

RURAL CLIMATE AND ADAPTIVE STRATEGIES FOR SUSTAINABLE FOOD SECURITY IN AKUNGBA-AKOKO, NIGERIA

Abiodun Daniel OLABODE*

Department of Geography and Planning Sciences, Adekunle Ajasin University Akungba-Akoko, Ondo, Nigeria.
e-mail: olabiodun4real@gmail.com

Elisha Ademola ADELEKE

Department of Geography and Environmental Management, University of Ilorin, Nigeria
e-mail: adelekeelisha@yahoo.com

Abstract: Nigeria is highly vulnerable to the impacts of climatic influence on accessibility to quality food. Thus, this study focused on how people relate to the climatic condition with emphasis on improving crop production and the challenge of food insecurity. Systematic method was adopted for distribution of one-hundred and twenty copies of questionnaire among the head of the households. The sampling method involved selection of every 15th building with copy of fifteen questionnaire in each of the eight (8) quarters that made up the entire study area. 3-points Likert scale was adopted. Poor food production results from increased temperature and irrigation deficiency. Among all other adaptive measures adopted in response to climate impact on food production in this area, only irrigation system was rejected because its Mean Weight Value at 1.73 is below the 2.07 Grand Mean Weight Value. Intensive agricultural practices with irrigation-based system of farming is capable of producing crops with required moisture under diverse climatic conditions. Descriptive statistics such as tabulation and simple percentages were also employed for data analysis and presentation of results.

Key words: Rural Climate, Adaptive Strategies, Crop, Food security, Irrigation, Nigeria,

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INTRODUCTION

The focus of many researchers is on increasing warming of the globe propelled by various human activities. Though, all the happenings around us may not be specifically attached to global warming alone, but various researches prove that issues bordering on global change today are mostly precipitating from increase in the earth's temperature. Nigeria has for long been subjected to the influence of climate change with daily temperature increase. The increasing rate of heat in urban areas for instance, has become one of the striking problems in many of the developing countries. Daily increase in temperature tends to worsen and continuously becoming threat to human existence. This assertion according to Wilby (2003), Oke (1973) and International Panel of Climate Change (2007) had been a central theme among climatologists and it is well documented by many scholars around the world.

* Corresponding Author

In another dimension, micro climate has long subjected most of the rural areas in the country, where major food production come from to bare lands. Though, attentions have not been properly devoted to studying climatic influence on rural development; the fact is that factors like rainfall anomalies and prolonged dry season pose serious concern on the sustainable farming activities in rural areas. The situations here can be generally established under two phases of environmental challenge that: water holding capacity in soil would become so low and lack enough water that is necessary to support crop growth, and abnormal excess water will create cold climate that will impair normal plant development and reduce crop production. This shows that crop yield and moisture availability should be mutually connected and that water should be available in good quantity to support crop growth and development to enable sufficient food production from time to time.

Crop yield is one of the important variables in a given society being the major source of food and income for farmers. Climatic variations could have negative and positive impact on this variable. Though, studies have confirmed that climatic influence on crop growth and development is based on management practices employed by the rural farmers. However, farmers who only depend on inherited farming methods will have different approach in terms of coping strategies to climate change in general. The issue here is based on the level at which rural farmers understand the phenomenon called “Climate Change” visa-vis the adopted adaptation mechanism.

The truth is that most urban environments largely depend on rural areas for food supply. It is likely for such regions that feed on rural areas to experience loss of food production due to the burden of population increase, heat generation tendency and increased reliability. This is because lack of population control, efficient adaptation strategies to climate change and ability to prioritize intensive farming methods are capable of reducing yields of major crops such as wheat, rice and maize.

Iheanacho and Abdullahi (2006) stated that food is a basic need for sustenance of life which has to be provided to maintain good health and optimal performance. In view of this, food must be available in adequate quality and quantity (Umar et al., 2008). Food insecurity according to Quandt et al, (2001) is limited or unavailability of certain nutrition and safe foods, especially, the inability to acquire major acceptable foods within a social time frame. The World Bank (2006) reports that global food prices rose 83% over the last three years; while the Food and Agriculture Organization (2007) cites a 45% increase in the world food price index. According to International Food Policy Research Institute (2006), the global food security crisis jeopardizes the lives of millions of people in vulnerable communities, particularly in Africa where poverty, malnutrition and death from hunger strife.

Nigeria, like any other countries of sub-Saharan Africa is highly vulnerable to the impacts of climate change (NEST 2003), with increased influence on reduced accessibility to quality food. It is on this premise that this study was focused on addressing how people relate to the climate condition of their rural environments with emphasis placed on their cultivation practices. The continuous improvement on rural crop production in the face of climate variation with relationship to food security challenges in the nation was another concern of this study.

STUDY AREA

The study area is Akungba, a town in Akoko South-West Local Government Area of Ondo State in the Southwestern Nigeria. It is about 56 km away from Akure the state capital of Ondo State, and located between latitudes 7°28' and 7°0' N of the equator and longitudes 5°44' and 5°0' E of Greenwich meridian. The people are mainly farmers, planting food crops such as Yams, Maize, and Plantain among others. The population of this area according to National Population Commission (2006) is 15,579 consisting of major ethnic groups that include, Yorubas, Igbos and Hausas.

The climate of the study area is equatorial with two peaks of rainfall and a dry season. The two peaks of rainfall made up the wet season in the study area. The first peak comes up between April and July while the second peak falls between late August and October. These two peaks are

marked by heavy rainfall with the mean annual rainfall of 1500-2000 mm. The dry season is between November to March.

Akungba-Akoko relative humidity varies from 75-95% and this result into severe cold condition in most cases. As observed by Olabode (2014) the mean annual temperature is 23-26°C. The soils are mainly oxisols and utisol (Tropical ferruginous) which vary over space with respect to texture, drainage and gravel content. The dominant deciduous forest in this area is as a result of the amount of rainfall receive yearly. The vegetation is densely evergreen and consist of palm trees, bamboo trees, thick grasses and shrubs.

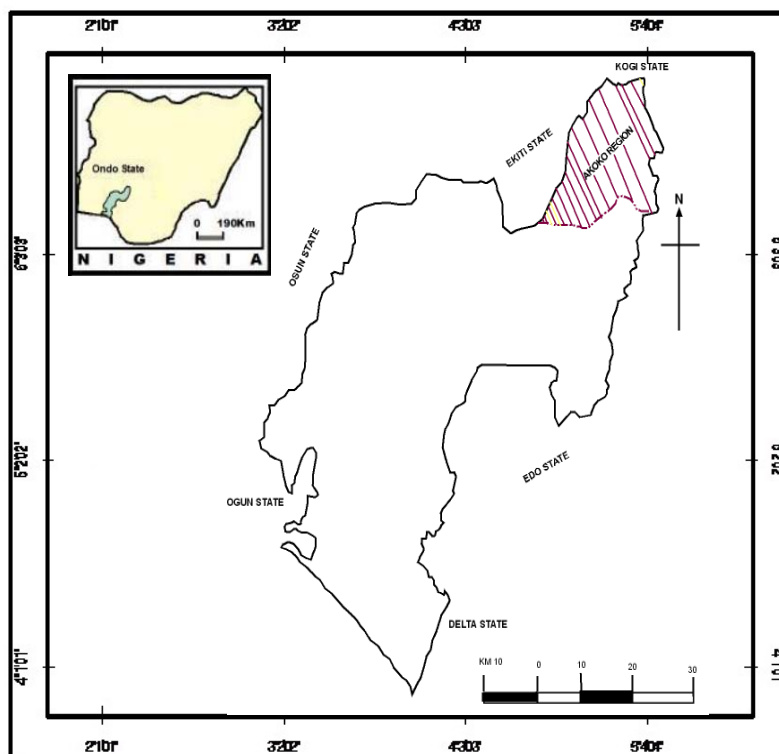


Figure 1. Study area

Source: Adapted from Olabode (2013)

LITERATURE REVIEW

Farmers' Perception on Climate Change and Food Insecurity

There is a close relationship between farmer's perception on climate change and food insecurity and the choice of adaptation, mitigation, coping options. Improving agricultural productivity is critical to achieving food security, as well as most of the targets specified under the Millennium Development Goals- MDGs (Lawal et al, 2012).

According to the Food and Agricultural Organization (FAO, 2009), farmers in Ethiopia and Uganda observed that there were marked increase in temperature and rainfall for the past five years. The same observation was made by Bryan et al (2009) through their study in Ethiopia and South Africa. The impacts of climate change are manifested by floods, droughts, erratic rain and extreme events.

A study carried out by Ofuoku (2011) in Delta state, Nigeria on the rural dwellers perception of climate change revealed that farmers were aware of climate change in their region. This is supported by Tarleton and Ramsey (2008), who revealed that climate change could

influence intensified agriculture, population explosion and use of chemical fertilizer, increased use of fossil fuel and loss of indigenous practice due to of gas flaring. According to Mary and Majule (2009) on the other hand, in Tanzania, farmers perceive changes in rainfall and temperature as climate change, leading to low crop yield as a result of erratic rainfall and temperature which in turn has affected income of farmers and consumption level.

In another related research carried out by Mutekwa (2009), rural farmers in Zimbabwe view prolonged wet, hot and dry weather conditions having negative effect on the efficient use of their resources and investment decisions. Moyo et al., (2012) investigated farmer's perception of climate variability in semi-arid Zimbabwe and found out that farmers perceived climate and weather pattern to have changed over the past decade or two. Gwinbi (2009) argued that the farmer's perception of climate change are influenced by incidences of drought and changes in the seasonal timing of rainfall, and few cases of unusual floods. The majority of the farmers in Zimbabwe believe the frequency of drought is increasing (Gwimbi, 2009).

In the context of Nigeria as in Swaziland according to Manyakasi et al., (2010), the most susceptible sector of human life which are sensitive to climate change and hence highly at risk are water resources, agriculture, biodiversity, health, food supply and security. Abnormal changes in temperature and rainfall and the increasing frequency and intensity of drought and floods in most parts of the states in Nigeria such as Benue, Imo, Anambra, Kogi, Sokoto etc. Are prominent among rural communities.

In Nigeria rural areas, tradition and culture often determine and influence their belief systems. These belief systems determine their level of perception and influences their interaction with the environment especially farmers. Thus, scenarios of climate change are often times perceived by these rural people as naturally occurring events which may not have any adverse effect on the environment and the future. One major reason for this is lack of awareness or adequate and prompt information on contemporary climate trends as well as affordable and feasible adaptive or mitigation measures or strategies which would have a positive impact on food supply system (Ambo, 2011).

Despite the nature of their perception, the rural people are also seen as valuable actors for developing and implementing mitigation, adaptation and coping strategies or policies for climate change and problem of food insecurity. The rural communities possess traditional and local knowledge that may help them adapt, mitigate and cope with the impact of climate change and food insecurity for example, some communities use traditional knowledge to record observation of climate variability/change, their impacts on the environment even before the change became threatening because of their close relationship with the land and dependence on natural resource exploitation for livelihood (United Nation Education scientific and cultural Organization, 2010).

MATERIALS AND METHODS

The data acquired for this study were collected from both primary and secondary sources. Questionnaire was employed in gathering primary data. The secondary data were assessed from related reports on climate change and food production in Nigeria. The questionnaire generally focused on socio-economic characteristics of people, climate change and food insecurity, and coping strategy for climate change in the study area. A systematic sampling method was adopted where every 15th building was sampled from the eight (8) quarters that made up the entire study area. Fifteen (15) copies of questionnaire were administered in each of the quarter. In all, a total of one hundred and twenty (120) copies of questionnaire were administered and retrieved for the purpose of this study. This study employed 3-points Likert Scale where the Mean Weight Value (MWV) for each response and the General Mean Weight Value (GMWV) to all responses were both calculated. MWVs of all the variables were collated and ranked. The decision rule stated that response should be rejected if $MWV < GMWV$. The topped ranked factors were noted. Descriptive statistics such as tabulation and simple percentages were also employed for data analysis and presentation of results.

DISCUSSION OF RESULTS

Socio-economic characteristics of the respondents

The study revealed that women are the top ranked respondents (51% as depicted in table 1). This implies that female were mostly accessible due to their availability at home and various trading centers. Men are always preoccupied with farming activities and are not available as much as women. The researcher was fortunate to have more women for they are in best position to respond substantially when it comes to issue that is related to food stuffs. This is because, women are mostly in charge of buying and selling of food stuffs, especially in small scale in their various community markets.

It was also revealed that 18-30 years has the highest 39%, which confirmed the accessible age group during the survey. This implies that most of the respondents are within their active age and knowledgeable of what transpires in their environment. The assertion can also be viewed from the educational perspective where 40.8% of the respondents have tertiary educational background.

Table 1. Respondents' characteristics
Source. Author Field survey, 2016

Age (year)	Freq	%	Occupation	Freq	%	Sex	Freq	%	Education	Freq	%
18-30	47	39	Civil servant	19	16	Male	59	49	Primary	30	25
31-40	42	35	Farmer	16	13	Female	61	51	Secondary	30	25
41-50	21	18	Retailer	32	27	Total	120	100	Tertiary	49	41
51 above	10	8	Others	53	44				Informal	11	9
Total	120	100	Total	120	100				Total	120	100

Perceived effect of climatic variation on food production in the study area

The condition of climate variation in the study area was determined based on changes in temperature and rainfall pattern. The study revealed that two major climatic indices have not only determined the condition of climate, but also revealed the level of crop yield and food supply in the study area. The existing variations in temperature and rainfall were examined through the perceived responses. Variation in climate expressed based on prolong period of temperature has been experienced with corresponding decrease in the amount of rainfall received. As indicated in figure 2, 77% respondents agreed on increased temperature with corresponding rainfall declined at 43%. In support of this observation, recent findings by Olabode (2014) established that 66.7% response described the climatic situation in the study area as hot with continuous increase in temperature.

In other words, food security and favourable climatic condition are non-negotiable. The World Bank (1986) observed that climate change has negative effect on all the four components of food security; food availability, accessibility, utilization and stability. The situation observed in the study area indicates insufficient food production characterized with increased cost of food produce, low yield of crops and lack of accessibility to quality food. Figure 2 shows the level of food production, which is at 57% while crop yield is 47%. Food production at this level outweighs crop yield because of additional food importation into this location. Actually, crop yield is one of the major determinants of food production, but seems to be inadequate as observed in this study.

The described conditions of the climatic variation in this study contributed to drastic reduction in food production. The study further identified five (5) perceived effects of climate on food security (table 2). These effects include poor crop yield, disease infestation, loss of soil fertility and low food variety. This observation is based on the Mean Weight Values (MWVs) of the problems associated with climatic variation, which are higher than the calculated GMWV (2.25). It should be noted that low food variety (2.41) and poor crop yield (2.35) indicate a leading effect of climate change as perceived by the respondents. However, reduced land cover was rejected at 1.91 MWV below the GMWV (table 2). The basis for the rejection could be based on the fact that people are not convinced that removal of vegetation is majorly attached to climate

influence. This is more so when it was perceived that farming and other human activities could in greater dimension result into removal of land cover. Corroborating this is the confirmation by Action Aid (2009). Increase in temperature can lead to increase in pest development and fecundity and frequency of outbreaks of insect pest and diseases that affect crops and livestock (Spore, 2008). Thus, the increasing temperature in the study area has a tendency of affecting root and tubers production in the study area, with implication on food security.

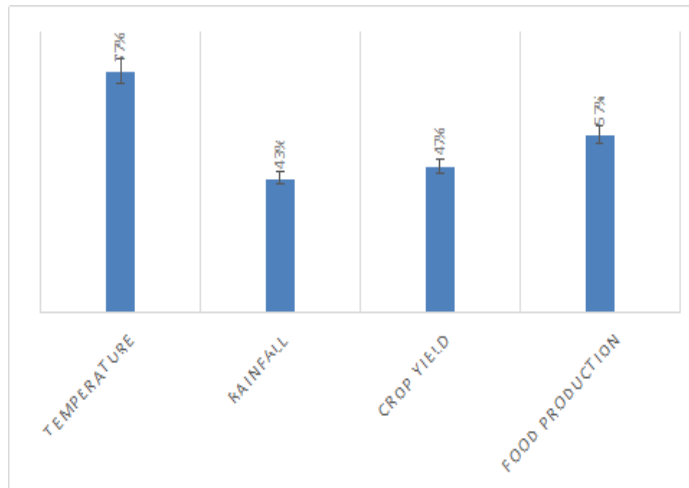


Figure 2. Condition of climate in the study area

Source: Authors' survey, 2016

Table 2. Effect of climate variation on food production

(Data source: Authors' computation, 2016)

Perceived effect of climate change	Seldom	Often	Very often	Total	Linkert 3 Points Rating Scale			Total Weight Value	Mean Weight Value	Decision
					1	2	3			
Poor crop yield	19	40	61	120	19	80	183	282	2.35	Accepted
Pest infestation	20	44	56	120	20	88	168	276	2.3	Accepted
Reduced land cover	50	27	43	120	50	54	129	230	1.91	Rejected
Loss of soil fertility	20	44	56	120	20	88	168	276	2.3	Accepted
Low food variety	15	41	64	120	15	82	192	289	2.41	Accepted
GMWV or COV									2.25	

Food types and level of availability in the study area

Grains, vegetables, tubers and fruits are the major grown crops in the study area (figure 3). Vegetables and tubers were presented as the leading crops with 30% and 35% level of availability. Though, other crops like grains and fruits are equally available but not mostly produced within the study area. In other words, both grown and less-grown crops are majorly at the high consumption level of the people in this area. These observed categories of food crops have increased the purchasing power based on their sources of availability. This situation as noted by Okuneye (2008) presents a trend in the recent escalation of world food prices that has transformed food insecurity in Nigeria from a difficult development problem into an emergency. This essentially necessitates skipping of certain food by the people, a major experience, which reflects inability to afford quality food in the study area.

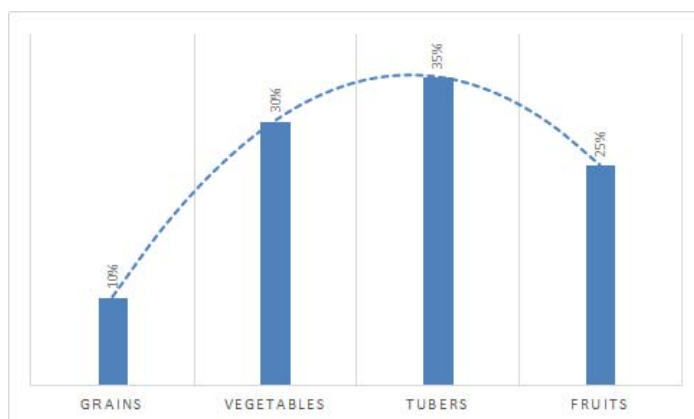


Figure 3. Available food crops in the study area

Source: Authors' survey, 2016

Observed impact of food insecurity on peoples' livelihood

This study observed three (3) major impacts of insufficient food availability in the study area. In table 3, malnutrition indicates 2.9 MWV of its regular occurrence that forms the highest response in this study. This shows that people in this area suffer hunger as a result of inconsistent food production. In relation to this finding, Okuneye (2008) submitted that the problem posed by hunger and malnutrition arising from acute shortages of food has become critical in Nigeria.

Table 3. Perceived effect of food insecurity

(Data source: Author's computation, 2016)

S/N	Variables	Very Often	Often	Seldom	Total	Linkert 3 Points Rating Scale			Total Weight Value	Mean Weight Value	Decision
						1	2	3			
1	Malnutrition	17	32	71	120	71	64	213	348	2.9	Accepted
2	Anxiety	22	41	57	120	57	82	171	310	2.58	Accepted
3	Anger	30	57	33	120	33	114	99	246	2.05	Rejected
GMWV or COV										2.51	

In a similar trend, anxiety has been equally observed as a resultant effect of food insecurity in this study. The response of the people in the study area indicated that anxiety had 2.58 MWV representing constant influence on human life. That is, the concerns of what to eat, at what time and in what quantity often dominates the mind of people at the expense of concentrating on other developmental issues. Anger was also observed as part of what constitute implications of food insecurity in the study area. However, the recorded 2.05 MWV for this parameter indicates that GMWV (2.51) is higher than MWV implying that anger is rejected and does not at all times related to hunger alone. To these findings, Ojo (1991) observed that food insecurity has adverse consequences, most especially, in children with higher level of aggressive or destructive behaviour, hyperacid and anxiety.

Adaptation strategies to food insecurity in the study area

This study observed five (5) adaptation strategies in the study area which were adopted with a view to alleviate the effect of climate change on food production. Table 4 shows that introduction of new crops with resistant capacity to climate impact and planting of cover crops are

the dominant strategies for improving food production in this study. It was recorded that MWV for cover crops is at 2.26. Practicing of cover crops to prevent soil degradation is not new, though sounds odd in the system of farming today. This study has re-established this method as one of the best ways in stabilizing crop production in the study area. Equally observed parameter is the planting of new breed of crops. This MWV at 2.15 was recorded and indicates the fact that farmers are meticulous in planting new breed of crops that could withstand climatic stress.

Table 4. Adaptation strategies GMWV or COV 2.07
(Data source: Author's computation, 2016)

Adopted strategies	Very often	often	Seldom	Total	Linkert 3 Points Rating Scale			Total Weight Value	Mean Weight Value	Decision
					1	2	3			
Adoption of new crops	24	54	42	120	24	108	126	258	2.15	Accepted
Planting of cover crops	23	43	54	120	23	86	162	271	2.26	Accepted
Irrigation practices	59	24	37	120	59	48	101	208	1.73	Rejected
crop change to animal production	39	29	52	120	39	58	156	253	2.11	Accepted
animal change to crop production	41	25	54	120	41	50	162	253	2.11	Accepted
GMWV or COV									2.07	

However, irrigation farming system, and switching from animal rearing to crop production attract low response on their regular practices as a means to overcoming the challenge posed by climatic influences on agricultural practice in the study area. It is worthy to note that irrigation practices has MWV of 1.73 lower than the GMWV of 2.07. Hence, irrigation system was rejected. This shows that irrigation farming system is rarely embraced and that effort to improve crop production in this direction is weak.

Remedial action on food security in Akungba-Akoko

People have always engaged in diverse ways to adjust to the situation of food insecurity in the study area. As revealed in Table 5 for instance, reliance on less expensive food, purchase food on credit, street begging for food, children eating from neighbor, and limiting portion size at mealtime formed the leading options in coping with food insufficiency in this study. These parameters were accepted among the people based on the fact that their MWVs are higher than the computed GMWV (2.09). The observation implies that people lack access to quality food but rather prefer available food stuff within their means. It could be established that purchasing food on credit has prevalence among other coping strategies employed in this area. Though, people sometimes prefer reduction of the quantity of food consumes at a meal within the household. The assertion here is that people do not tolerate selling food items on credit basis because buyers have not been faithful in offsetting their debts. The study further revealed that street begging for food often observed as a common way to manage and coping with food insecurity in the study area.

The observed patterns of coping strategies adopted by the household in this study were in agreement with the previous studies of Devereux and Maxwell (2001). These authors reported similar strategies whereby relying on less preferred, less expensive food, dietary change have been adopted in a similar situation of food insecurity among the household to meet the daily food needs.

It is however clear that dependence on friends or relations, hunting/harvesting premature crops/animals, minimization of adult consumption rate for the children, and daily meal reduction/skipping as means of coping strategies for food security were entirely rejected in this study. This is because the respective computed MWVs (1.89, 2.06, 2.08, 2.0, and 2.0) for the observed parameters are below the GMWV (1.89).

Table 5. Coping strategies adopted
(Data source: Author's computation, 2016)

Coping strategies for food insecurity	Very Often	Often	Seldom	Total	Linkert 3 Points Rating Scale			Total Weight Value	Mean Weight Value	Decision
					1	2	3			
Reliance on less expensive food	25	40	55	120	25	80	165	270	2.25	Accepted
Dependent on friends or relations for food	33	67	20	120	33	134	60	227	1.89	Rejected
Purchase food on credit	37	28	55	120	37	56	165	258	2.15	Accepted
Hunting/harvesting immature crops/animals	43	27	50	120	43	54	150	247	2.06	Rejected
Street begging for food	32	45	43	120	32	90	129	251	2.09	Accepted
Children eating from neighbors' crumbs	28	29	63	120	28	58	189	275	2.29	Accepted
Limit portion size at meal time	30	49	41	120	30	98	123	251	2.09	Accepted
Minimizing adult consumption rate for the children	38	35	47	120	38	70	141	249	2.08	Rejected
Daily meal reduction	36	48	36	120	36	96	108	240	2.0	Rejected
Daily meal skipping	31	58	31	119	31	116	93	240	2.0	Rejected
GMWV or COV									2.09	

CONCLUSIONS AND RECOMMENDATIONS

In the preceding sections, attempts have been made to examine the impacts of local climate on food availability and adaptive mechanism adopted in tackling food insecurity in the study area. The study revealed that; grain/cereal, root/ tuber, and vegetables and fruits are the common grown food; poor production was as a result of increased temperature; that farmers in the study area lack irrigation system that could necessitate all year round crop growth and development; in-availability of sufficient food has subjected people into high level of malnutrition and anxiety. Though, some measures have been introduced in managing food insecurity in this area, this study suggests intensive agricultural practices with irrigation-based system of farming as a capable method of producing crops with required moisture under diverse climatic conditions.

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