populations to be aware of these changes and to evolve appropriate responses. Sustainable rural livelihoods and food security depend on local awareness and community responses, which in turn depend on their capacity to adjust their practices and lifestyles according to changes in climatic conditions. The global climate is highly variable and is also influenced by local conditions such as landforms; land use and land cover which are being

continuously changed by human related activities. Human activities are exploitative of natural resources and livelihood systems. In the Nigerian savannah, the teeming rural agricultural and pastoral populations are exploiting the natural resources in unsustainable ways as means of livelihood. Climate change is threatening the capacity of these ecosystems to support the teeming rural communities and the livelihood systems (IPCC, 2014; Fasona *et al.*, 2012).

The fact that the savannah region is projected to become drier has implications for land and water resources that are the basis for rural livelihoods and food security (Fasona *et al.*, 2005). Depletion of land and water resources in the face of climate change will lead to food insecurity and loss of livelihoods. Giving this backdrop, it becomes necessary to understand local coping and adaptation strategies to ensure sustainability. Sustainability of rural livelihoods and food production is connected to short-term provisioning services and the long-term capacity of ecosystems to function as climate regulator. Rural communities have a role to play in maintaining the integrity of ecosystems and preserving their functions, including food and water supply necessary for continued rural livelihood systems (Zoa, 2009). The ability of the rural communities to adapt to and cope with climate change depends on demographic and socioeconomic factors including income, technology, education, information, skills, infrastructure, and management capabilities (Folke *et al.*, 2002; Fabricus and Koch, 2004). The aim of this study is to understand the adaptive capacity of rural agricultural communities to climate change in the Nigerian savannah. The specific objectives are to analyse demographic and socioeconomic characteristics of the rural population towards building their adaptive capacity, to identify local adaptation strategies and to examine the role of local knowledge and experiences in local adaptive capacity.

Review of Relevant Studies and Conceptual Framework

There is a growing body of literature on the confluence between climate change, human livelihoods and adaptive capacity. According to the Intergovernmental Panel on Climate Change Third Assessment Report, adaptive capacity is defined as the ability of a system to adjust to climate change, including climate variability and extremes, to moderate potential damages, to take advantage of opportunities, or to cope with the consequences. As human populations grow and the environmental conditions of food production systems become highly unpredictable, the ability of rural communities to understand and adapt to these changing conditions are indispensable for sustainable livelihoods. Given the speed and magnitude of these changes, it is important to know how rural communities can quickly adapt, in what context and at what costs. Climate change refers to the potential shifts in the longer run mean and extremes of temperature, precipitation and other meteorological parameters in specific geographic areas. Longer-run climate extremes have great impact on food production affecting what crops farmers grow, when and where they grow them, and the actual tonnes of foods produced in a particular year. It also affects the incomes and responses of rural

households and communities. The ability to respond to the climate, for instance, determines a farmer's performance and food production. Burke and Lobbel (2010) identified and classified farmer's responses to climate change into two: ex-ante measures and ex-post responses. The former refers to measures taken in anticipation of future climate change and the latter are taken after the occurrence of the event.

Pandey et al. (2007) identified ex-ante measures to be strategies of diversification which include attempts to capitalise on the different effects that an anticipated climate event might have on different crops and farmer's activities in a particular year. He observed that the farmer could choose to change location of farm plots, for instance, away from drought-prone environments for rain-fed crops or grow a range of crops or crop variations with different sensitivities to climate. The farmer may similarly choose flexible timing for planting or diversify income sources to alternative livelihoods that are less sensitive to the climate. As for ex-poste strategies to decrease crop or welfare risks once climate events have occurred, Burke and Lobbel (2010) listed measures such as drawing down cash reserves or store of grain; borrowing from formal or informal credit markets or family; selling assets such as livestock or migrating elsewhere in search of non-affected areas. Furthermore, the measures could involve adopting new land and crop management practices, including replanting of quick-maturing varieties or introducing irrigation.

Meanwhile, what is of great concern is how these measures can help to improve livelihoods and food security in the rural communities towards adaptation to climate change. The sensitivity of local communities to climate change, their adaptation to reduce risks and the effectiveness of the adaptation to reduce risks are very critical in determining their resilience. Burke and Lobbel (2010) argued that not all measures are available to farmers or are sufficiently capable to reduce risks of climate change to food security and rural livelihoods. The opportunities available to farmers and consumers in developed countries during difficult times are not readily available to the poor local communities in developing countries. In developed economies available measures are social safety schemes and effective financial markets which could insure against losses, provision of credits or government incentives to maintain livelihoods and ensure that only a small percentage of their income is spent on food and are thus not very sensitive to the food price fluctuations. This cannot be said to be applicable to developing economies. The fact that both ex-post and ex-ante strategies to an extent can reduce climate-related risks does not guarantee that the poorest farmer households can fully insulate himself or his household from the effects of climate change. Hoddinott and Kinsey (2001) and Maccini and Yang (2008) have documented the failure of these measures to protect from the negative impacts of climate change on the health and economic livelihoods of the poor farmer households. This is because ex-ante measures are insufficient and ex-poste strategies, such as insurance and savings, are unavailable in developing countries. It has also been argued that

while ex-ante strategies can reduce the risk of catastrophic losses in bad years, they can also reduce the income earned in good years. It has also been argued that the ex-post strategy can lead to devastating declines in consumption in such a way that they could harm the longer-term earning potential after shrinking food production (Burke and Lobell, 2010). The reality of the threats from climate change on rural livelihoods and food security makes it imperative to help local communities to adapt. This underscores the need to engage rural communities by recognising local experiences and knowledge and robust engagement of all stakeholders including farmers, governments and non-governmental agencies to building local adaptive capacity and institutions to cope with climate change (Washington et al., 2006; Cooper et al., 2008).

The Role of Demographic and Socioeconomic Factors in Climate Change Adaptation

Building local adaptive capacity to climate change depends on demographic and socioeconomic characteristics of rural populations which may increase or limit adaptations (Chambers and Richards 1986; Chambers 1989). Among the key demographic and socioeconomic factors for building local adaptive capacity are age composition, gender, local knowledge and experience about climate change, behaviours towards climate change, livelihood activities, and income characteristics. A study of social dimensions of adaptation to climate change in Ghana identified vulnerability, pathways of impacts and assessing local adaptations based on socioeconomic conditions and livelihood systems (The World Bank 2010). By using livelihood systems of different social groups in different agro-ecological zones, the study enumerated robust strategies at both local and national levels towards sustainable development. These coping and adaptation strategies were largely related to the socioeconomic conditions of the people and their agro-ecological resources. Demographic and socioeconomic conditions are important measures for understanding existing and future coping and adaptive capacity for climate change.

Leveraging Demographic and Socioeconomic Characteristics for Rural Adaptation

Adapting to climate change in local communities faces a number of challenges. There is the challenge of discerning changes, determining how it could favour a change in behaviour, and the willingness to adopt the change (Kandlikar and Risbey 2000). The paucity of climatic data to farmers in developing countries and their literacy levels compared to their counterparts in developed nations is another challenge. This could hinder their ability to learn about new trends in climate change which often limit them to common sense for discerning changes and the application of traditional methods for forecasting future trends and decision-making. Even where the records are available, they are varied and the usefulness depends on the ability of the farmers to discern correctly the climate change (Mese-Hausken, 2004; Maddison, 2007; Thomas et al., 2007; Cooper et al., 2008). Besides, once a change has been discerned by a farmer it is another thing for him to decide how and when to change and he may just as well remain indifferent to the change. By and large, farmer's perceptions of

climate change and the potential threats and his dispositions to diversify are important factors in his response to change. Furthermore, where the farmer perceives the need to change, the choice of how and when may also be dependent on the costs and benefits of the available choices. Burke and Lobell (2010) tabulate farmers' potential adaptation to climate change with some reasons why these strategies might or might not work (Table 1). The prospect of rural adaptation is, therefore, based on a number of social and economic characteristics as further emphasised in the table. Indeed, the link between adaptation and development further make the case for indispensability of social and economic factors. The choices and actions of rural communities are explained by their social and economic circumstances.

Table1: Climate Change Adaptation Choices and Strategies

Adaptation Strategies	Why they might work	Why they might not work
Shift planting date	Take advantage of lengthened growing season	Less useful where current growing season length is not limited by cold temperatures
Switch methods	Other existing methods better suited to new climates	More suitable varieties not always available
Switch crops	Other crops more suitable to new climates	Hot countries have nothing to switch to
Expand cultivable area	Climate change could expand suitable area	Less true in the tropics; possible soil constraints; expansion may come with significant environmental costs
Explore irrigation	Helps alleviate moisture constraints	Can be expensive; often requires large government investment; many places have limited water resources
Diversify income	Off-farm income sources less climate sensitive	Rural off-farm economy linked to agricultural productivity
Migrate	Some areas might be hurt less than others by climate Change	Urban areas already strained

Source: Adapted from Burke and Lobell (2010)

Methodology

This article is derived from a larger study on community based management of ecosystems and natural resources for the improvement of rural livelihood and food security in the wooded savanna funded by the Global Change SysTems for Analysis, Research and Training (START) through the Global Environmental Change Research in Africa. The methodological framework adopted for this aspect of the study entails detailed social surveys, household surveys key and informant survey and focused group discussions. This was based on multistage random sampling technique and Rural Rapid Appraisal (RPP) of 11 communities across 10 Local Government Areas (LGAs) in two states of the southwest and north central Nigeria. Site visits, Key Informant

Interview of traditional rulers and Government officials were carried out while an intensive Focused Group Discussion among all the actors was done.

i. Data Collection and Analysis

The total sampling frame is over 2000 communities. A multistage stratified random sampling was adopted. The first stage involved setting criteria for candidate community for selection. The criteria were as follows:

- The community must not be more than 5km away from a forested land or woodland in order to be able to connect livelihood to forest or woodland. This is based on the assumption that the more isolated a forested or woodland landscape, the less the risk of disturbance;
- Communities around protected areas have higher chance of being selected. This was to allow us probe into how resource use conflicts are managed between community and park managers and to also understand their concept of alternative livelihoods; and
- The community must be a rural or semi-urban. This is based on the assumption that the natural resource capital is more important to livelihood and food security in rural and semi-urban areas than urban areas.

From the preliminary list of over 400 communities that satisfied the above criteria, another stage of stratified random sampling was used to select 42 community clusters across 21 LGAs mainly in Oyo and Kwara states. A pilot survey was carried out on the 27th and 28th December 2011. Based on the results from the pilot survey, the sample size for the final survey was further reduced to 11 communities (total estimated population of about 140,000). These communities were spread across 10 LGAs in Oyo and Kwara states. The final survey was conducted from the 5th to 9th February 2012. The final sample size was 191 households (see Table 2).

Three sets of questionnaires/interview guide were designed for households, key informants/focused groups and government (Local and State Government) offices in charge of natural resources and related agencies. The questionnaires were designed to capture demographic and socioeconomic characteristics as well as the ex-ante and ex-post strategies of individuals, households and communities towards adaptation planning for climate change. Five focal group discussions with selected men, women and youths in the communities were convened in Sepeteri, Igboho, Ipapo, Orile Igbon and Baasi. Four traditional rulers were engaged in Iganna, Ikoyi Ile, Agbonda and Yaaru for the key informant interview.

Key informant interviews were conducted with government officials at the state and local government levels as well as the officials of the Old Oyo National Park. Descriptive statistics such as frequency and cross tabulations in the Statistical Package for Social Sciences (SPSS) was used to analyse the demographic and socioeconomic variables towards understanding local adaptive capacity for climate change in the Nigerian savannah. The recorded

audio and text proceedings of the KII and FGD were transcribed and incorporated in the presentation of results.

Table 2: Surveyed Communities and Household Respondents

S/n	State	LGAs	Communities	*Population (1991)	**Population (2012)	No of selected household respondents	Percent of respondents to total respondents
1	Kwara	Ifelodun	Yaaru	1222	1961	22	11.5
2	Kwara	Ifelodun	Idofian	5519	8857	16	8.3
3	Kwara	Irepodun	Agbonda	1030	1653	13	6.8
4	Oyo	Surulere	Orile Igbon	219	351	14	7.3
5	Oyo	Saki East	Sepeteri	12317	19766	22	11.5
6	Oyo	Iwajowa	Iganna	17666	28350	17	8.9
7	Oyo	Orellope	Igboho	38871	62380	19	9.9
8	Oyo	Olorunsogo	Dogo	450	722	10	5.2
9	Oyo	Itesiwaju	Ipapo	5962	9568	19	9.9
10	Oyo	Orire	Ikoyi-Ile	3328	5341	23	12.0
11	Oyo	Atisbo	Baasi	541	868	16	8.3
				87125	139817	191	100

Source: *National Population Commission 1991 **Estimates based on 2.83 annual growth rate.

ii. The Study Area

The study area is approximately demarcated by Latitudes 8° to 9°15' North and Longitudes 3°50' to 5°50' East. It covers about 40,000km² spanning parts of Oyo, Kwara and Niger State in West-Central Nigeria (Fig 1). The vegetation type is derived from savannah which is dominated by mixture of forest and woodland interspersed with tall grasses and fire-resistant trees. The tree cover is as much as 30%. This zone continues to expand to the south as more forest land is degraded (Bucini and Lambin 2002; Hoffmann and Jackson 2000). The protected forest of the Old Oyo National Park (OONP) is the most significant forest unit in the study area. A number of other forest reserves exist but have been significantly degraded by uncontrolled human population and activities. The study area is also a very important headwater for several important rivers including the Teshi, Moshi, Asa, Oro and Kampe rivers that flow into the Niger River and Ogun, Ofiki, Oba and Oyan Rivers which flow southwards towards the Atlantic Ocean (Fasona et al., 2013).

Meanwhile, the climate of the study area is characterised by a sub-humid Koppen's *Aw* climate (an equatorial savanna where minimum precipitation is less than 60mm in dry season (Kottek et al., 2006)). Fasona et al. (2013) and Omotosho and Abiodun identified rainfall as the limiting factor of land-cover and human activities in the study area. Population density is relatively high and survival for large rural communities depends on small-holder rainfed agriculture (Afiesimama et al., 2006; Fasona et al., 2007; Odekunle et al., 2005). Other observable means of livelihood in this area include charcoal

production, firewood collection, hunting, herbs and seeds collection and local processing of farm products (mainly cassava) provide supplemental income. The rich undergrowth makes the study area a hotspot of extensive grazing lands for nomadic agro-pastoralists, especially in dry season. One notable characteristic of the study area is high tendency for conflict related to resource use (Fasona and Omojola, 2005).

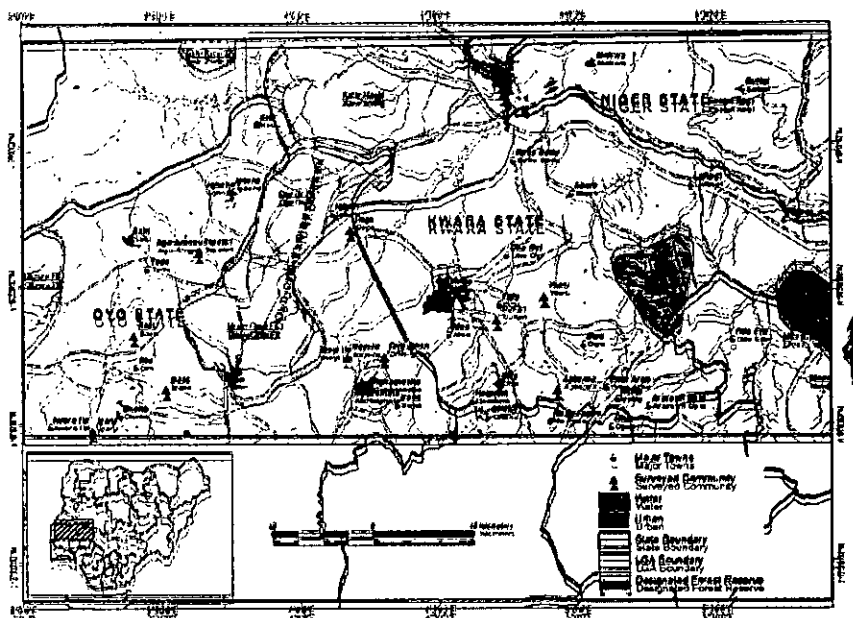


Figure 4: The Study Area (Source: Fasona et al., 2012)

Results and Discussions

Demographic and Socioeconomic Characteristics

Demographic and socioeconomic characteristics are important factors to understand the responses and adaptive capacity of the surveyed communities to climate change. The study surveyed eleven communities including Bassi, Sepeteri, Igboho, Iganna, Dogo, Ikoyi-Ile, Ipapo, Yaaru, Idofia, Agbonda, and Orile-Igbon. The total number of respondents from these communities was 191, with Ikoyi-Ile having about 12.0% of the total respondents; Yaaru and Sepeteri had an equal number of respondents (11.5 %) while Igboho and Ipapo also had the same number of respondents (9.9%) each. Iganna has 8.9% respondents while Idofia and Baasi had 8.3% of respondents each. Dogo had the lowest number of respondents representing about 5.2 % of the overall respondents of the study area. This is not unconnected with their population size. Meanwhile, seven (63.3%) of these communities fall within Oyo State boundary while the rest four (36.3%) belong to Kwara State.

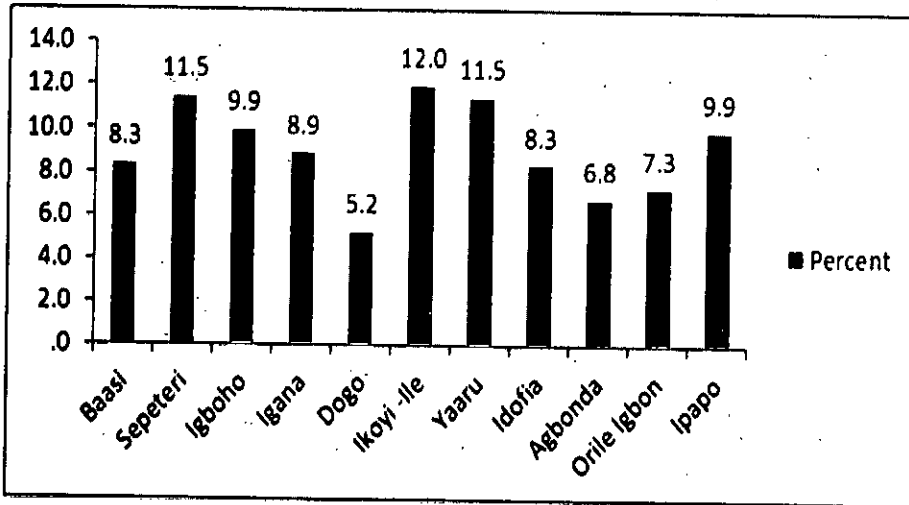


Figure 3: Sampled sizes of selected communities

The respondents of these agricultural communities were mostly male. The male gender accounts for 70% of the total respondents with a total number of 134 respondents. This is because of the predominant nature of farming as an activity associated with males and their predisposition to respond to interviews. The female respondents represent 29.2% of the total sampled population. The proportion of male to female could be significant in the analysis of adaptive capacity along gender lines.

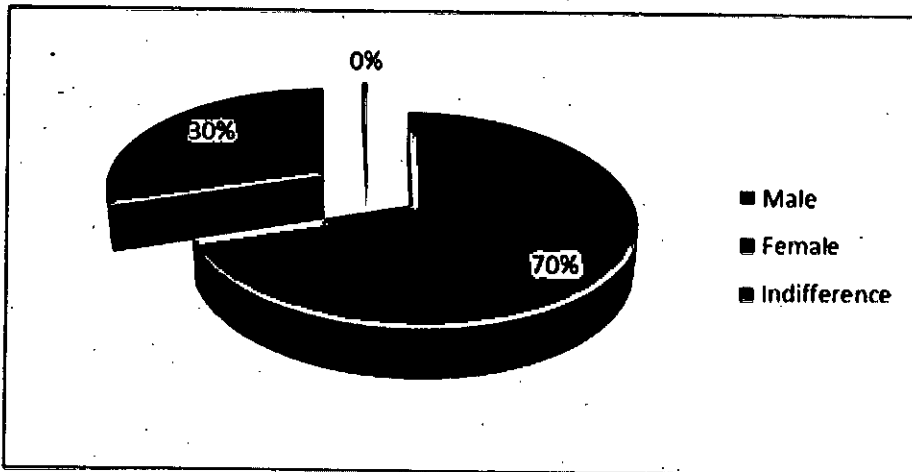


Figure 4: Sex of Respondents

The marital status of the respondents revealed that 76% are married, 15.6% are single while the remaining 3.1% have either lost their spouses or divorced. This analysis also depicts that the respondents were adults and matured, a fact which could play an important role in their adaptive capacity. Also, the high number of married respondents could influence local adaptive capacity as marriage could contribute to emotional stability.

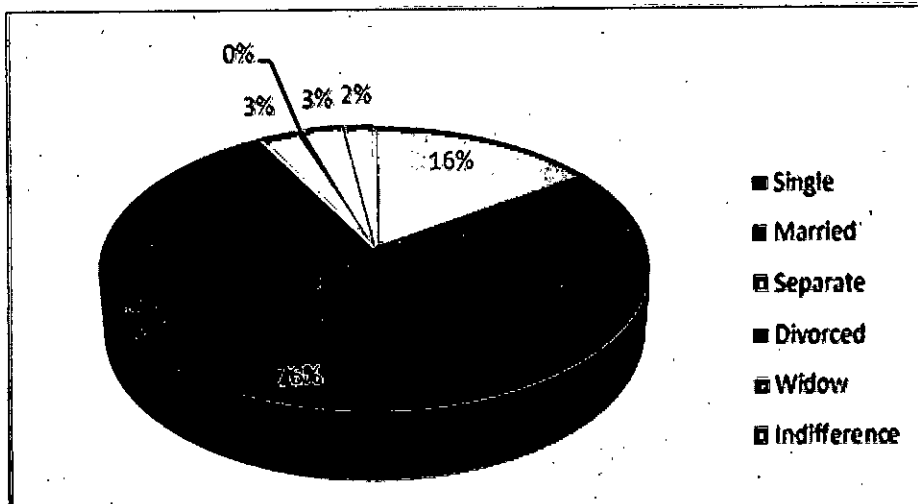


Figure 5: Marital Status

The analysis of household size shows that a household size of 4-7 people accounts for 38% of the total respondents while 29% of them fall within the household size between 8-11 persons. Large family sizes are considered an asset to rural farming households because they play important roles in farming activities. However, large family sizes could be a serious burden to poor rural farming households if agricultural production should fall in the era of climate change.

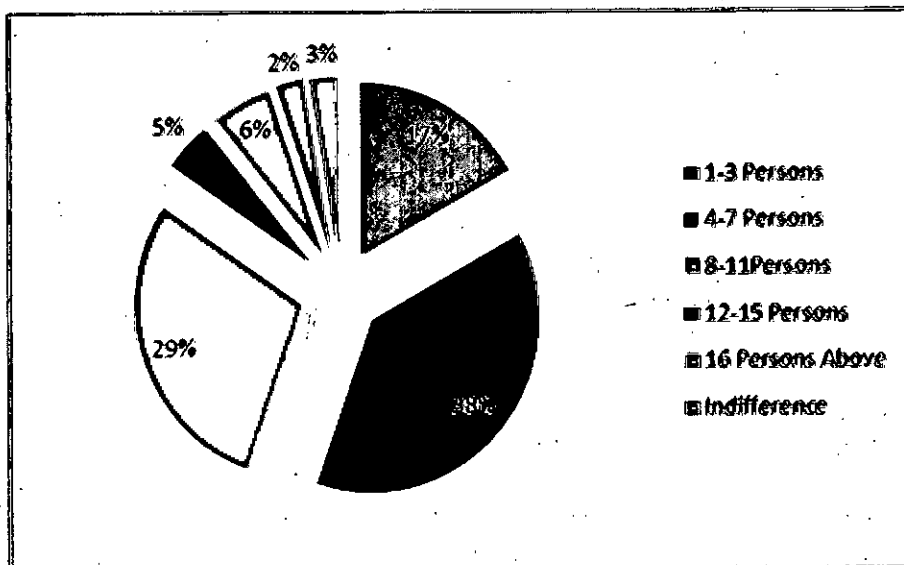


Figure 6: Size of households

The analysis of the number of adults in households shows that 70% of the respondents have 1-3 adults in their households. The respondents that indicated that the number of adults in their households was 4-7 persons accounts for 19%; those with 8-11 adults represents 2% while 9% were indifferent. The number of adults in the surveyed households could influence the nature and types of decisions towards adaptation strategies to climate change.

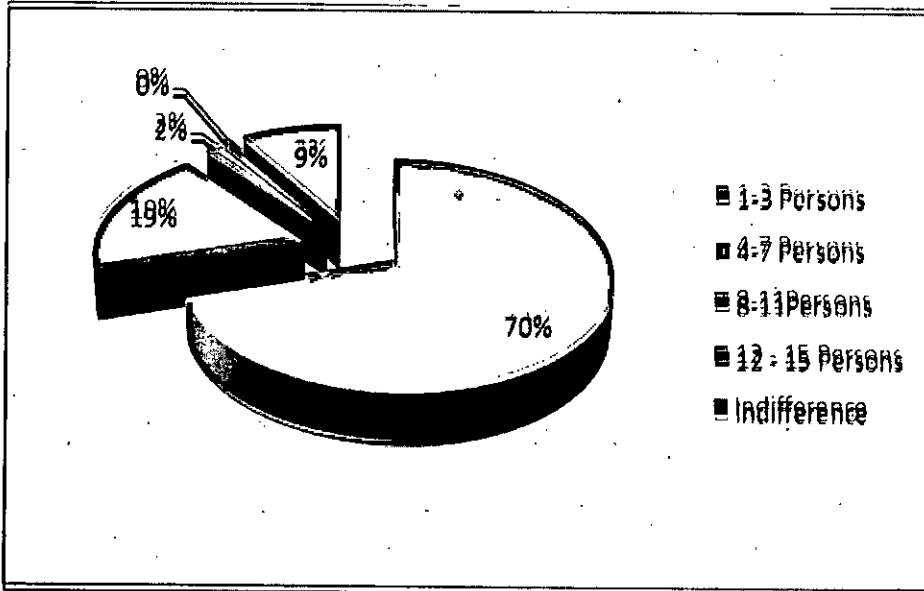


Figure 7: Number of adults in households

Similarly, the analysis of number of youths in households indicated that 46.9% have 1-3, 16.1% have 4-7 and 6.1% are with more than 8 youths. Relatively, a large number of the respondents did not indicate the number of youths in their family. Youths are very energetic and this could enhance adaptive capacity to overcome the stress associated with climate change.

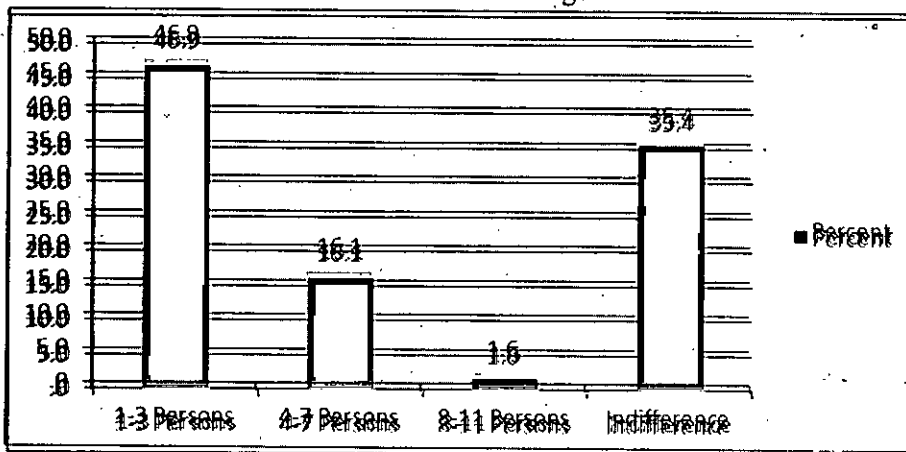


Figure 8: Number of youths in the family

Length of stay is useful in assessing local knowledge and experience with serious implications for knowledge of climate change and the ability to adapt. The analysis of length of stay in communities revealed that those who have lived between 21 to 30 years account for 27% and those that have lived for below 10 years represent 23%. 17% have lived for between 30 to 40 years and 13% have lived for between 40 to 50 years. In contrast, those that have lived for between 50 to 60 years account for 4%.

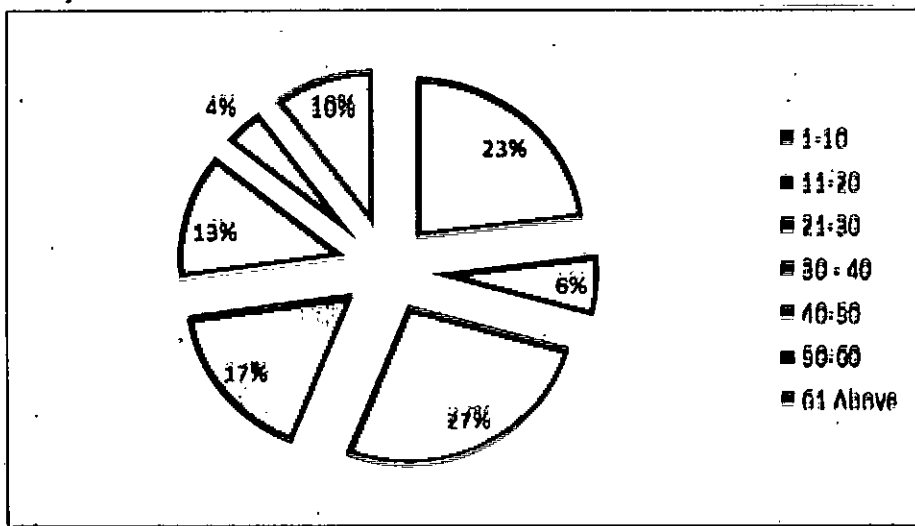


Figure 9: Length of stay in the study area

Similarly, the level of education of people may influence how they reason or behave, embrace new ideas and adapt to changes in the era of climate change. The analysis of the educational status of the respondents shows that those with no formal education and those who completed primary education represent 31% and 30% respectively. Similarly, about 23% completed secondary education and 12% have post-secondary education. Educational attainment is very crucial for knowledge-based decisions and choices in the context of climate change.

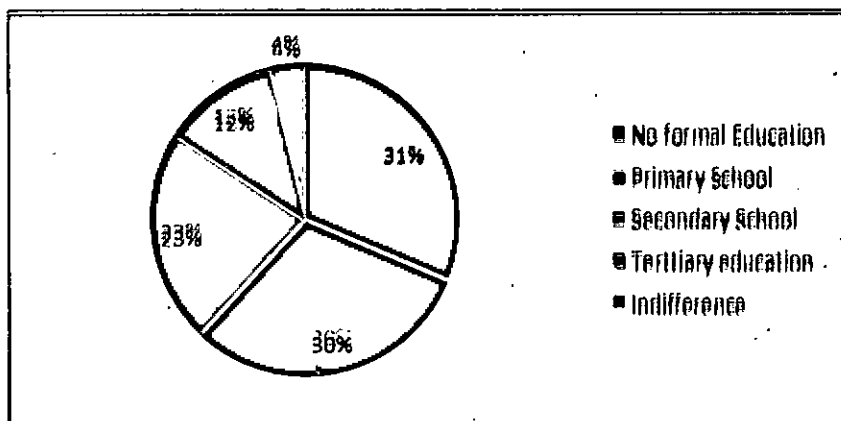


Figure 10: Level of highest education

Inclusive gender participation is expected to enhance adaptive capacity. The analysis of the level of gender participation in farming activities provides a very useful result. The result of the analysis revealed that about 58% of the respondents indicated that males play the most prominent role in farming while only about 4% indicated that females play the most leading role in farming. However, 32% of the respondents indicated that prominent roles in farming are undertaken equally by both male and females in the study area. Only 6% of the respondents were indifferent.

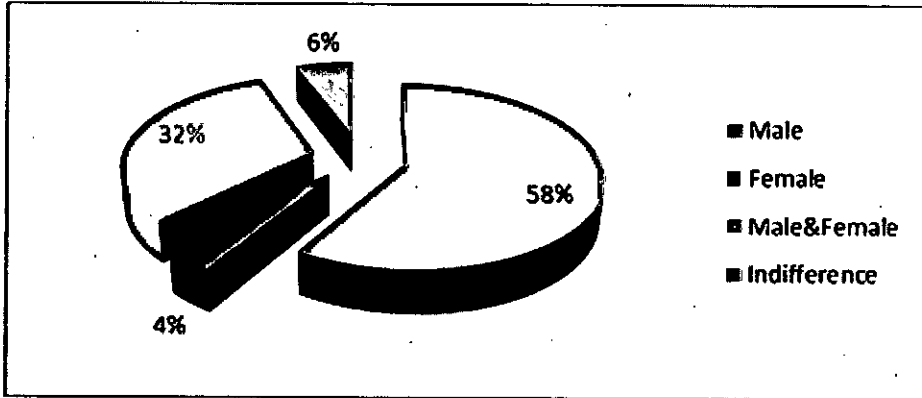


Figure 11: Gender and involvement in farm activities

In addition, a diverse age composition is also very essential for building local adaptive capacity. The analysis of the prominent age group involved in farming shows that both youth and old persons are the highest, representing about 40% of the respondents. In the same breadth, 24% of the respondents indicated that only youths play a prominent role in farming activities while 15% indicated that it is all of children, youth, and old that play prominent roles in farming. It is only about 9.9% of the respondents that shows that old people play a prominent role in farming. The respondents who indicated that it is children were 2.1%, while 1.6% chose both youth and children as playing prominent roles in farming.

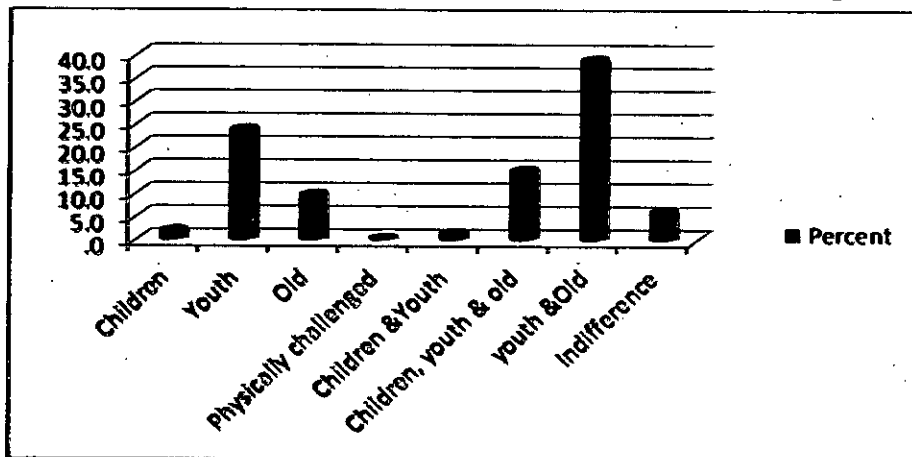


Figure 12: Age groups who play prominent roles in farming

Types of occupation in the surveyed communities explain livelihood systems which include farming, processing, trading, and formal activities. The analysis of types of occupation in the study area suggests that farming is the most popular. The respondents that indicated they are farmers account for 65.1% of the total respondents; 4.2% indicated that they work in the formal private sector such as schools, banks, health facilities, etc. Those who work in the public sector, otherwise known as civil servants, represent about 3.1% of the respondents. Students and unemployed people among the respondents represent 7.3% and 3.1% respectively, while those that did not indicate their employment status account for 1.6%.

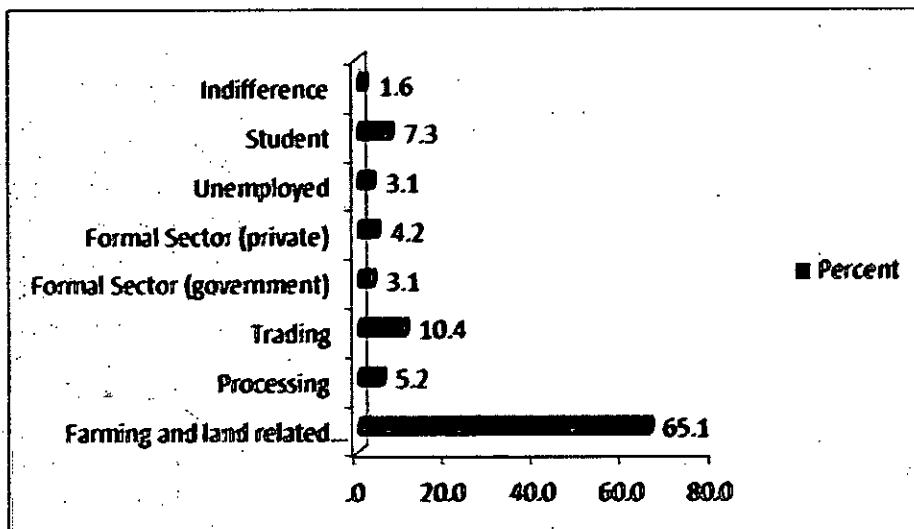


Figure 13: Types of occupation

The income characteristics revealed the financial asset for possible choices and strategies to build adaptive capacity for climate change in the surveyed communities. The analysis of the monthly income of the respondents reveals that those earning below N7,500 account for 17.7%, between N7,500- N10,000 represent 20.8% while those with income between N10,001- N20,000 and N20,001- N30,000 represent 19.3% and 13.5% respectively. Those that indicated their income per month to be between N30,001- N50,000 are 8.95%. The highest monthly income (N50,000) represents the lowest percentage of the respondents (about 7.3%). About 12.3% did not disclose their monthly income. This may be due to their inability to take record of income or their unwillingness to disclose their income.

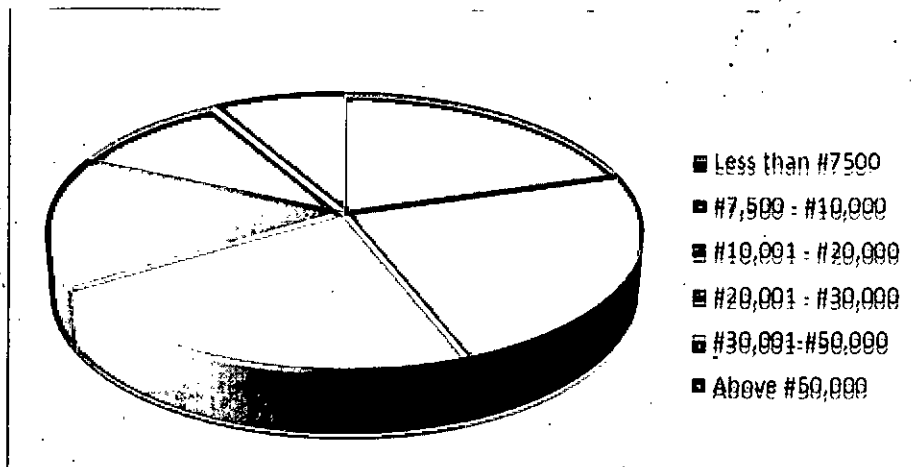


Figure 14: Monthly income of respondents

The analysis of other sources of income of respondents shows that 45.5% of the respondents have other things they do to get more money to augment their incomes while 9.4% of the respondents were indifferent. Only 11.5% of the locals do not have any other sources of income aside their main occupation. Those that indicate that their main occupation is not farming but engage themselves in it to augment their income include drivers, artisans, clerics, etc., and this category accounts for about 9.9% of the respondents. Furthermore, some of the respondents are house owners or landlords and therefore get income from rents and they represent 6.3% of the respondents. Those who get money from their friends, siblings, children living within or outside the communities are 4.7%, while 7.3% and 5.7% of the respondents get additional income from co-operative ventures and pension schemes respectively. This indicates multi-stream incomes that could provide some cover during shocks from climate change impacts.

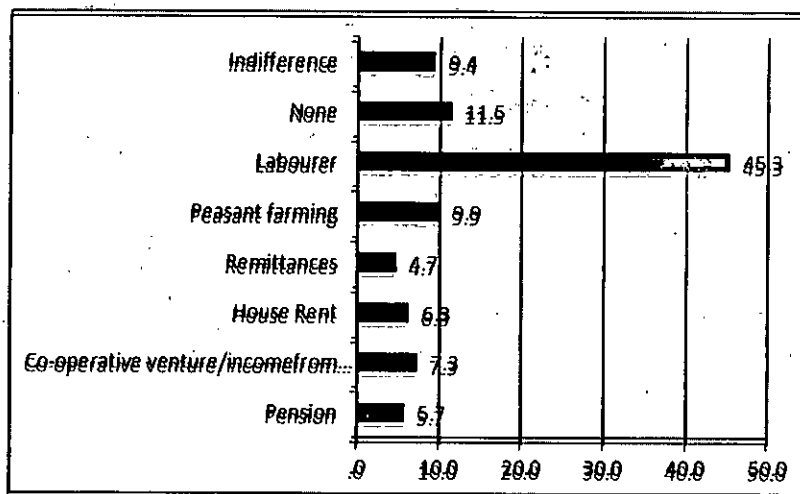


Figure 15: Additional sources of income

Household savings have implications for investments in local choices and strategies to build adaptive capacity. Unfortunately, most of the respondents spend much of their household income on present needs without saving for the future. This is typical of peasants who are largely subsistence farmers. This explains the high level of poverty in these predominantly rural communities and could predispose these populations to vulnerability and thus limit their adaptive capacity to climate change. The analysis of savings shows that 1%-10% of the household income of the respondents is saved. Respondents that saved between 11%-20% of their household income accounted for 11.5% of the total, 9.9% indicated their savings constitute 21%-30% of their household income while a paltry 1% of the respondents save 31%-40% of their household income. The respondents, who do not save at all, together with those who cannot estimate their household savings, accounted for about 21.4% of the total respondents.

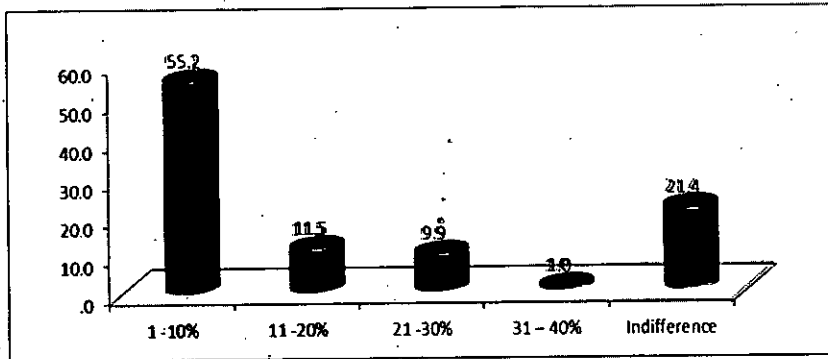


Figure 16: Percentage of household income saved

The analysis of coping mechanisms to ameliorate climate change shows that about 30% of the respondents indicate that they have been adapting themselves to the changing climate through the judicious use of local assets, while 21.9% of the respondents have no coping strategy. Also, about 3.1% of the respondents use fertiliser application to boost crop yield as another coping strategy. Similarly, about 1.6% of the respondents uses the method of shifting cultivation while those who embark on artificial supply of water to supplement the insufficient rain account for 4.2% of the total respondents. Those who do not know what to do are 17.2%.

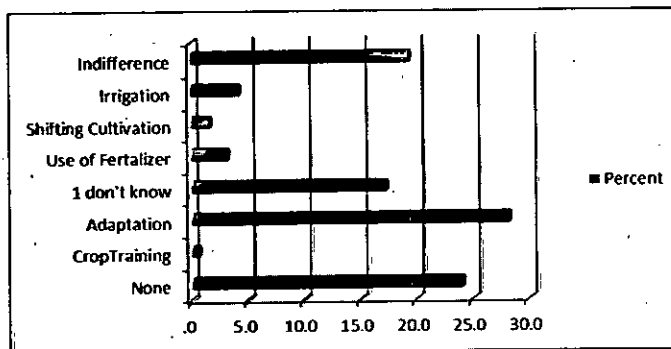


Figure 17: Coping strategies for ameliorating climate change impacts

In like manner, analysis of methods to improve farming activities in the face of insufficient rainfall and fluctuations rainy seasons shows that local farmers are aiding their farming activities through resort to irrigation, which was not part of their usual or routine farming practices. About 35.4% of the respondents indicate that they deploy irrigation and organic farming to improve their farming, 22.4% use irrigation and rain harvest, while 17.7% of the respondents, most especially the aged, hire labour to help them do their work such as bush clearing, heap making, etc. Other less common practices include irrigation (4.2%), organic farming (3.6%), while domestication of plants and animals represents 3.6% of the total respondents surveyed. Another method of improving farming activities in these communities is mulching. The results of the interviews from KII and FGD revealed that irrigation is just becoming popular in the study area, and this validates the fact that the recent weather conditions are unfamiliar, thus revealing their level of awareness of climate change.

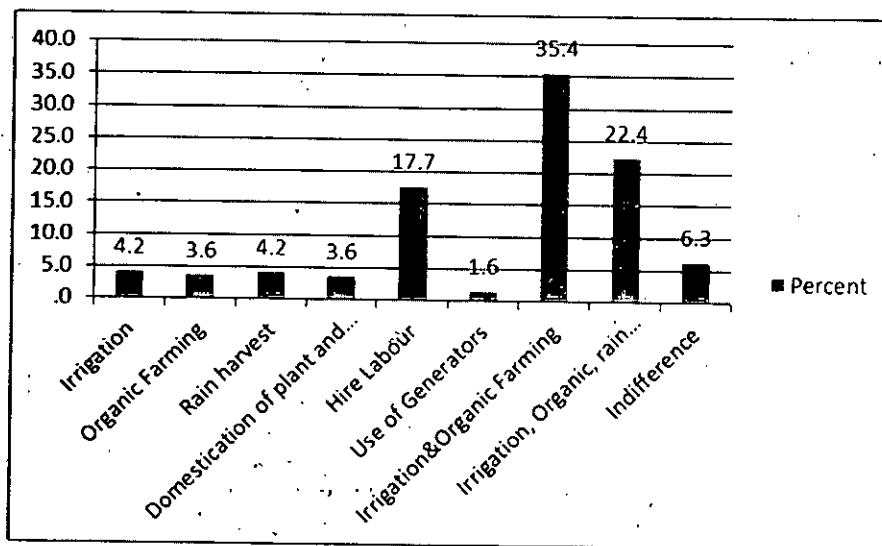


Figure 18: Method of improving farm activities

Analysis of sources of food supply reveals that about 52.6% of the respondents get most of their food from their farm. This is an expected situation. However, the analysis of the KII and FGD with some of the locals including traditional rulers and opinion leaders show that no individual gets all the food he consumes throughout the year from his farm alone. For instance, they eat rice but they do not cultivate it. Meanwhile, those who indicate that they get their food from their farm and relatives represent 3.6% of the total respondents, 19.8% represent those who get their food from farm but still purchase from others. In the same vein, about 15.6% of the respondents indicate that their only source of food supply is through purchase and exchange. This set of respondents is the non-farming population. Moreover, only 1% depends entirely on relatives for food supply. This represents the aged respondents who could not farm anymore. These scenarios are very critical for understanding food security and adaptive capacity to climate change.

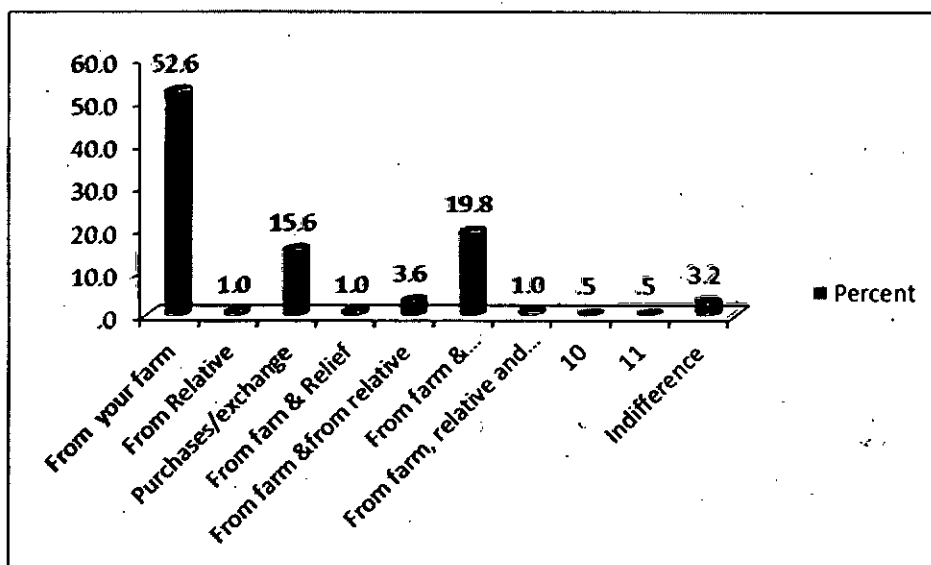


Figure 19: Sources of food supply

The analysis revealed that the most important crops contributing to the economic development of the study area are yam and cassava. The respondents that indicate cassava as the backbone of their economic development represent 18.8% while those that indicate yam account for about 15.1%. Meanwhile, some 9.4% of the respondents indicate that it is a combination of yam, maize and cassava that helps their economy. Similarly, about 6.8% of the respondents indicate that it is yam and maize, 3.1 % tomatoes while the combination of cassava and maize or cassava and yam account for 2.6% each of the respondents.

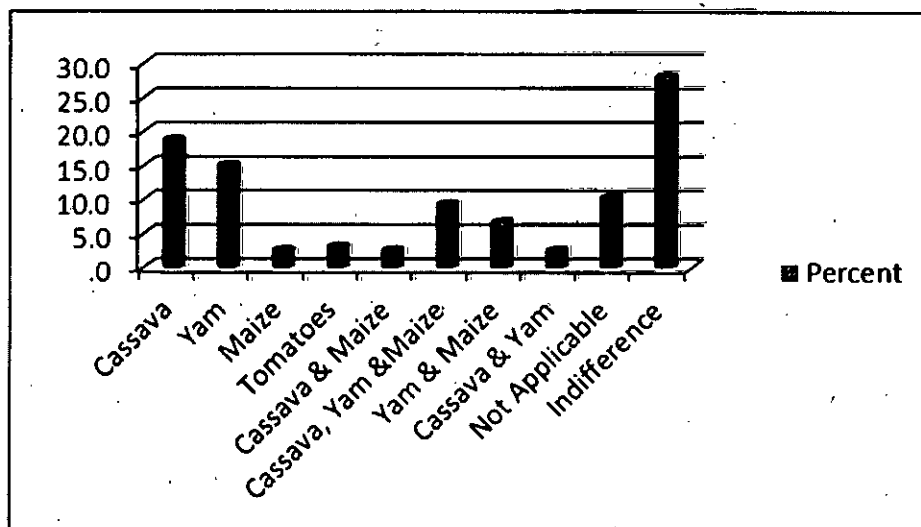


Figure 20: Important farm produce contributing to rural economic development

Summary and Discussions

This study has focused on the adaptive capacity to climate change in the Nigerian savannah. Building local adaptive capacity to climate change is closely related to the demographic and socioeconomic conditions of local communities. This is important for understanding factors which could increase or limit adaptive capacity to climate change at the local level. This could then be upscaled for regional or national policies for sustainable rural development. The farming communities used both the ex-ante and ex-poste strategies for coping and adapting to emerging climate change. The demographic and socioeconomic dimensions of adaptive capacity to climate using the factors of gender, age composition, marital status, proportion of adults and youths in households and size of households of the respondents reveal how typical rural farming communities respond and adapt to climate change. These factors are what could increase or reduce resilience of rural farmers and their households to climate change impacts.

Due to widespread poverty and the variable nature of the climate, the surveyed rural communities are sensitive to climate related shocks which resulted in ex-post coping and adaptation as corroborated by both household surveys, KII and FGD. The common adaptation strategies adopted by the agricultural communities include use of fertiliser, rain-harvesting, irrigation, organic farming, shifting cultivation, and domestication of plants, crop training or a combination of two of these methods. Available livelihood systems including non-farm activities such as charcoal production, firewood harvesting, agro-based processing and trading offer great opportunities and assets for local farmers and their households to explore alternative activities which could provide multiple streams of income. These show that they could be protected from unexpected shocks from climate-sensitive natural resource-based activities while their incomes from non-farm activities could guarantee sustainable livelihood systems under climate change scenarios.

It is rather worrisome that the culture of savings is very low in these communities which cannot be divorced from their poor incomes from farm-based activities. This will require provision of external supports and incentives in form of insurance, loans and trainings to promote food security. Moreover, it will be appropriate to improve existing strategies for food security such as improved storage, food processing and packaging to enhance rural economic development and to promote local industries as indicated by the results of the KII and FGD. This will further create jobs and increase income among rural farming households in this region.

Recommendations

There is need to promote access to support systems for improved food security. Policies for rural development should encourage alternative livelihoods, adaptation of new technologies and incentives for behavioural change such as the culture of savings and multi-stream incomes. There should be a rural development policy to increase opportunities and prospects of non-farm

activities to cushion the effects of climate change on rural farming populations. The identified strategies for ameliorating climate change and improving farm activities must be developed sustainably to ensure rural adaptation. There should be efforts to encourage agro-based processing and improved packaging of agricultural produce for increased earnings and for development of local industries and the economy.

Conclusion

Demographic and socioeconomic dimensions provide verifiable bases for understanding adaptive capacity which could point to how communities think and behave, indicating the strengths and preferences of rural communities for building resilience. Understanding local coping and adaptive capacity to climate change can also be upscaled for regional and national policies towards building the resilience of rural agricultural communities. This is very critical for promoting food security in rural agricultural communities under climate change scenarios. In addition, the fact that both ex-ante and ex-post factors were adopted by the surveyed communities underscores their understanding of the reality of climate change, given their local knowledge and experiences which cannot be overlooked in local adaptation planning.

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