Journal of Earth Science & Climatic Change

Research Article Open Access

Assessing Impact of Climate variability on Food Security using Household Food Insecurity Access Scale (HFIAS): Case Study from Mirababaya Woreda Gamo Zone Ethiopia

Lemma Tadesse Andarge*

Arbaminch University Ethiopia

Abstract

The aim of this study was to investigate impact of climate variability on household food security in the case of Mirababaya woreda Gamo Zone Ethiopia. Multi-staged sampling techniques were used to select the targeted area and sample household respondents. A total of 30 sampled households were selected using systematic random sampling techniques and household survey was conduct using Household Food Insecurity Access Scale (HFIAS) questioners. The study used qualitative and primary data collection methods. Various descriptive and inferential statistic techniques were applied to analyze the collected survey data. Household Food Insecurity Access Scale and multi-linear regression model were used to analyze the determinant factors which affect food security of sampled household. The result of the study revealed that four of gender/sex, education, land size and livestock size have significantly associated with household food security status. The result of HFIAS shows that 50% of households were categorized as moderately food insecure e in the study area. From the result, it is also possible to conclude that farmers are aware of changes in climatic variables, especially increasing temperature and decreasing in annual rainfall and changing the seasonal patterns. Facilitate income diversification, use of well-organized meteorological information, and small irrigation are identified recommendations.

Keywords: Food securities; Household; Food insecurity access scale; Variability

Introduction

Background and Justification of the Study

Food insecurity is a condition that put impact on population that usually experience food shortage. It must be analyzed in the context of climate variability, climate change and uncertainty in order to minimize its future impact (WFP, 2009). Climate variability has an impact on human health, livelihood assets, food production and distribution channels, as well as changing purchasing power and market flows. Its impacts can be categorized in to both short term, resulting from more frequent and more intense extreme weather events, and long term, caused by changing temperatures and precipitation patterns. People who are already vulnerable and food insecure are likely to be the first affected.

Drought in particular is a major problem and immediate cause of food shortages and famines. For instance, a major drought in 1984/85 led to decline of the GDP by 9.7 per cent, decline of agricultural production by 21 per cent and reduction of gross domestic savings by 59 per cent (World Bank, 2006). In 2002/03, 13.2 million Ethiopians required emergency food assistance due to a major drought (World Bank, 2006). Climate change is likely to increase rainfall variability and incidence of dry spells and droughts, potentially affecting larger areas and larger populations than at the present. On the other hand, according to UNFCCC (2015) population projections, Ethiopia's population will reach 100 million by 2020, 120 million by 2030 and 145 million by 2050. These indicate that attaining food security is likely to remain, at least for the short term, a key challenge to Ethiopia.

Ethiopia agricultural sector is dominated by small scale farmers who are relay on low input and low production rainfed and mixed farming with traditional technologies. Government of Ethiopia has given top priority to the sector and has taken steps to enlarge productivity. However, various obstacles are grasp back the main causes of inadequate production or less than expected production due to disaster like drought, which frequently causes famine, and floods. As a result, it follows climate connected disasters makes the nation dependent on food aid. The tendency of the contribution of agriculture to total GDP of the country understandably describes the connection between the impact of climate change on agriculture and economy.

According to Hassen & Berehan (2013), it will also affect all four dimensions of food security: food availability, food accessibility, food utilization and food systems stability. Food insecurity is a condition that put impact on population that usually experience food shortage. It must be analyzed in the context of climate variability, climate change and uncertainty in order to minimize its future impact (WFP 2009). Rather climatic shocks render already vulnerable population susceptible to livelihood crises that force millions of people to turn to the government for emergency assistance and safety net benefit each year to augment their own productive and coping strategies. The country is extremely vulnerable to the least change in climate. If the rain is late, does not arrive or irregular, it immediately result in an increase in the number of people who food insecure because they are already living on the margins of life [1].

Food insecurity describes a situation where people are at risk of not having adequate physical, social and economic access to sufficient, safe

***Corresponding author:** Andarge LT, Department of Meteorology and Climate Change, Arbaminch University Ethiopia, Tel: +251916861622; E-mail: tadesse_lemma@yahoo.com

Received: 27-Jul-2022, Manuscript No. jescc-22-66413; **Editor assigned:** 29-Jul-2022, PreQC No. jescc-22-66413 (PQ); **Reviewed:** 12-Aug-2022, QC No. jescc-22-66413; **Revised:** 16-Aug-2022, Manuscript No. jescc-22-66413 (R); **Published:** 23-Aug-2022, DOI: 10.4172/2157-7617.1000633

Citation: Andarge LT (2022) Assessing Impact of Climate variability on Food Security using Household Food Insecurity Access Scale (HFIAS): Case Study from Mirababaya Woreda Gamo Zone Ethiopia. J Earth Sci Clim Change, 13: 633.

and nutritious food which meets dietary needs and food preferences for an active healthy life. Vulnerability to food insecurity describes a situation of 'being at risk to become food insecure' [2]. Food insecurity is a widespread problem particularly in sub-Saharan Africa (SSA) where small-scale rain-fed agriculture employs the large majority of populations (FAO, 2013).

Ethiopia is one of the most food insecure countries in SSA despite its being endowed with abundant ecological diversity and land and water resources. Nearly 10 per cent of Ethiopia's annual food need is dependent on international food aid and in drought years this figure reaches up to 25 per cent (Planning and Development Commission, 2018). It is estimated that Ethiopia receives about 5 per cent of the total food aid given to Africa [3]. In Ethiopia, rainfall variability, drought, land degradation, antiquated farm technology, and low level of use of modern agricultural inputs are often cited as the major factors exposing the rural poor to food insecurity [4].

From different reports the problem of food insecurity has been challenging the livelihoods of the rural households in the in drought-prone areas of the Gamo zone whose existence is largely dependent on agriculture. According to Disaster Prevention and Preparedness work Unit of Gamo zone; in 2000 year 56,020, in 2015 year 32,324 and in 2016 up to May 27, 226,475 households were registered to be victims of food shortage and famine and food aid was provided to sustain their life. This obviously verifies that food shortage and famine is prevalent in the study area. Officers indicated that rainfall variability and temperature fluctuation are major causes for food insecurity and famines frequently observed in the area. However, no study has been found that upholds or denies the views of the Agriculture Officers. And, the study conducted by Addise (2014) reveals only land degradation dimension without showing such climate variability with food security. Taking this in to consideration, this study aimed to assess household perception on the climate variability and to analyze the household food security access of in Gamo zone Mirababaya Woreda, Ethiopia in 2022 G.C.

Description of the Study Area and Methodology of the Study

Description of the Study Area

This study was conducted in, the area geographically located at 50 55'N to 60 20'N and 370 10'E to 370 40'E in southern Ethiopia Gamo Zone Mirab-Abaya Woreda. Mirab-Abaya is one of the woredas in Gamo Zone. Based on the 2007 Census conducted by the CSA, this woreda has a total population of 74,967, of whom 37,444 are men and 37,523 women; 5,834 or 7.78% of its population are urban dwellers. The majority of the inhabitants were Protestants, with 64.9% of the population reporting that belief, 32.54% practiced Ethiopian Orthodox Christianity, and 1.93% was Muslim (Figure 1).

Climate and Rainfall Trends

The highlands of Gamo-Gofa are characterized by nine rainy months, which occur from March to October and mid-January. Furthermore, the southern parts of Gamo-Gofa are characterized by eight rainy months from February to July and from September to October. Some high land regions have maritime temperate climate or oceanic climate and lowland areas are warm semiarid tropical climate. A highest pike of rainfall occurs in the month of April and October, which describes bimodal type of rainfall and helps rapid vegetation growth. Using the traditional agro-climatic classification, 28.4% of the zone falls under the lowland (Kola), 41.4% under mid altitude (Woina Dega), 30.1% under high altitude (Dega)and 0.5% cold(Wurch). And as Shown on above Figure 2 there is both rainfall and temperate variabilities in the study area.

Research Methodology

Descriptive survey research design was applied in this research. Because descriptive survey design out to describe and to interpret the questions and looks at the study units with the aim to describe, compare, contrast, classify, analyze and interpret the entities, and the events that constitute the study. And Household survey and field observations are methods enabled the researcher to describe the phenomena. The regression model was used to determine the kind and magnitude of relationship among the dependent and independent variables under study. Moreover this design was selected for the advantage that the information about independent and dependent variables that was gather represent what goes on at only one point in time [5].

Sampling techniques and sample size

The study followed a multi-stage sampling technique where both

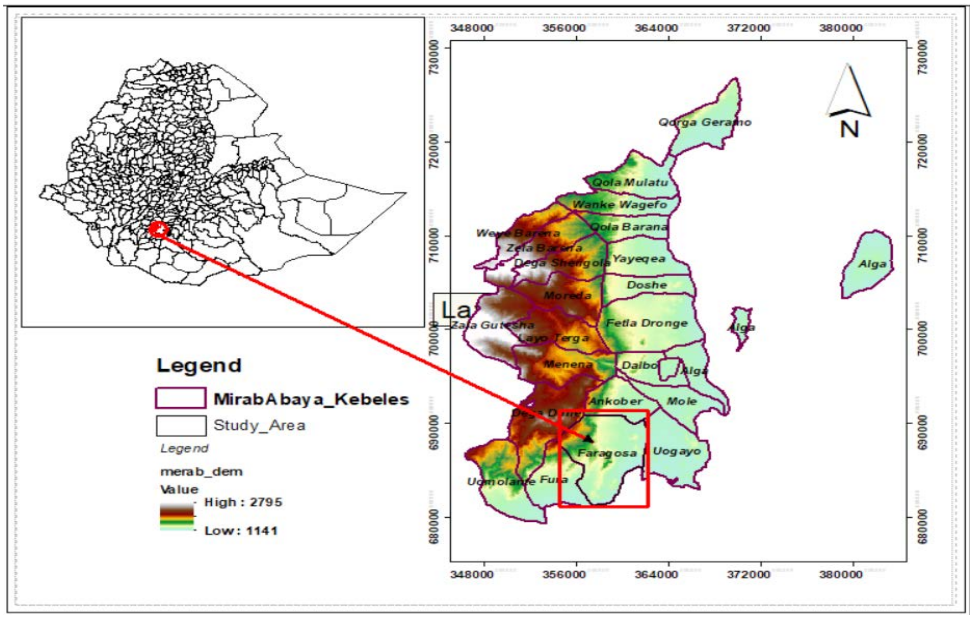

Figure 1: Location of study area.

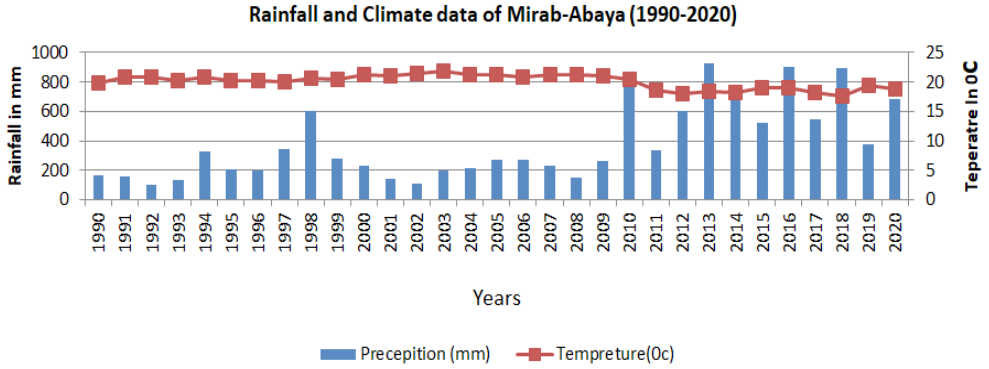

Figure 2: Rainfall and temperature graph of the study area.

Table 1: Distribution of sample households.

No.	Kebeles	Total HHs	Sex		Total Sample HHs	*Sex*	
			Male	Female		Male	Female
1	Faragossa	304	279	25	30	25	5

Source: Mirababaya Agricultural Office.

Table 2: The variables and their categories, measurements.

Variable name	Category	Measurement
Age of household head	Continuous	Years
Sex of household	Dummy	1or2
Marital status	Continuous	1 married, 2 unmarried, 3 divorce
Educational level of household head	Continuous	School
Livestock unit	Continuous	Number
Land size	Continuous	Hector
Family size	Continuous	Number
Income diversification	Dummy	1 or 2

probability and non-probability sampling techniques i.e. (purposive and simple random sampling) as follows (1) to select both the woreda, and kebeles purposive sampling techniques was used (i.e. Mirababaya woreda was purposively selected due to its accessibility and time constraint of the research duration, while Faragossa kebele was due to one of drought prone kebeles in the woreda) and simple random sampling (lottery system) was employed to select 10% of the households due to their homogeneities maintain the proportion of male and female households. According to the data obtained from Mirababaya Agricultural Office, the total number of households in the sample kebele is **304** households. Accordingly 10% of households are obtained as indicated in the Table 1.

Data collection instrument

Questionnaire-based survey and field observations were administered. Questionnaire-based survey was used to collect relevant data respecting the consent of the respondents as a research ethics. With this technique data related to demography, socioeconomic, farmers understand of climate variability, food security and adaptation mechanism were collected. And field observation was also carried out to validate the information provided through questionnaire based survey. Observation is a qualitative method whose objective is to help researchers learn the perspectives held by study households. Data obtained through observation serve as a check against participants subjective reporting of what they believe and do.

Definition of variable used in the Study

Dependent Variable: The dependent variable used for analysis was Household Food Security Status and climate change and variabilities perception. The ordinal values were obtained from HFIAS model, which was used to analyze the food security status of the study households.

Independent variables: The independent variables of the model are those variables that were expected to have relationship with the climate variability and the effects on food security. The variables were selected depending on available literature and researchers' personal experience. And the following factors, which are expected to affect Household food security presented with their operationalization (Table 2).

Data Analysis Techniques

To address the objectives of this study, both descriptive statistics and inferential statistics were employed. After coding and feeding the collected primary data into the SPSS version 24, STATA version 16 was used for analysis. Descriptive statistics such as mean, minimum, maximum, percentages, and frequencies are applied to describe demographic, socio-economic, data's. While Household Food Insecurity Access Scale (HFIAS) which is an adaptation of the approach used to estimate the prevalence of food insecurity in the United States (U.S.) annually. Was employed for the analysis of data's related to food security access. The method is based on the idea that the experience of food insecurity (access) cause predictable reactions and responses that can be captured and quantified through a survey and summarized in a scale [6].

Results and Discussion

Household perception on the climate variability

Data on this issue were collected by means of the following nine items and the results are presented below in Table 2.

As showed on Table 2, the majority of respondents perceived changes on temperature and rainfall within the twenty-year period 2000 to 2020. In this regard, on the idea of temperature increasing, 76.7 %(n=23) of the respondents reported they strongly agree, Again regarding on the idea rainfall pattern is decreasing, 70 %(n=) of the responded agree whereas early onset of rain days disagreed by 73.3% (n=22). Generally one can concluded that in the study area farmers mostly perceived as rainfall is decreasing, and temperature increase since 2000. The studies indicates that the food security of the farmers at risk as indicated by (Edwards, *et al.*,2009) Higher temperatures, reduced rainfall and increased rainfall variability reduce crop productivity that would be affected food security in low income and agriculture-based economies. Thus, the impact of climate change is detrimental to countries that depend on agriculture as the main livelihood.

Furthermore, as shown in Table 3, below an independent sample t-test was run on a sample of 30 respondents to detect if there were differences in households climate perception between male and female respondents. Both groups consisted of different randomly assigned participants. The results showed that statistically significantly there is no significant different between male and female on climate perception t (28) = -0.111, p = 0.9123. That is, there is no a significant difference in climate variability perception between male and female respondents at P < 0.05.

As shown on Table **4,** below a one-way ANOVA was conducted to determine if mean perception towards climate variability was statistically different based on educational level for the groups. Respondents were classified into four educational groups as non-formal education, primary education (grade1-8), secondary education (grade 9-12) and tertiary education (college/universities). Assumptions were checked and no significant violations were observed. There was a statistically significant difference in mean between the groups as determined by one-way ANOVA F (2, 27) = .344, p = .012. That is, there is a significant difference in climate variability perception four educational groups at P < 0.05.

Household Food Insecurity Access Scale Score

The HFIAS score is a continuous measure of the degree of food insecurity (access) in the household in the past four weeks (30 days). First, a HFIAS score variable is calculated for each household by summing the codes for each frequency-of-occurrence question. Before summing the frequency-of-occurrence codes, the data analyst should code frequency-of-occurrence as 0 for all cases where the answer to the corresponding occurrence question was "no" (i.e., if Q1=0 then Q1a=0, if Q2=0 then Q2a =0, etc.). The maximum score for a household is 27 (the household response to all nine frequency-of-occurrence questions was "often", coded with response code of 3); the minimum score is 0 (the household responded "no" to all occurrence questions, frequency-of-occurrence questions were skipped by the interviewer, and subsequently coded as 0 by the data analyst.) The higher the score, the more food insecurity (access) the household experienced. The lower the score, the less food insecurity (access) a household experienced. Model used to calculate Household Food Insecurity Access Scale Score is as follows:

Model used to calculate Household Food Insecurity Access Scale (M1)

Average HFIAS Score	Sum of the frequency-of-occurrence during the past four weeks for the 9 food insecurity-related conditions Sum frequency-of-occurrence question response code (Q1a + Q2a + Q3a + Q4a + Q5a + Q6a + Q7a + Q8a + Q9a)

Next, the indicator, average Household Food Insecurity Access Scale Score, is calculated using the household scores calculated above.

Average HFIAS Score	Calculate the average of the Household Food Insecurity Access Scale Scores Sum of HFIAS Scores in the sample
	Number of HFIAS Scores (i.e., households) in the sample

As illustrated on Table 5, the majority of respondents responded sometimes or moderately food insecure for all Household Food Insecurity Access Scale (HFIAS) measurement tool except of questions 1a, 7a, 8a and 9a. And according to Household Food Insecurity Access Scale (HFISA) techniques of food security measurement and analysis (M1) mentioned above from all respondent 13.3% (n=4) are food secure while 20% (n=6), are mildly food insecure, 50 %(n=15) and

Table 3: Frequency, percentage, and mean a values of household perceptions on the climate variability (N=30).

Roll No	household perceptions on the climate variability since 2000	Strongly agree		agree		Undecided		Disagree		Strongly disagree		Mean
		F	%	F	%	F	%	F	%	F	%	
1	Increasing rainfall amount during rainy season			4	13.3	1	3.3	21	**70**	4	13.3	3.83
2	Decreasing rainfall amount during rainy season	7	23.7	21	70			1	3.3	1	3.3	1.93
3	Increasing length of rain season		2	6.7				19	**63.3**	9	30	4.17
4	Decreasing length of rain season	10	33	19	**63.3**	1	3.3					1.73
5	Early onset of rain days	1	3.3	1	3.3			22	**73.3**	6	20	4.03
6	Late onset of rain days	11	36.7	18	**60**			1	3.3			1.70
7	Increase of strong winds events	1	3.3	25	**83.3**			3	10	1	3.3	2.27
8	Increasing temperature of the area	23	**76.7**	7	23.3							1.23
9	Decreasing temperature of the area	1	3.3	1	3.3	1	3.3	13	**43.3**	14	**46.3**	4.27
G/mean		**2.796**										

Table 4: Summary of one way ANOVA among respondents based on level of educational (n=30).

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.674	2	.837	.344	.012
Within Groups	65.745	27	2.435		
Total	67.419	29			

Table 5: Household Food Insecurity Access Scale (HFIAS) Measurement Tool.

Roll No	Questions	Response Options								
		No =Food secure		Rarely= Mild food insecure		Sometimes =Moderately food insecure		Repeatedly Severely food insecure		Mean
		F	%	F	%	F	%	F	%	
1a	In the past four weeks, how much you worry that your household would not have enough food, due to climate variability impact on food security? How often did this happen?	3	10	1	3.3	10	33.3	16	**53.3**	2.30
2a	In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of climate variability impact on food security? If 'yes' how many days within the month? How often did this happen?	3	10	5	16.7	18	**60**	4	13.3	1.77
3a	In the past four weeks, Did you or any household member have to eat a limited variety of foods due climate variability impacted on food security? If 'yes' how many days within the month this happen?	2	6.7	3	10	18	**60**	7	23.3	2.00
4a	Did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food, due climate variability impacted on food security? If 'yes' how many days within the month?	2	6.7	6	20	18	**60**	4	13.3	1.80
5a	Did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food? If 'yes' how many days within the month?	2	6.7	1	23.3	19	**63.3**	2	6.7	1.70
6a	Did you or any household member have to eat fewer meals in a day because there was not enough food? If 'yes' how many days within the month?	3	10	5	16.5	22	**73.3**			1.63
7a	Was there ever no food to eat of any kind in your household because of lack of resources to get food? If 'yes' how many days within the month?	6	20	13	**43.3**	11	36.7			1.17
8a	Did you or any household member go to sleep at night hungry because there was not enough food? If 'yes' how many days within the month?			15	**50**	8	26.7	1	3.3	1.13
9a	Did you or any household member go a whole day and night without eating anything because there was not enough food? If 'yes' how many days within the month?	20	**66.7**	7	23.3	3	10			0.4
G/mean		**1.55**								

16.7% (n=5) are, moderately food insecure and severely food insecure respectively. Therefor possible to concluded that half of the population in the study area categorized as moderately food insecure.

Interpretation of significant predictor variables of the model

Sex

An ordered logit regression was conducted to determine the effects of sex, on food security status of household. Assumptions were checked and no significant violations were observed. Holding other variables constant, the model shows as sex is one of the food insecurity predictor by the coefficients/factor of .202(20.2%) t (.982), p =.007. This is also statistically significant at P < .05. The finding confirmed with the research output said that the gender difference is found to be one of the factors affecting food security of household and labor supply plays a great role [7].

Education

Holding other variables constant, the Ordered logit regressions predicts that for every one unit increase in education food insecurity status decrease by the coefficients/factor of 0.623(62.3%) with t 0.508), p=.006.This is also significant at P < 0.05.More over according [8] education helps to increase farmer's ability to obtain, process, information relevant to coping strategies for food security at a time of climate variability and it increases the probability of adapting climate variability strategies. Education level could measure the household's human capital and therefore attainment of higher level of education is expected to provide higher levels of household welfare.

Land size

As shown on the above Table **5**, holding other variables constant, the model predicts that for every one unit increase in farm size food insecurity status decrease by the coefficients/factor of .230, t(-1.141), p=.006.This is also significant at P < 0.05. Agricultural Land size positively associated with the food security status, this means that those farmers who have relatively large farm size are more likely to different adaptation strategies and secure their food security. And the reverse is true for small farm size owners [9].

Size of livestock

The model predict that for every one unit increase in livestock size food insecurity status decrease by the coefficients/factor of .750 with t (4.386), p=.000 holding the other variables constant. This is also significant at P < 0.01. Livestock unit is continuous variable refers to the total number of animals possessed by the household measured and can be attributed to increase wealth and income based on the farm households which makes more money available in the households. Livestock is considered as another asset which is a security against crop failure [10-16].

Summary and Recommendation

The main purpose of this study was to exploring impact of climate variability on the households' food security in drought prone areas of the Gamo Zone: case study from Mirababaya Woreda. In order to meet these aims, the following two basic questions were posed: (1) what is the perception of house hold on the climate variability in the study area? (2)What is the household food security status of study area? Find answers to these basic questions;

The findings of this paper suggest that farmers are aware of changes in climatic variables, especially increasing temperature and decreasing in annual rainfall and changing the seasonal patterns. The HFIAS analysis result indicated that among the respondent 13.3% (n=4) are

food secure while 20% (n=6), are mildly food insecure, 50 %(n=15) and 16.7% (n=5) are, moderately food insecure and severely food insecure respectively. These shows, that half of the population in the study area categorized as moderately food insecure. The result of Multi linear regression indicated that, male headed household, education, agricultural land size and livestock size keeping other variables constant, has positive relationship with food secure and study area is mildly food insecure. Finally on the basis of the findings and conclusion drawn the following recommendations are identified for enhancing household food security status.

- To address food security issue in the stud area, the household head and members should involve in different income generating activities for means of living and coping mechanism and incorporate with different research outputs to design income diversifying programs that could relive the study area from its food insecurity.
- Rainfall seasonal variability and temperature fluctuation was influencing agricultural productivity and food insecurity. Therefore, the experts from disaster prevention and preparedness, crop and animal production offices and farmers have to integrate in the update information of weather and climate conditions and there should be established using weather forecasting and meteorological stations.

Authors' Contributions

Author has performed the methodology, literature review, software analysis, result interpretation and validation, formal analysis, and investigation, data collection, writing original draft preparation, funding acquisition, and prepared the manuscript text and agreed to the published version of the manuscript.

Acknowledgment

The author is very much grateful to, Dr. Teshome Yirgu, for his guidance and collaboration in sharing knowledge and invaluable comment.

Conflict of Interest

The author declares that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/ or falsification, double publication and/or submission, and redundancy has been completely observed by the authors.

Abbreviation

ANOVA	Analysis of Variance
FAO	Food and Agricultural Organization
HFIAS	Household Food Insecurity Access Scale
UNEP	Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WFP	World Food Program

References

1. Bethel G (2018) Analysis of Meteorological Drought Using SPI and Large-Scale Climate Variability (ENSO)-A Case Study in North Shewa Zone, Amhara Regional State, Ethiopia. Hydro Current Res 9(4):1-9.
2. Deressa T, Rashid MH, Claudia R (2008) Measuring Ethiopian farmers' vulnerability to climate change across regional states. Intl Food Policy Res Inst 1-11.
3. Devereux S (2000) Food insecurity in Ethiopia. A discussion paper for the Department for International Development. Great Britain UK 1-10.
4. Datt G, Simler K, Mukherjee (2000) Determinants of Poverty in Mozambique: 1996-97. IFPRI 70-78.
5. Edwards Jones G, MilàCanals L, Hounsome N, Truninger et al. (2009) Testing the assertion that 'local food is best': the challenges of an evidence-based approach. Trends Food Sci Technol 19(5):265-274.
6. FAO (2013) The Sate of Food Insecurity in the World: The Multiple Dimensions of Food Security. FAO 4-6.
7. Hassan A, Bhuiyan AB (2013) Microcredit and Sustainable livelihood: An Empirical Study of Islamic and Conventional Credit on the Development of Human Capital of the Borrowers in Bangladesh. J Econ Cooperation Dev 34(3):101-128.
8. Mekuanent M (2014) Determinants of Household Food Security among Southwest Ethiopia Rural Households. Food Sci Technol 2(7):93-100.
9. Planning and Development Commission (2018) Poverty and Economic Growth in Ethiopia 1995/96-2015/16.
10. Obayelu OA, Adepoju AO, Idowu T (2014) Factors Influencing Farmers" Choices of Adaptation to Climate Change in Ekiti State, Nigeria. J Agric Environ Int Dev 108(1):3-16.
11. Olsen C, George M (2004) Cross-Sectional Study Design and Data Analysis. Yes Comp 2-53.
12. Paulos A, Belay S (2017) Household and plot-level impacts of sustainable land management practices in the face of climate variability and change: empirical evidence from Dabus Sub-basin, Blue Nile River, Ethiopia. Agric Food Secur 6(1):1-12.
13. UNFCCC (2015) Conference of the Parties Twenty-first session Paris, 30 November to11 December 2015.
14. UNEPA (2001) Annual Evaluation Report.
15. World Bank (2006) Ethiopia: Managing Water Resources to Maximize Sustainable Growth a World Bank Water Resources Assistance Strategy for Ethiopia. Water P-Notes 13.
16. World Food Program (2009) Food consumption analysis: Calculation and use of the food consumption score in food security analysis. Rome. WFP.