Journal of
Climate Policy
(JCP)

Provenance of Food Insecurity. A Critical Literature Review

CARI Journals

Journal of Climate Policy

Vol.1, Issue No.1, pp 36 – 48, 2022 www.carijournals.org

Provenance of Food Insecurity. A Critical Literature Review

Dr. Jilet Makrini Kamunywe

School of Environmental Studies of Kenyatta University

Corresponding author's email: journals@carijournals.org

Abstract

Purpose: In particular, it affects crop production due to temperature and rainfall changes, and more extreme weather events. Erratic rainfall and temperatures are said to reduce crop yields through shortening growing seasons, exaggeration of water stress and promote invasion and intensity of weeds, pests and diseases. The overall objective of this study was to examine provenance of food insecurity.

Methodology: The paper used a desk study review methodology where relevant empirical literature was reviewed to identify main themes and to extract knowledge gaps.

Findings: This study concluded that the effects of rainfall and temperature adversely affect to maize and beans production in Africa. The effects are significant and positive for all crops. Generally, there is better correlation of production with precipitation than temperature. From the findings Pearson's correlation showed positive correlation for crop yields against climate data except for minimum temperature that exhibited weak negative correlation for maize and no correlation for beans. This shows plainly that "business as usual" food grain growth is altered by changes in climate. These changes could alter growing seasons, planting and harvesting calendars or even invasion of pests, weeds and diseases.

Unique Contribution to Theory, Policy and Practice: This study recommended that adoption of other food grains that may do well under this current climatic condition. Crops such as millet and sorghum are encouraged due to their high tolerance to droughts, soil infertility and high temperatures. Households also to be guided on how to monitor crop-climate relationship so as to achieve improved crop production drought resistant modern seed varieties are very important to the population.

Keywords: *Provenance, food insecurity*.

INTRODUCTION

Climate variability has far reaching effects on food grain production and thus food security. Food production will be affected by shortening of growing seasons, shift in planting seasons, increased crop pests and diseases, loss of soil fertility and decreasing moisture content. This can lead to seasonal crop failure and long-term production problem leading to low yields hence food insecurity (Adane, 2015). Climate variability as well can affect food access in a way that, as agricultural produce decreases, food prices shoot, and the purchasing power reduces. Natural and human (anthropogenic) drivers such as will accelerate climate variability (Rainfall and temperature) by changing weather patterns making production more unpredictable. Environmental change in this case involves the extreme weather events such as droughts and floods. More intense and increased frequent extreme weather events and increasing abnormalities in seasonal rainfall changes are already having significant impacts on crop yields and thus food insecurity. Erratic and unpredictable rainfall will lead to changes in rainfall thus floods, high temperatures coupled with low rainfall can lead to droughts. Both natural and human drivers will accelerate the extreme events thus reducing food production. Appropriate climate adaptation and mitigation strategies will minimize the effects of natural and human drivers hence stabilizing the effect of climate variability on the environment and increase food production hence food security (Araya, 2018).

There is no doubt that the earth is warming. Globally, surface temperature change is estimated to be 0.78°C since the 19th century with intervals of 0.72 to 0.85°C (Stocker et al., 2013). Precipitation on the other hand reported a small global annual mean with uncertain rising trend over the 20th century of about 1.1mm per decade (UNFCCC, 2007). Regions around mid to high level latitudes are said to experience more intense rainfall. These changes have received reasonable attention in the past years due to increased extreme events such as droughts, floods and hurricanes (Asadieh & Krakauer, 2015). According to IPCC (2007) it's never been this warm for the past 1000 years and precipitation events are anticipated to become significantly intense under warming. In Africa, climate variability is aggravated by the interaction of different stresses and low capacity to adapt. The continent's climate is controlled by the interplay of both maritime and terrestrial activities that give diverse climate ranges in different regions (Boko et al., 2007; Mburu et al., 2015). In general, African continent temperatures are anticipated to increase by two to six degrees Celsius by 2100 (IFPRI, 2010).

In the Sub-Saharan African region, warming is also predicted to extend till the end of the century with temperatures hitting 5◦ C by 2100 which is beyond the 1951 to 1980 baseline (Gebremedhin, 2018). In this case inland sub-tropics are said to warm the most (Serdeczny et al., 2016). These changes may seem homogenous, but they are not always. For example, the African tropical forests warming rate is 0.29°C, in South Africa a rate of 0.1 to 0.3°C has been noted (Sianungu, 2015). Eastern Africa has recorded declining trend in temperatures in areas nearing the coast and main inland lakes, they are also likely to increase more in the drier subtropical regions (Boko et al., 2007). Unlike temperature changes, rainfall variability is a bit complex due to its complicated feedback mechanisms attributed to temporal and spatial variability. Nevertheless, interannual rainfall variability is conspicuous over most of Africa and for some regions, multi-decadal variability is also significant. For instance, Herrero et al. (2010) reports a likely increase in annual mean rainfall in East Africa which appears to be a relatively more stable albeit some evidence of long-term wetting and a decrease in both Mediterranean Africa and in the Northern Sahara regions. West Africa has also recorded a decrease in annual rainfall since 1960 by 20 to 40% (1PCC, 2007).

Ziervogel et al. (2006) further reports that winter rains will reduce by 40% in the Southern Africa region with higher rainfall anomalies and more intense and widespread droughts reported. In Kenya, climate ranges from a humid tropical climate along the coast to arid areas inlands while temperatures shift with change in altitude. GoK (2009) reports that temperatures in the country have increased by 1°C over the past 50 years and warming is set to escalate by almost 3°C by 2050 (IPCC, 2007). Temperature increase is normally higher in the months March, April and May which has attributed to experiencing hot days and nights around this time. The northern parts of Kenya experience high temperatures of up to 35° C and the western and central parts of the country experience the lowest of 10 °C and below (Naanyu, 2013). Rainfall variability experiences regional rainfall differences. Long rains are less variable so inter-annual variability is as a result of short rains (Herrero et al., 2010). Rains are predicted to increase in some parts for instance around Lake Victoria region to the central highlands, east of the Rift Valley whereas the eastern and northern arid and semi-arid lands (ASAL) are anticipated to experience decrease in rainfall amounts (IPCC, 2007).

Statement of the Problem

Ensuring food security amidst climate variability is at the top of the agenda in all developing nations is no exception. Climate is anticipated to warm through all seasons in the country (Naanyu, 2013). Variability will lead to increased variation in weather patterns primarily between seasons and years. This evidence is backed up by data of over 50 years from Kenya Meteorological Department that shows the effects provenance of food insecurity (GoK, 2010). Long-term shift in temperature and precipitations changes are expected to alter production seasons, the patterns of pests and diseases, increase water stress and also alter the set of crops thus affecting the yields (Amwata, 2013). Increased climatic uncertainty means food production will change and become unpredictable and this will have severe consequences on food security status (FAO, 2010). According to Nga'ng'a (2015) extreme weather events in the country such as high temperatures and sporadic rainfall are already having significant effects on food production. As well increased temperature and change in precipitation that come as a result of climate variability are anticipated to further stress marginal areas that are already practicing agriculture (Bobadoye et al., 2014).

Household food insecurity in arid and semi-arid lands (ASALs) constitute 88 % of total land area and are dominated with rain fed agriculture (Icheria et al., 2015). Currently, it is estimated that million Kenyans are food insecure and between two and four million people require emergency food (Wakibi et al., 2015). This number includes 3.2 million persons in ASAL parts of Kenya

(Wambua, 2014). Previous assessment of the impacts of climate variability on agriculture in the area concentrate more on pastoralism (Amwata et al., 2016). Studies (Amwata, 2013; Osano et al., 2013; Opiyo, 2014; Bobadoye et al., 2016) have analysed and documented climate variability and pastoralism at the household and community level. However, there is relatively little information in the literature available on provenance of food insecurity. More evidence on the topic is necessary in providing further understanding on provenance of food insecurity. This study will bridge the gap by assessing provenance of food insecurity.

Objective of the Study

The overall objective of this study was to examine provenance of food insecurity.

Significance of the Study

The study will inform the households on effectiveness of the already adopted strategies, inform the stakeholders of the climate trend and food security status in the area. The study as well may be of significance to policy makers such as the Ministry of Agriculture, Livestock and Fisheries, Ministry of Environment and Mineral Resources, NGOs, local organizations and development agencies among other stakeholders working in the area by providing policy recommendations that may guide decisions that could bring change in agriculture to enhance food security. The study findings will also contribute to the existing literature on the topic.

LITERATURE REVIEW

Food Security and its Vulnerability

Food security is referred as a state when: "all people at all times, have both physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life," (FAO, 2010). On the other hand, food insecurity is a state when food is not easily accessible to households and they are facing difficulties in securing sufficient and nutritious food (Wakibi et al., 2015). Food insecure households are those that do not have both economic and physical access to food and this may be due to inadequate food, low purchasing power and poor usage of food at household level (Icheria, 2015). The four components of food security are stipulated as: availability, access, utilization and stability as explained below:

Food Availability

Food availability plays a very important part in food security. It refers to the production, distribution, and exchange of food in appropriate quality for people to meet basic food needs and this can be supplied through household's own production or import (FAO, 2015). Food availability at household level can be described as the food's physical existence, either from markets or own production including food imports and aid (Bunyasi, 2012). In evaluating food availability factors such as sufficiency supply of energy, animal proteins and the numerical quantity of food production are considered (Oyiga et al., 2011). Food supply per person in developing nations in the last two decades has grown faster than the population and quality of diet has improved (FAO, WFP and IFAD, 2013). For example, vegetables and fruits availability per person increased by 90 %, livestock products by 70 % and vegetable oils increased by 32 % since 1990–92 (FAO, 2015). This has changed into better diets, inclusive of increased protein of 20 % per person (Chauvin, 2012). Food availability in the SSA region has increased by nearly 12 % since (1990-92 and 2012-14) (FAO, 2010). In this period, countries such as Ethiopia experienced increase in food availability of 41 %, Mozambique 41 %, Cameroon 27 %, Sao Tome 23 % and Malawi 26 % (FAO, WFP and IFAD, 2013).

Climate Implication on Food Availability

The most notable effects of climate variability on food availability is through changes in production. Extreme weather events disrupt production cycles (Sianungu, 2015). Climate changes affect crop production directly through environmental changes and indirectly by affecting distribution of incomes and growth (Zewdie, 2014). Warming of over 3 °C will have negative effects on crop production. However, moderate warming of 1°C is anticipated to boost food crop and pasture growth in temperate regions, while it is likely to have negative effects in tropical and semi-arid regions, to cereal crops (Baldos and Hertel, 2014).

Food Accessibility

Food accessibility is referred as a household's capacity to access food of the needed quantity, quality, and nutritional type through production, purchase, gifts, borrowing or aid. Food access is directly associated with a household's financial ability to afford needed food for an active and healthy life (FAO, WFP and IFAD, 2015). The ability to acquire food is influenced by physical and financial resources (allocation, preferences and affordability) Zewdie (2014). Physical availability of food alone is not enough to a household or a person to have access to food. There may be adequate food in the market but due to the economic access aspect, some households may not be able to access it (Belloumi, 2014). Food access is influenced by physical access which is determined by infrastructure and economic access. This is further determined by level of income, the cost of food and social access (Kabunga et al., 2014). Therefore, insufficient access to food could be due to high market prices or lack of capacity to acquire food and sociopolitical access for example traditional rights to common resources (USAID, 2013). Access to food is often measured using entitlement proxies such as price, income, monitoring, consumption or assets. It reflects the demand, uneven food distribution side of food security as well as cultural values within a community. It accentuates challenges in response to severe shocks such as unemployment, hiked prices or loss of assets resource base (Poppy et al., 2014). In the SSA nations, households are unable to access food for many reasons such as hiked food prices, markets inaccessibility, high poverty levels, employment status, level of education and rights to property. This will affect SSA communities that depend mainly on subsistence agriculture and markets as an important source of secondary food (Huppe et al., 2013; Zewdie, 2014). The effort to quantify food access is new and comes with a lot of challenges since households or individuals have many ways to react/respond to shock. Some of the indicators that have been put into consideration include; affordability or ability of consumers to buy food, money spent on food, market access, although a nearby market with plenty of food does not necessarily imply that households in the neighborhood are food secure (FAO, WFP and IFAD, 2014).

Food Utilization

This is the ability or capacity of the household to utilize essential food nutrients from the food they consume or access (FAO, 2008). Utilization includes the nutrient content of the diet that is, how well food is utilized and whether the diet is well balanced with adequate nutrients (Chauvin, 2012). A house that has both physical and economic food access may be branded food insecure if it is not able to achieve a nutritious and balanced diet. These factors are influenced by preparation of food, knowledge on nutrition, access to clean drinking water and health care. These are particularly less if not lacking in most SSA nations where malnutrition is widely spread (Oyiga et al., 2011). Utilization shows whether individuals and households use well the food that they have access to, whether they consume well balanced and nutritious foods they can easily afford or choose a nutritionally low diet. As well as if the foods they consume are safe and well-cooked so as to give their full nutritional value and substantive nutrients.

Utilization is basically keen on dietary quality, especially intake of important minerals and vitamins (Poppy et al., 2014). Food utilization is reflected when there is adequate food intake and members of the household are in good health care to reach a state of nutritional well-being where all physiological needs are met. Food wasting can lead to inadequate food intake and this can cause repeated occurrence of illnesses or infections. This will further cause acute under nutrition (Li & Zheng, 2016). The number of undernourished and underweight children under five years has decreased in all developing regions since the year 1990, thus improved nutrition resulting from easy access to and availability of food. (FAO, IFAD and WFP, 2013).

Empirical Review

Ogega (2021), conducted a study on study assessed historical intraseasonal rainfall variability, generated future intraseasonal rainfall scenarios, and made recommendations to build on climate service foundations for a sustainable climate change adaptation in East Africa. Relatively better performing RCM runs were then used to assess projected precipitation changes (for the period 2071-2099 relative to 1977-2005) over the study domain under the representative concentration pathway (RCP) 8.5 scenario. Results showed the performance of RCMs to be descriptor- and scope- specific. Overall, RCA4 (r1i1p1) forced by CNRM-CERFACS-CNRM-CM5 and MPI-M-MPI-ESM-LR, REMO2009 (r1i1p1) forced by MPI-M-MPI-ESM-LR, and RCA4 (r2i1p1) forced by MPI-M-MPIESM- LR emerged as the top four RCM runs. Further, an ensemble mean of the top four model runs outperformed an ensemble mean of 24 model simulations and ensemble means for all runs in an RCM. An analysis of projections showed a reduction (increase) in mean daily precipitation for MAM (OND), an increase(decrease) in CDD(CWD) events, and a general increase in SDII and the width of the right tail of the precipitation distribution (99p-90p). An increase in SDII and 99p-90p implies a possibility of heavy and extreme precipitation incidences by the end of the 21st century. The study presented a geographical gap as it majored in East Africa while our study will focus provenance of food insecurity in Africa.

Koimbori (2019), conducted a study on the effects of climate variability on maize yield among farm holders in Bahati Sub- County, Kenya for the period 1985 to 2015. A descriptive case study was used relying on both primary and secondary data. The findings were that annual rainfall and maize yield have shown a decreasing trend, while the average annual, maximum and minimum temperature have shown an increasing trend from 1985 to 2015. Rainfall has shown a decreasing trend during the long rain season and an increasing trend during short rain season. Rainfall variability is significant in both seasonal and annual trends with the highest annual rainfall variation below average occurred in 2000 with a variation of 350.40mm and highest annual variation above average occurred in 2010 with a variation of 475.80mm. The long rain season recorded the highest rainfall variation below average in 2000 with a variation of 253.17mm and the highest rainfall variation above average in 2010 with a variation of 263. 53mm.The Short rain season recorded the highest rainfall variation below average in 1985 with a variation of 111.08mm and the highest rainfall variation above average in 1997 with a variation of 247.31mm. Annual average temperature has shown an increasing trend ranging from 17.7°C in 1989 to 19.7°C in 2009. Maximum temperature trend has shown a slightly gradual increase of 0.008°C annually. Minimum temperature trend has shown a slightly gradual increase of 0.075°C annually. The study however presented a methodological gap as it utilized descriptive research design while our study will utilize desktop review approach.

Gakuu (2018), conducted a study to find out the climate change effects on food security, and the community coping strategies in Gikindu Division in Murang'a County. A descriptive research design was employed to achieve the desired data in the area. The members of the women groups actively engaged in agricultural activities served as the target respondents. The study found out that: most of the respondents perceived the difference in rainfall and temperature levels to be profound thus confirmation that over a period of time, there had been noticeable variation in terms of the rainfall amounts and the temperature levels. It was observed that majority (55%) of the respondents considered there to have been improvement of their agricultural production activities by virtue of participation in the group activities thus confirmation that membership in the women groups had impacted positively on the households' economic mainstays. The climate change phenomenon had occasioned suffering to the farmers. Likewise, majority of the families in the area were entirely dependent on the rains for their agricultural production activities exposing them to risk at the advent of crop failure. The study concluded that the challenges faced by farmers in the area are to a great extent as a result of the climate change that has taken place over time. The study however presented a contextual gap as it focused on variation in temperature and rainfall, analyze climate change effects on food security, and the community coping strategies while our study will focus on provenance of food insecurity.

Borona (2016), conducted a study that evaluated to determine the extent of vulnerability among small scale farmers in Wote division, Makueni County by specifically determining exposure, sensitivity and adaptation mechanisms as pertains climate extremes. Descriptive and inferential statistics approaches included correlation, chi square, non-parametric tests and regression. Household characteristics included main respondents and correspondents, 86% and 76% respectively, engaging in farming as the main occupation with 86% of household's main income obtained from on farm produce. Results showed that households have been exposed to calamities in form of; drought, 100%: crop pests, 93%: crop diseases, 83% and erratic rains, 59% with drought ranking highly (=1.06,σ=0.28).Crop diseases significantly related to occurrence of crop failure, χ2=24.860,p=0.000 and Cohen's index=0.445 showing a medium relationship. Drought however did not show a significant relationship with crop failure, p=0.334.Temperature data indicated an annual trend of 0.21220C (R2=0.4881) per year with annual means varying significantly, p=0.002. The study presented a conceptual gap as it focused on extent of vulnerability among small scale farmers while our study will focus on provenance of food insecurity.

Apindi (2016), conducted a study on establishing the influence of climatic elements such as dry spell, rainfall and strength of wind; and non-climatic factors such as overfishing, water hyacinth and predators on fishing activities in beaches of Lake Victoria within Kisumu County. The study employed descriptive survey design. The area of study, had thirty two beaches, out of which eight were sampled to represent the entire Kisumu County. Systematic sampling technique was used to sample the eight beaches. A The findings were coded and analyzed using the Statistical Package for Social Sciences (SPSS) programme which helped in calculating frequencies, means and percentages. The study found a significant relationship between climatic factors and fishing activities. Fish catches were influenced by the amount of rainfall, though the effect varied with fish types; Orechromis (r = .260), Lates niloticus (r =.130) and Protopterus (r =.184), however, Rastrinoebola argentea and Claras gariepinus revealed a negative correlation with the amount of rainfall. Overall, the results revealed a positive correlation coefficients (r = .079) between the amount of rainfall and the total amount of fish catch. Dry spell which is associated with high temperatures led to a decrease in fish in the Lake. Whereas mild or moderate winds were found to favour fish catch, strong winds had negative effect on fishing activities. The study also established that non-climatic factors too had immense negative influence on fishing activities in Lake Victoria. The study presented a methodological gap as it focused on descriptive research design while our study will focus will be a desktop review approach.

METHODOLOGY

The study adopted a desktop literature review method (desk study). This involved an in-depth review of studies related to provenance of food insecurity. Three sorting stages were implemented on the subject under study in order to determine the viability of the subject for research. This is the first stage that comprised the initial identification of all articles that were based on provenance of food insecurity. The search was done generally by searching the articles in the article title, abstract, keywords. A second search involved fully available publications on the subject on examine provenance of food insecurity. The third step involved the selection of fully accessible publications. Reduction of the literature to only fully accessible publications yielded specificity and allowed the researcher to focus on the articles that related to provenance of food insecurity which was split into top key words. After an in- depth search into the top key words (provenance, food insecurity) the researcher arrived at 5 articles that were suitable for analysis. This were findings from:

Ogega (2021), who conducted a study on study assessed historical intraseasonal rainfall variability, generated future intraseasonal rainfall scenarios, and made recommendations to build on climate service foundations for a sustainable climate change adaptation in East Africa. Specifically, (i) nine reanalysis data (ERAINT)-driven and (ii) 24 model runs from five general circulation model (GCM)-driven CORDEX-Africa RCMs were analysed. Relatively better performing RCM runs were then used to assess projected precipitation changes (for the period 2071-2099 relative to 1977-2005) over the study domain under the representative concentration pathway (RCP) 8.5 scenario. Results showed the performance of RCMs to be descriptor- and scope- specific. Overall, RCA4 (r1i1p1) forced by CNRM-CERFACS-CNRM-CM5 and MPI-M-MPI-ESM-LR, REMO2009 (r1i1p1) forced by MPI-M-MPI-ESM-LR, and RCA4 (r2i1p1) forced by MPI-M-MPIESM- LR emerged as the top four RCM runs. Further, an ensemble mean of the top four model runs outperformed an ensemble mean of 24 model simulations and ensemble means for all runs in an RCM. An analysis of projections showed a reduction (increase) in mean daily precipitation for MAM(OND), an increase(decrease) in CDD(CWD) events, and a general increase in SDII and the width of the right tail of the precipitation distribution (99p-90p). An increase in SDII and 99p-90p implies a possibility of heavy and extreme precipitation incidences by the end of the 21st century. The study presented a geographical gap as it majored in East Africa while our study will focus provenance of food insecurity in Africa.

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SUMMARY, CONCLUSION AND RECOMMENDATIONS

Conclusion

This study concluded that the effects of rainfall and temperature adversely affect to maize and beans production in Africa. The effects are significant and positive for all crops. Generally, there is better correlation of production with precipitation than temperature. From the findings Pearson's correlation showed positive correlation for crop yields against climate data except for minimum temperature that exhibited weak negative correlation for maize and no correlation for beans. This shows plainly that "business as usual" food grain growth is altered by changes in climate. These changes could alter growing seasons, planting and harvesting calendars or even invasion of pests, weeds and diseases. Some years that experienced relatively higher rainfall gave the lowest yields. This is likely to be caused by poor distribution of rains across seasons. Therefore, there is need to devise proper adaptation practices to curb climate variability to improve food production.

Recommendations

This study recommended that adoption of other food grains that may do well under this current climatic condition. Crops such as millet and sorghum are encouraged due to their high tolerance to droughts, soil infertility and high temperatures. Households also to be guided on how to monitor crop-climate relationship so as to achieve improved crop production drought resistant modern seed varieties are very important to the population.

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