African Journal of Climate Change and Resource Sustainability, Volume 3, Issue 1, 2024
Article DOI : https://doi.org/10.37284/ajccrs.3.1.2187

African Journal of Climate Change and Resource Sustainability
ajccrs.eanso.org
Volume 3, Issue 1, 2024
Print ISSN: 790-962X | Online ISSN: 790-9638
Title DOI: https://doi.org/10.37284/2790-9638

EAST AFRICAN NATURE & SCIENCE ORGANIZATION

Original Article

Effects of Changing Weather Patterns on Household Food Availability in Bukiro Sub County Mbarara District

John Francis Nuwasasira[1], Ewaechabo Tiyo Christopher[1], Wycliffe Tumwesigye[1] & Agnes Tusingwire[1]*

[1] Bishop Stuart University, P. O. Box 09, Mbarara, Uganda.
[*] Author for Correspondence Email: nuwasasira17@gmail.com

Article DOI: https://doi.org/10.37284/ajccrs.3.1.2187

Date Published:

07 September 2024

Keywords:

Food Security, Changing Weather Patterns, Prolonged Dry Spells, Rain.

ABSTRACT

Changing weather patterns and their variables are already negatively impacting food security by damaging crops, reducing yields, and increasing the prevalence of pests and diseases. These pests and diseases contend with crops for sunlight, water, and nutrients, further diminishing agricultural yields and creating issues for crops that were previously unexposed to these threats. Climate-related disruptions in food distribution and transportation, both internationally and domestically, have a substantial impact on not just safety and quality but also access to food. Prolonged dry spells followed by heavy and stormy rains cause interruptions in food production and transportation, reducing farmers' ability to get their grains to market and potentially affecting food prices. This study assessed farmers' perceptions of effects of changing weather patterns on food security and their coping strategies towards effects of weather changing patterns in smallholder households in Bukiro Sub County, Mbarara District. A sample of 100 smallholder farmers were randomly selected from four parishes of Bukiro sub county and studied using questionnaire and observations. Key informants Interviews were also conducted with nine technical workers and three opinion leaders. Software STAT 26 and Ms excel version 2016 were used to do data analysis. The study found out that changing weather patterns through its variables specifically heavy and stormy rains, late of set of rains, and prolonged dry spells had significant effects on food security. The perceived effects of changing weather patterns established were drying up of water sources (83.8%), decreased land for crop growing (82.4%), reduction in crop yields (77.7%), drying of pastures for animals (67.4%), drying of crops (58.1%), and occurrence of crop and livestock pests and diseases at (56.6%). Also, the perceived weather changing variabilities were late onset of rains (60.1%), prolonged dry spells were responded at 17.6%, and heavy and stormy rains 22.3%. From the study finding farmers clearly perceived that changing weather patterns had negative effects smallholders' agricultural production systems impacting negatively on food security.

Article DOI : https://doi.org/10.37284/ajccrs.3.1.2187

APA CITATION

Nuwasasira, J. F., Christopher, E. T., Tumwesigye, W. & Tusingwire, A. (2024). Effects of Changing Weather Patterns on Household Food Availability in Bukiro Sub County Mbarara District *African Journal of Climate Change and Resource Sustainability*, *3*(1), 317-330. https://doi.org/10.37284/ajccrs.3.1.2187.

CHICAGO CITATION

Nuwasasira, John Francis, Ewaechabo Tiyo Christopher, Wycliffe Tumwesigye and Agnes Tusingwire. 2024. "Effects of Changing Weather Patterns on Household Food Availability in Bukiro Sub County Mbarara District", *African Journal of Climate Change and Resource Sustainability* 3 (1), 317-330. https://doi.org/10.37284/ajccrs.3.1.2187.

HARVARD CITATION

Nuwasasira, J. F., Christopher, E. T., Tumwesigye, W. & Tusingwire, A. (2024) "Effects of Changing Weather Patterns on Household Food Availability in Bukiro Sub County Mbarara District", *African Journal of Climate Change and Resource Sustainability*, 3(1), pp. 317-330. Doi: 10.37284/ajccrs.3.1.2187.

IEEE CITATION

J. F. Nuwasasira, E. T. Christopher, W. Tumwesigye & A. Tusingwire "Effects of Changing Weather Patterns on Household Food Availability in Bukiro Sub County Mbarara District", AJCCRS, vol. 3, no. 1, pp. 317-330, Sep. 2187.

MLA CITATION

Nuwasasira, John Francis, Ewaechabo Tiyo Christopher, Wycliffe Tumwesigye & Agnes Tusingwire. "Effects of Changing Weather Patterns on Household Food Availability in Bukiro Sub County Mbarara District". *African Journal of Climate Change and Resource Sustainability*, Vol. 3, no. 1, Sep. 2024, pp. 317-330, doi:10.37284/ajccrs.3.1.2187.

INTRODUCTION

According to (Danandeh Mehr et al., 2020), climate refers to the typical weather patterns of a location, characterized by temperature, precipitation, and humidity over thirty years. Climate change describes the alterations in weather patterns over decades or longer, resulting from both natural and human influences. Changes in weather patterns can occur due to prolonged periods of excessive rain, hail, and windstorms causing damage, or when an area experiences a deficit in its water supply, whether surface or underground (FAO, 2015),

Food security means everyone has steady, physical, economic, and social access to sufficient safe and nutritious food to fulfil their dietary needs and preferences for a healthy and active lifestyle (FAO, 2015). Food availability is having enough high-quality food, whether produced locally, imported, or provided through aid. The FAO identifies four main aspects of food security: availability, access, utilization, and stability. Food accessibility is the ability to get the right number of resources to obtain nutritious food. Food stability means having consistent access to food, while utilization is about using food properly through a balanced diet, clean water, sanitation, and healthcare to meet all nutritional needs.

Climate change is expected to significantly impact food security at global, regional, and local levels. It can disrupt how much food is available, limit access to food, and affect food quality (Brown et al., 2015). For example, increasing temperatures, altered rainfall patterns, more frequent extreme weather events, and decreased water availability could decrease agricultural productivity. Additionally, more frequent and severe extreme weather can disrupt food distribution and lead to higher food prices. Additionally, higher temperatures may contribute to spoilage and contamination. Environmental changes, including climate change and water scarcity, pose threats to global agricultural production, food security, and health. Evidence suggests that environmental changes will decrease the yields of crops, fisheries, and livestock. For example, Ziska et al. (, 2016) noted that prolonged dry spells and intense rains could present challenges for farmers and ranchers, potentially compromising food safety. Overall, shifting weather patterns could make it more challenging to cultivate crops, rear livestock, and catch fish using methods and in places that used to work. It's also important to consider these weather changes along with other factors that affect farming, like changes in farming practices and technology.

Article DOI : https://doi.org/10.37284/ajccrs.3.1.2187

Extreme temperatures and precipitation can hinder crop growth. Hatfield et al. (, 2014) indicated that severe weather events, especially heavy rains and prolonged dry spells, can damage crops and reduce yields. Warmer temperatures and wetter conditions may also promote the growth of weeds, pests, and fungi, which vie with crops for sunlight, water, and nutrients, ultimately reducing agricultural yields and food security. The range and distribution of these pests and weeds are expected to increase with changing weather patterns, potentially introducing new challenges for crops previously unexposed to these species. Heat waves, expected to become more common due to climate change, could directly impend livestock. Heat stress impacts animals directly and indirectly, making them more prone to diseases, reducing their fertility, and lowering milk production. Extended dry spells can further threaten pasture and feed supplies, leading to lower quality forage for grazing livestock and an increased prevalence of parasites and diseases. Climate-related disturbances in food distribution and transportation, whether international or domestic, may significantly impact food safety, quality, and access. For example, in the United States, large volumes of grain are transported by water. Extreme weather events affecting waterways can limit alternative transport routes. Prolonged dry spells followed by heavy rains can disrupt food transport (Hatfield et al., 2014), affecting farmers' ability to deliver grains to markets and influencing food prices.

The food insecurity threat global situation is no different from Africa. In sub-Saharan Africa, escalating thrilling weather patterns are already obstructing people's capability to grow food and raise livestock. Pastoralists and agro-pastoralists will need to familiarize themselves to changes in water availability to keep their food security and overall well-being (FAO, 2018). In Uganda farmers are exposed to prolonged dry spells and late sets of rains and such variabilities have disastrous consequences on smallholder farmers' food security(McSweeney et al., 2010)

Statement of the problem

Changing patterns in climate are already affecting land resources, crops, livestock, fisheries, biodiversity, and human health. Climate-associated morbidity renders people inactive and reduces workforce for food production; Extreme weather changes can be devastating, potentially leading to the loss of crops, livestock, and even human lives. Such events can force-displacement and exacerbate famine, hunger, and poor nutrition in areas where people are unable to grow or access sufficient food (FAO, 2014). The research thought to prove if this also true in the research area. Extreme events, especially heavy and stormy rains and prolonged dry spells can harm crops and reduce yields. Many weeds, pests, and fungi flourish in warmer temperatures and wetter climates, competing with crops for light, water, and nutrients reducing agricultural yields- and eventually food security and therefore this research sought to establish if such information is also true in the research area. According to Uganda, Climate Action prolonged dry spells were known as the most challenging climate hazards to food security in Uganda through its negative impacts on agricultural production as indicated by (Mfitumukiza et al., (2020), and Nuwagaba and& Namateefu, (2013) noted that southwestern region has been devastated by the effects of changing weather patterns. Climate change is expected to significantly affect food security at global, regional, and local levels. It can disrupt food availability, restrict access to food, and impact food quality. Therefore, the objective of, this study was to establish the effects of changing weather patterns on food security and the coping strategies employed by farmers to develop approaches that ensure sustainable food production.

Changing patterns in climate are already affecting land resources, crops, livestock, fisheries, biodiversity, and human health. Climate associated morbidity renders people inactive and reduces work force for food production; Extreme weather changes can be devastating, potentially leading to the loss of

Article DOI : https://doi.org/10.37284/ajccrs.3.1.2187

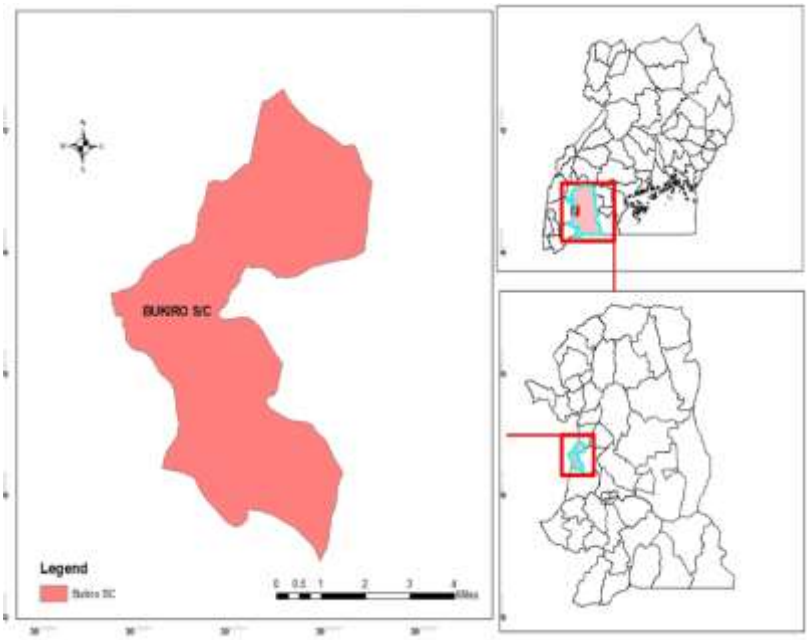
crops, livestock, and even human lives. Such events can force displacement and exacerbate famine, hunger, and poor nutrition in areas where people are unable to grow or access sufficient food (FAO, 2014). The research thought to prove if this is also true in the research area. Extreme events, especially heavy and stormy rains and prolonged dry spells can harm crops and reduce yields. Many weeds, pests, and fungi flourish in warmer temperatures and wetter climates, competing with crops for light, water, and nutrients reducing agricultural yields-and eventually food security and therefore this research sought to establish if such information is also true in the research area. According to Uganda, Climate Action prolonged dry spells were known as the most challenging climate hazards to food security in Uganda through its negative impacts on agricultural production as indicated by (Mfitumukiza et al., (2020), and (Nuwagaba & Namateefu, (2013) noted that the southwestern region has been devastated by the effects of changing weather patterns. Climate change is expected to significantly affect food security at global, regional, and local levels. Changing weather patterns can disrupt food availability, restrict access to food, and impact food quality. Therefore, the objective of, this study was to establish the effects of changing weather patterns on food availability among households in Bukiro Sub County.

Methodology

Area of the study

This study was conducted in the four parishes (Bukiro, Nyanja, Nyarubungo and Rubingo) of Bukiro Sub County found in Mbarara District in the southwestern farmlands and cattle range lands located at latitude -0.60467 and longitude 30.64851. The area is mostly inhabited by smallholder farmers depending on rain-fed subsistence farming for their food production. Food production in the study area was attributed to its soils and weather patterns but under threat of changes in weather patterns and soil degradation, food security is at stake (MoWE, 2020). Bukiro Sub County lies in the North-western part of Mbarara District and covers an area of 261 km^2 with a population of 32,323 (Mukasa et al., 2020). The study was conducted in the whole sub-county covering all its four parishes of Bukiro, Nyanja, Nyarubungo and Rubingo.

Figure 1: Location of Bukiro Sub County



Article DOI : https://doi.org/10.37284/ajccrs.3.1.2187

Climate /Weather data for the study area

The climatic conditions in this region are characterized by a tropical climate. In Mbarara, the precipitation during summers is significantly higher in comparison to winters. According to the Köppen-Geiger classification, the prevailing climate in this region is categorized as Aw. The temperature averages 21.1 °C | 69.9 °F. Each year, there is an approximate 773 mm | 30.4 inch of precipitation that occurs. Due to its proximity to the equator, it is quite challenging to precisely delineate summers in Mbarara https://en.climate- data.org/africa/uganda/ western-region/mbarara-29829/ February is the warmest month of the year, with an average temperature reaching 22.5°C (72.5°F), making it the hottest period. This is followed by March and July, with average temperatures of 22°C (71.5°F) and 21.2°C (70.2°F), respectively. July experiences the lowest rainfall at 15mm, making it the driest month, while November has the highest rainfall at 104mm. The variation in precipitation between the months, with the difference between the lowest and highest rainfall, is 94mm (4 inches). Notably, October and November recorded the highest number of rainy days, with 17 each, making them the wettest months. In contrast, July had only 3 wet days. Regarding relative humidity, November shows the highest level at 77%, while July records the lowest, with only 54%.

Household survey

A cross-sectional survey was conducted in the sub-county using a structured questionnaire and data was collected from 100 smallholder households. The sample size was calculated from the total population of households in the study area using the formula provided by Yamane (1967).

$n= N/1+N(e2)$

Where n = Sample size, N = Total population of households in the sub-county, and e = error tolerance (was set at 10%).

N = $32323/1+32323(0.1)^2$ = 99.7. this was approximated to the nearest whole number which is 100.

The survey household were randomly picked from the four parishes of Nyanza, Nyarubungo, Bukiro and Rubingo which make up Bukiro sub-county.

Key informant interviews

Interview guides were used to obtain data from key informants. This was used because more probing questions would be asked to dig deeper so that more information about changing weather patterns and their effects on food availability could be revealed through the interviews. An interview guide is a list of topics or questions that the interviewer hopes to cover during an interview Ma, (2015)T. he interviews lasted for between 30 minutes and One hour with the respondents.

Data analysis

Data collected from observations of various effects of changing weather patterns in farmers' fields, along with information from the household survey, were analyzed using descriptive statistics. Software Stata 26 and MS Excel version 16 were employed to create frequency tables, percentages, charts, and graphs to summarize, present, and interpret the survey results.

RESULTS

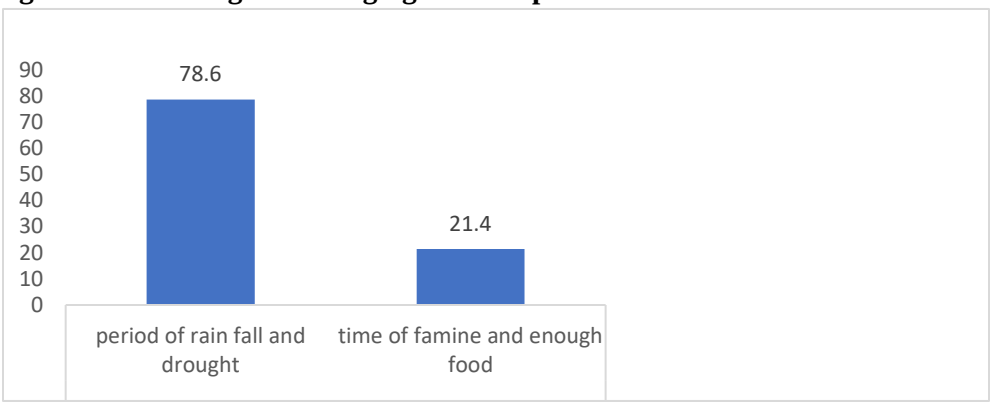
Understanding of Weather changing patterns by smallholder farmers

From the research findings, all the farmers (100%) agreed to have knowledge on weather-changing patterns and its variabilities, experienced their effects on the production of foods in the sub-county, indicating having great knowledge of problems associated with effects of changing weather patterns. Farmers' knowledge on weather-changing patterns is critical in their decision-making, and the research finding farmers understood changing weather patterns in two perspectives as shown in fig.2 below. With the majority understanding it as a

Article DOI : https://doi.org/10.37284/ajccrs.3.1.2187

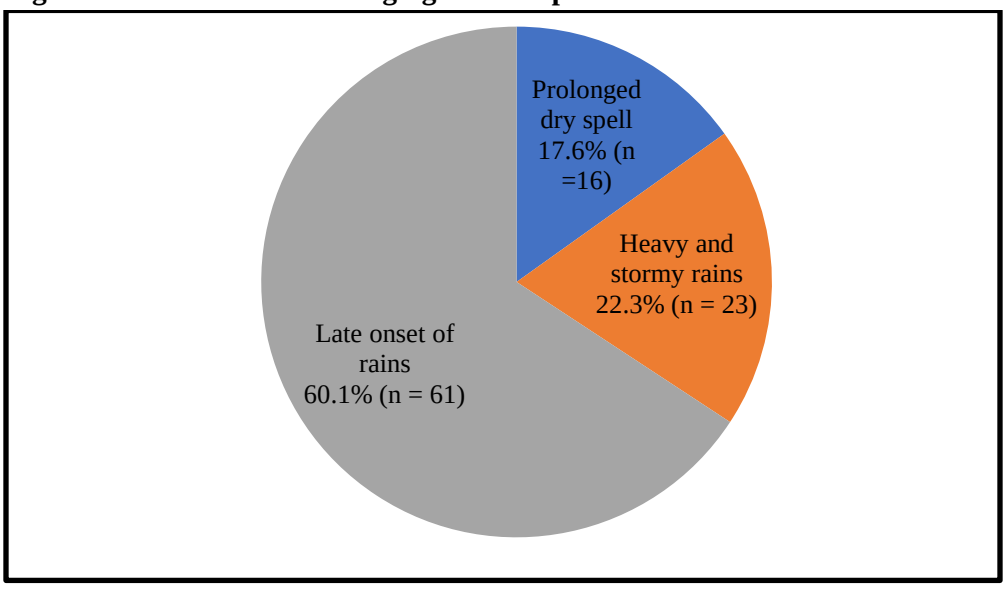
period of rain and prolonged dry spells (78.6%) while the others (21.4%) understood as a time of Plenty of food and hunger. This meant that farmers get enough food during rain time and that it is during the time of prolonged dry spells/drought that they are faced with hunger.

Figure 2: Knowledge of Changing weather patterns.



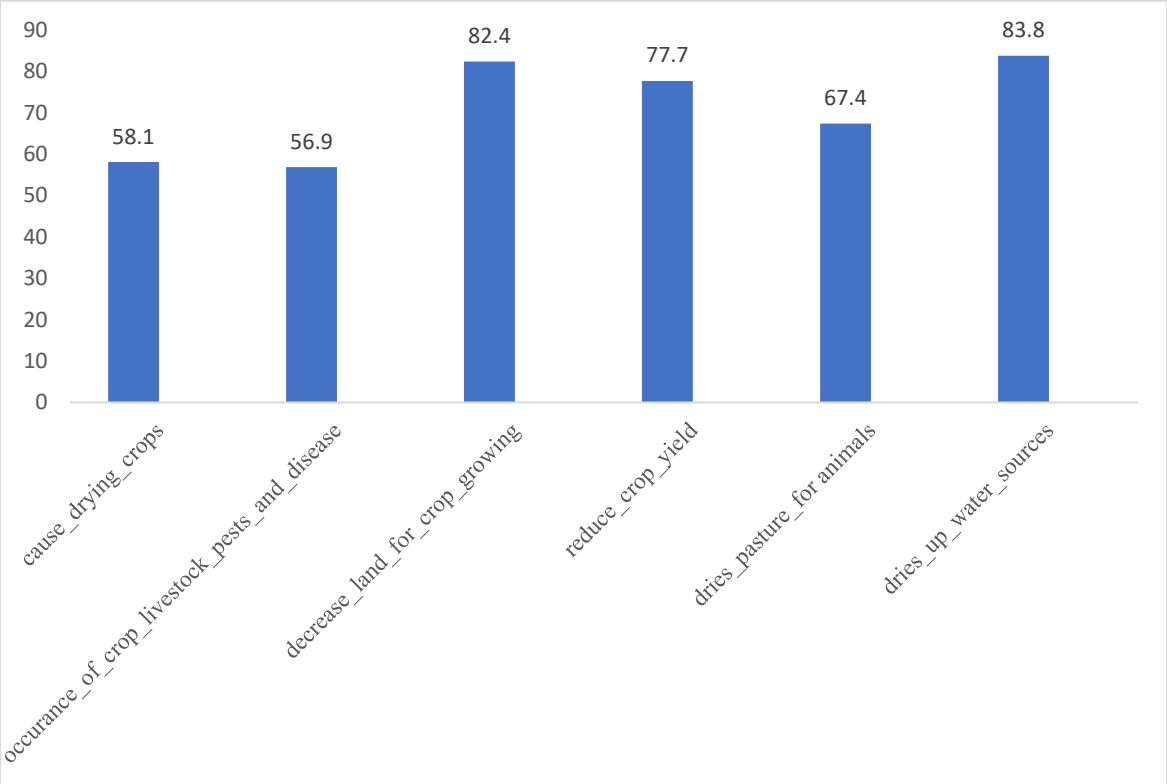
Also, from the research findings farmers had knowledge of the variabilities of changing weather patterns which is vital in choosing the appropriate coping and adaptation measures. Figure 3 below, shows the responses of farmers on their knowledge of changes/variabilities on weather patterns in the last five years. The findings indicate that the biggest fluctuations in changing weather patterns observed by smallholder farmers in Bukiro sub-county were, increased late on set of rains (60.1%), increased in heavy and stormy rains (22.3%), and increasing prolonged dry spells (17.6%) over the past five years.

Figure 3: Variabilities of changing weather patterns



Article DOI : https://doi.org/10.37284/ajccrs.3.1.2187

Figure 4: Effects of changing weather patterns on production of agricultural produce



Source: Field data 2022

Farmers indicated that the effects of weather changing patterns reached far and near on production cycle and water resources. From the study most farmers (83.8%) indicated that changing weather patterns caused drying up of water sources reducing animal productivity, affecting food security, and nutrition in most portions of the subcounty. 82.4% of the farmers from the study also indicated decreased land for crop growing and animal rearing in the area. In addition, 67.4% reported drying of pastures for animals while 58.1% of the farmers also indicated drying of crops crop and 56.6% of the farmers affirmed increases outbreak of crop and animal pests and diseases. All the above resulted in reduction in crop and animal yields as reported by 77.7% of the farmers. clearly indicating that changing weather patterns were affecting smallholders' agricultural production process.

Article DOI : https://doi.org/10.37284/ajccrs.3.1.2187

Table 1: Results from Key informants.

Key Informants	Effects of changing weather patterns on Accessibility	Effects of changing weather patterns on Stability	Effects of changing weather patterns on Utilization
KII_1_ District Production Officer	Food accessibility is heavily and negatively affected by changing weather patterns as bad weather leads to bad or poor harvests because crops dry and fail to yield during the longer dry seasons and that when rains are heavy, banana plantation are destroyed, crop gardens along the hill slopes are washed away down the valleys.	Very bad. It destroys people's crops, banana plantations, washes away people's gardens along mountain slopes to valley, and floods those crops in the wetlands, leading to poor harvests. It also affects access roads to markets where farmers can buy food. Prices increase for foods in the villages and markets. these the affect stability of foods in a community.	The way people use food depends on how much they have. People with plenty of food eat more and those with little food eat less. But during prolonged dry spells there is not enough food that can be eaten to realize full utilization by the body. During heavy rains, harvest get rotten during drying. These are usually thrown away causing a negative effect on the way farmers utilize their food. So food utilization is affected negatively by bad weather
KII_2_ Sub County Agriculture officer	Food accessibility is heavily and negatively affected by changing weather patterns. Bad weather leads to bad or poor harvests because crops dry and fail to yield during the longer dry seasons. When rains are heavy, banana plantation are destroyed, crop gardens along the hill slopes are washed away down the valleys.	In markets very few people take there food produce for sale which leads to price increase due to low quantities of foods in markets, making food expensive for households.	Food utilization depends on the situation, for example during too much rain, there are a lot of storage diseases and aflatoxins are too much in the grains due to rotting that happens during drying as a result of little sunshine.
KII_3_ District Agriculture Officer	Access roads to farmer gardens and markets are cut off due to destruction/blockage of roads/pathways by rain run offs. There are outbreaks of pests and diseases that affect farmers crops and livestock and this reduces the yield affecting food accessibility. in gardens and stores	With poor harvests due to harsh weather conditions, the food stability is very poor or even not there.	The utilization of food is negatively affected as people eat poor quality foods, some eat partially rotten grains due to poor harvest handling brought about by heavy rains
KII_4_ LC3 Chairperson	The crops in wetlands are flooded by rain run offs and get rotten and all in all harvests become very poor, negatively affecting food availability and accessibility. Changing weather patterns leads to low production of food in the area. Families get little food due to poor harvests. Some families sell their properties to access food in markets. So, it is very badly affected	Prolonged dry spells lead to drying of crops in gardens and poor harvests. Water wells dry up and those with cows get very little or no milk, causing food instability. Some people move from the families to look for food in other areas	In most cases changing weather patterns affect food utilization negatively. People eat less, which is not enough for their bodies to utilize maximally.

Article DOI : https://doi.org/10.37284/ajccrs.3.1.2187

KII_5_ Environment Officer	The effect is very bad. Heavy rains with hailstorms destroy people's gardens, rain ran offs cause soil erosion, wash away people's crops very badly reducing yields and these bring hunger due to poor harvests. People go without food during prolonged dry spells as their crops dry in gardens causing total destruction of harvests which negatively affects food availability and accessibility.	Changing Weather Patterns affects the production and yield of crops, and this negatively affects the stability of food in the sub county.	Many farmers lose their crops in the garden due to heavy rains or prolonged dry spells, making people get less harvest to utilize for their food requirement. And is very bad. Some ware grains get rotten reducing the amount of food available for utilization.
KII_6_Sub County Community Development Officer	Changing weather patterns negatively affect food stability. Bad weather like prolonged sunshine kills and dries crops causing hunger and too much rain destroys gardens and makes crops rotten in the gardens with poor yields and harvests, food stability is affected negatively. They cause Poor- and low-quality harvests. And worse is that a hungry family is violent family so changing weather patterns also bring domestic violence.	If there are low yields, then there is also instability in food supplies to the households. The food requirements are not met.	People get little food to eat when their harvests are poor. Some go without some meals, affecting the bodily food requirements. This means there is no enough food to use by farmers.
KII_7_sub county chief	There are poor harvest due to prolonged dry spells which causes drying of crops. But also, when the rains are too much, crops get rotten in garden and on the compounds without drying.	In markets foods become very few and rare, so changing weather patterns negatively affect the stability of food in the sub county.	Some families eat the rotten grains.
KII_8 District Natural Resources Officer	Prolonged droughts lead to drying of crops in gardens and poor harvests. Water well dries up those with cows get very little or no milk, so food accessibility is very much affected by the changing weather patterns. Also natural ecosystems are destroyed leaving no place to gather natural foods.	When weather patterns change a lot, the stability of food in highly affected stable weather conditions brings food stability as enough food is produced and harvested. But changing weather pattern leads to poor harvests due to destruction of crops by heavy rains or drying of crops by long dry seasons.	People lack what to eat, and less food eaten then poor health. When people don't eat enough food, their bodies are not satisfied. Households skip their meals and as a result deficiently diseases due to poor meals as a result of Changing weather patterns which affect production.
KII_9 District Forestry Officer	It causes Famine due to drying of crops during prolonged dry spells. rotting of crops due to heavy rains destruction of gardens by stormy and heavy rains, washing away of planted crop by rain offs and also plant and animal disease accuracies increases which reduces yields.	Average rainfall and sunshine lead to food stability, Heavy rains, and prolonged drought lead to food instability. Too little rain leads to food instability	

Article DOI : https://doi.org/10.37284/ajccrs.3.1.2187

DISCUSSION OF RESULTS

Understanding changing weather patterns and its variability

From the study findings, Smallholder farmers understood changing weather patterns from two dimensions as presented in Figure 2. (1) as periods of prolonged dry spells and heavy rains. As stated by farmers, periods of prolonged dry spells meant that farmers sometimes experienced somehow extended periods of sunshine and faced a deficiency of water limiting agricultural production, and at some other times they experienced extended periods of heavy rains favouring agricultural production, and (2) as periods of famine and plenty of foods which also correlates well with the first understanding because it is during the periods of prolonged dry spells that agricultural production is affected resulting into famine, and also it is in periods of availability of rains that farmers get plenty of food harvests. This understanding by farmers correlated to the description of changing weather patterns by (FAO, 2015) which indicated that changing weather patterns occur when there are prolonged periods of excessive rain, accompanied by hail and windstorms causing destruction, or when a region experiences a shortage of water supply, whether surface or underground.

Variabilities of weather changing patterns as perceived by smallholder farmers

The farmers also had knowledge on variabilities of changing weather patterns (figure 3). The variabilities reported by the smallholder farmers and affecting their food security were prolonged dry spells, late on set of rains, and heavy and stormy rainfall. The farmers reported that they experienced Prolonged drought immediately after planting resulting in germination failures, crop wilting, and drying up partially or completely affecting the yield and quality of the crop harvests. They also indicated Late on set of rains delayed the timing for planting, delaying planting and germination, resulting into dwindling growth which result into poor and low yields. Furthermore, farmers reported experiencing heavy and stormy rains which caused extreme rain runoff washing away their crop garden, causing physical damage to the crops and causing rotting of crops in the fields. These variabilities affect agricultural productivity posing a big threat to food security. This result is in line with (Apanovich and& Mazur (, 2018) who indicated that these variabilities posed a threat to food security and that as the planet warms, rainfall patterns will shift, while extreme weather events such as prolonged dry spells, floods, and forest fires will become more frequent, impacting agricultural productivity and food security.

Effects of changing weather patterns on food accessibility among households in Bukiro Sub County

Drying of crops, pastures and water sources

The scourge that comes because of high temperatures. Agriculture production and productivity is fundamental to food security; however, this in most cases is affected by weather changing patterns and its variabilities which pose a threat to food security. From figure 4, the farmers reported that there were drying of crops, pastures, and water sources due to prolonged dry spells in relation to its time of set in, longevity and intensity. The drying of these resources is due extreme evapotranspiration that occur as a result of increased temperatures and reduced humidity during daytime and limited agriculture water supply in the soils. Drying of water sources exposes the livestock especially cattle and goats which get dehydrated and die because of extreme high heat stress during the daytime.

Furthermore, the farmers reported that the dying of water resources limited local fishing reducing some farmers' income and nutrition. This aligns with (Ziska et al., (2016), who noted that changes in the frequency and severity of prolonged dry spells, heavy rains, and stormy weather could present challenges for farmers and ranchers, potentially threatening food security. They also pointed out that

Article DOI : https://doi.org/10.37284/ajccrs.3.1.2187

shifting weather patterns might complicate crop cultivation, livestock rearing, and fishing, making it difficult to maintain previous methods and locations. The effects of changing weather patterns should be assessed alongside other growing factors influencing agricultural production, such as variations in farming practices and technology. Extreme temperatures and precipitation can hinder crop growth. This also agrees with (Brown et al. (, 2015), noting that climate variation is expected to impact food security at global, regional, and local levels by troublemaking food availability, restricting access to food, and affecting food quality. They highlighted that anticipated rises in temperatures, alterations in precipitation patterns, more frequent extreme weather events, and decreased water availability could result in reduced agricultural productivity, disruptions in food delivery, and higher food prices. All the key informants also agreed with the smallholder farmers when asked as they indicated that changing weather patterns caused the drying of crops and pastures for livestock.

Reduction of yields

Changing weather patterns affected agricultural production and productivity negatively resulting into reduction or total failure of yield and these leads to low seasonal and annual yields. This reduction in yields in terms of quantity and quality is because of drying of crops before maturity due to early onset of prolonged dry spells which reduce growth or cause crop retardation because of limited agricultural water in the soils, Reduced and poor yields are also because of increasing disease and pest incidences that attach and destroy crop and livestock. Reduction in quantity also occurs because of decreasing land for agriculture due to soil erosion, water logging emanating from heavy and stormy rains. Heavy rains too destroy crops physically, cause rotting of crops in the fields and limiting people from harvesting their crops which reduces quantitative and qualitative yields. The decreased and poor-quality harvests reduce available and accessible nutritious foods required by households in right quantities and at all times. This is consistent with (El Bilali et al., (2020), who reported that climate change will decrease food access by adversely affecting both food prices and rural livelihoods. This will lead to food supply shortages due to the adverse effects of changing weather patterns on yields and production, subsequently driving up food prices. It also corresponds with (Mbolanyi et al. (, 2017), who noted that food practices in Uganda, particularly in the cattle corridor, are marked by very low harvest levels, minimal quantities stored each growing season, short storage durations, and a limited number of daily meals consumed by many households. Additionally, it agrees with (FAO, 2014), which indicates that extreme weather events contribute to increased famine, hunger and malnutrition in regions where people cannot produce or access enough food.

Furthermore, the reduction in the harvested yields force households to reduce on their daily food rations, reduce number of meals per day which reduces their bodily food requirements for a healthy life. Also, the low yields are of poor quality due to rotting of crops in the gardens, pest and disease infestations and poor harvesting and post harvesting handling, which introduces aflatoxins into the ware grains and animal products which in turn lead food poisoning. These affect the quality and nutrient values of the food consumed by the households leading to food related problems like malnutrition-based diseases like stomach pains, ulcers, poisoning that affect the well-being of households and whole community. This is in agreement with (WFP (, 2012), which noted that climate change affects food safety, particularly by increasing the incidence and prevalence of food-borne diseases. It also impacts livelihoods and income, and contributes to food price increases and volatility. This, in turn, diminishes the purchasing power of poor net food buyers, forcing them to cut back on both the quantity and quality of their food consumption. Most of the key informants also indicated that

Article DOI : https://doi.org/10.37284/ajccrs.3.1.2187

changing weather patterns reduced agricultural yields which agreed with the information from household surveys.

Occurrence/outbreak of pests and diseases

Changes and variabilities in weather-changing patterns come with a threat of pest and diseases outbreaks for both crops and livestock. Farmers reported to have been armyworm a common pest of maize whose spread has been attributed to changes in weather patterns especially prolonged dry spells. Furthermore, the farmers reported foot and mouth disease posing a challenge to livestock farmers due to heavy rains which cause water logging in farmers affecting their lives. Banana bacterial wilt a common disease in banana plantations was also attributed to changes in weather patterns. Farmers growing beans a major delicacy in the area reported rot, black and dry spots of leaves/anthracnose and lepidoptera species affecting their crop, while the tomato growers reported late bright as a major disease disturbing them during rainy times. With diseases and pests attacking and destroying the farmers crops and livestock, their food security is threatened. This range of diseases reported by farmers distributed randomly across the sub-county was related to changed in weather patterns by farmers and agrees with (Hatfield et al. (, 2014), who suggested that climate change is likely to broaden the ranges and distribution of pests, potentially introducing new challenges for crops that were previously not affected by these species. The results from increased pest and disease occurrence also make farmers consume poor quality grains infected with aflatoxins introduced into crops and livestock products by pests and diseases leading to nutrition-related diseases and challenges, and this also aligns with (WFP (2, 2012), which found that climate change affects food safety by raising the incidence and prevalence of food-borne diseases, as well as affecting livelihoods and income. Additionally, it contributes to food price increases and volatility, which diminishes the purchasing power of poor net food buyers and forces them to reduce both the quantity and quality of their food consumption. This also agreed with information provided by key informants who indicated that changing weather patterns increased pests and diseases for both crops and livestock.

Conclusions

The research was conducted to establish the effects of changing weather patterns on food security among small farmer households in Bukiro sub-county and from its findings, the research made the following conclusions. The farmers had expanding knowledge on changing weather patterns and their effects on the households' food security. From the study, all farmers agreed with the certainty of changing weather patterns. The variabilities identified by the farmers in Bukiro sub cunty were prolonged dry spells, heavy and stormy rains, and late on set of rains. The study also established that changing weather patterns had both direct and underlying effects on both crop and livestock production, which are backbones of food security. The major effect was drying up of water sources, decreased land for crop growing and animal rearing in the area, drying of pastures for livestock, drying of crops, increases occurrence of crop and animal pests and diseases and decrease in crop and animal yields among others clearly indicating that changing weather patterns were affecting smallholders' agricultural production process.

Recommendations

There is a need for effective capacity building by the government and other stakeholders to empower the greatest defenceless smallholder farmers in agricultural production with the essential knowledge and information needed for reducing the effects of changing weather patterns such as embracing climate-smart agriculture practices, Sustainable land use management practices, appropriate farming systems, and proper post-harvest handling technologies.

Investment on modern agricultural technology, infrastructure and early warning systems by

Article DOI : https://doi.org/10.37284/ajccrs.3.1.2187

government and other stakeholders to enable farmers get access to appropriate and proper information, technologies, and practices necessary for adapting to climate change and mitigation technologies to be able to manage the impacts of climate change.

Acknowledgments

The authors wish to express their gratitude to farmers in Bukiro sub county, opinion leaders and the district local government in the production, natural resources and community development departments both at district and sub county of Mbarara district and Bukiro sub county respectively who agreed and gave their time and responded to key interviews.

REFERENCES.

Apanovich, N., & Mazur, R. E. (2018). Determinants of seasonal food security among smallholder farmers in south-central Uganda. *Agriculture and Food Security*, *7*(1). https://doi.org/10.1186/s40066-018-0237-6

Brown, M. E., Antle, J. M., Backlund, P., Carr, E. R., Easterling, W. E., Walsh, M. K., Ammann, C., Attavanich, W., Barrett, C. B., Bellemare, M. F., Dancheck, V., Funk, C., Grace, K., Ingram, J. S. I., Jiang, H., Maletta, H., Mata, T., Murray, A., Ngugi, M., … Tebaldi, C. (2015). *Climate Change, Global Food Security, and the U.S. Food System*. https://doi.org/10.7930/J0862DC7

Danandeh Mehr, A., Sorman, A. U., Kahya, E., & Hesami Afshar, M. (2020). Climate change impacts on meteorological drought using SPI and SPEI: case study of Ankara, Turkey. *Hydrological Sciences Journal*, *65*(2), 254–268. https://doi.org/10.1080/02626667.2019.1691218

El Bilali, H., Bassole, I. H. N., Dambo, L., & Berjan, S. (2020). Climate change and food security. *Agriculture and Forestry*, *66*(3), 197–210. https://doi.org/10.17707/AgricultForest.66.3.16

FAO. (2014). *Agroecology for food security and nutrition: proceedings of the FAO International Symposium: 18-19 September 2014, Rome, Italy*. Food and agriculure organisation.

FAO. (2015). *Climate change and food security: risks and responses*.

Fao. (2018). *Pastoralism in Africa's drylands Reducing risks, addressing vulnerability and enhancing resilience*.

Hatfield, J., Takle, G., Grotjahn, R., Holden, P., Izaurralde, R. C., Mader, T., Marshall, E., & Liverman, D. (2014). *Ch. 6: Agriculture. Climate Change Impacts in the United States: The Third National Climate Assessment* (J. M. Melillo, T. (T. C.) Richmond, & G. W. Yohe, Eds.). https://doi.org/10.7930/J02Z13FR

Ma, F. (2015). A Review of Research Methods in EFL Education. *Theory and Practice in Language Studies*, *5*(3), 566. https://doi.org/10.17507/tpls.0503.16

Mbolanyi, B., Egeru, A., & Mfitumukiza, D. (2017). Choice options to meet household food security in the cattle corridor of Uganda. *Environment and Natural Resources Journal*, *15*(1), 19–29. https://doi.org/10.14456/ennrj.2017.2

McSweeney, C., New, M., Lizcano, G., & Lu, X. (2010). The UNDP climate change country profiles. *Bulletin of the American Meteorological Society*, *91*(2), 157–166. https://doi.org/10.1175/2009BAMS2826.1

Mfitumukiza, D., Barasa, B., Kiggundu, N., Nyarwaya, A., Muzei, J. P., Box, P. O., & Kampala, U. (2020). *Smallholder farmers' perceived evaluation of agricultural drought adaptation technologies used in Uganda: constraints and opportunities 1**. https://www.elsevier.com/open-access/userlicense/1.0/

Article DOI : https://doi.org/10.37284/ajccrs.3.1.2187

MoWE. (2010). *Climate Change in Uganda Insights for Long term Adaptation and Building Community Resilience N M ENT A L A L E RT*.

Mukasa, J., Olaka, L., & Said, M. Y. (2020). Drought and households' adaptive capacity to water scarcity in Kasali, Uganda. *Journal of Water and Climate Change*, *11*(S1), 217–232. https://doi.org/10.2166/wcc.2020.012

Nuwagaba, A., & Namateefu, L. K. (2013). Climatic Change, Land Use and Food Security in Uganda: A Survey of Western Uganda. In *Journal of Earth Sciences and Geotechnical Engineering* (Vol. 3, Issue 2). online) Scienpress Ltd.

WFP. (2012). *Climate impacts on food security and nutrition*.

Ziska, L., Crimmins, A., Auclair, A., DeGrasse, S., Garofalo, J. F., Khan, A. S., Loladze, I., Pérez de León, A. A., Showler, A., Thurston, J., & Walls, I. (2016). *Ch. 7: Food Safety, Nutrition, and Distribution. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. https://doi.org/10.7930/J0ZP4417

