

Original Research Paper

Analyzing Food Security through Flood Recession Farming: A Case Study of the Upper East Region, Ghana

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Abstract: Sustainable Development Goals one and two aim at reducing poverty and eradicating hunger by the year 2030. However, the realization of these goals, especially among subsistent farmers in Africa, is marred by the occurrence of climatic events such as floods and drought which have retarded crop production in the sub-region. This means that there is a need to explore other alternative farming practices to ensure food security. The study sought to analyze the contributions of flood recession farming to food security in the Sudan ecological zone of Ghana. Qualitative approach was adopted, wherein 30 respondents were selected to participate in the study. In-depth interviews, focus group discussions and field observation was how data was collected. The data obtained from the field were analyzed using qualitative data analysis. From the study, it was observed that the nature of the soil in the Sudan ecological zone contains nutrients that promote both wet and dry seasons of farming. Flood recession farming was identified to provide more crop yield than the wet season as it has the potential to ensure food security in the region. Based on that it is recommended that more attention should be given to flood recession farming to ensure all year-round farming in the area as a measure of ensuring food security.

Keywords: Flood Recession, Sudan Ecological Zone, Hunger, Food Security

Introduction

Globally, the production of food has increased within the last decades with at least 2,720 kilocalories consumed per day by households which exceeds the minimum recommendation of 2,250 kilocalories as espoused by the Food and Agriculture Organization (FAO) of the United Nations (FAO, 2003; Atubiga and Donkor, 2022). Ironically, access to food security remains a major threat to many households in the global setting, especially in Sub-Saharan Africa. In 2015, it was estimated that 800 million people in the world were facing chronic food insecurity. In sub-Saharan Africa, the issue of food insecurity and malnourishment has increased since 1992 from 20% and it is estimated that by the year 2030, the region will be home to about 30% malnourished people (Yiran *et al.*, 2022).

According to FAO (2017) food security is seen as a situation where people have access to sufficient, safe, and nutritious food to meet their dietary needs and food preference for an active and healthy life. Food security has four main components: Availability, accessibility,

utilization, and stability. However, these four components are directly linked to the impacts of flooding (Yaro, 2004). Generally, a food system is considered vulnerable when one or more of these components is unavailable or insecure among households (Atubiga and Donkor, 2022).

The reduction of poverty and the achievement of sustainable food security are major challenges in the semi-arid areas of West Africa including northern Ghana (Devereux and Maxwell, 2001; Challinor *et al.*, 2007). This agroecological zone has intermittently experienced food insecurity in the past. Since the food crisis of 2008 and with an increased frequency of extreme weather events such as floods and droughts, there is renewed interest in finding alternative ways to promote food production which will bring about adequate nutrition and improve the resilience of populations living in this zone especially in rural areas (von Braun, 2008; UN, 2011).

In Ghana, flooding usually occurs in the rainy season. This is the period when rainfall is usually torrential with most rivers overflowing their banks thereby affecting crop production as well as other human activities. The Sudan ecological zone has over the years' experienced perennial

floods. The main cause of the floods in the area is excessive rainfall resulting in the overflow of the White Volta. The occurrence of the flood also marks the period when the Bagre Dam in Burkina Faso is usually spilled off worsening the situation (Forkuo, 2011). The floods always occur on both sides of the river banks destroying farmlands and exposing many households to food insecurity (Motsumi *et al.*, 2012). The frequency and severity of the floods as well as the drought witnessed in the area have resulted in many households resulting to flood recession farming.

The Sudan ecological zone contained so many floodplains created as a result of several tributaries of the White Volta. This makes the production of food from these floodplains high because of the perennial flooding that occurs every year in the area (Sidibe *et al.*, 2016). Also, it is important to note that flood-recession farming in the area is always done in the dry season. This is the period when most households are usually food insecure. The harvest obtained from this farming activity is used to support many households since most of them usually run out of food supplies and financial resources during this period as indicated earlier (Yiran *et al.*, 2022). However, over the years little attention has been given to this system of farming although studies have shown that it has the potential to minimize the impact of hunger among households in the area (Sidibe *et al.*, 2016; Atubiga and Donkor, 2022; Yiran *et al.*, 2022). This study seeks to analyze how recession farming can promote food security in the area. The study is essential because Ghana's quest to achieve sustainable food security and reduction of poverty has been confronted with the problem of a decline in crop production in recent times due to climatic hazards (Challinor *et al.*, 2007; Yiran *et al.*, 2022). This can be seen from the perspective of increasing extreme weather events like floods and droughts leading to loss of crop and rising prices of food items (Yiran *et al.*, 2022; Atubiga and Donkor, 2022).

Study Area and Methods

The Bawku West and Binduri Districts are located in the extreme northeastern portion of the Upper East Region of Ghana. The two districts (Bawku West and Binduri) were carved out of the old Bawku District under the local government system of 1988 and 2012 respectively (UNDP, 2011; GSS, 2014). In terms of absolute location, the Bawku West District is situated between latitudes 10°30'N and 11°10'N and longitudes 0°20'E and 0°35'E whereas the Binduri District is situated at latitude 11°11'N and 10°40'N and Longitude 00 18'W and 006'1'E (Fig. 1) (UNDP, 2011; GSS, 2014). The land size of both districts is massive and occupied much of the land area in the region (Fig. 1). According to the GSS (2002), the Bawku West District covered a total area of approximately 1,070 km² which represents about 12% of

the total land area of the Upper East Region. This makes it the fifth-largest district in the region in terms of land size (UNDP, 2011). The Binduri District also has a land size of about 391.91 square kilometers (GSS, 2002).

The districts are separated from one another by the White Volta River (Fig. 1). In this case, the Bawku West District shares a boundary to the North with the Republic of Burkina Faso, to the East with the Binduri District, to the South, with the East Mamprusi District, and to the West with the Talensi and Nabdam Districts (Fig. 1) (GSS, 2002). The Binduri District also shares boundary to the East with the Bawku Municipal, to the North with the Republic of Burkina Faso, to the South with Garu and Tempane Districts, and with Bawku West District to the West (Fig. 1) (GSS, 2014).

The districts are drained by many streams with fewer rivers. This is a result of the fact that the topography is gentle in nature (Yiran, 2014). Most of the streams and rivers only contain water during the rainy season with little or no water in the dry season. The major river in the two districts is the White Volta which flows throughout the year but decreases in volume during the dry season as a result of human activities along its banks (Obeng, 2000). Again, the driest nature of most of these rivers and streams in the dry season can be attributed to the activities of inappropriate farming practices along the banks of these rivers leading to siltation (O'Higgins, 2007; Tom-Dery *et al.*, 2012).

Because of the nature of the topography of the land (Fig. 1), the rivers and streams flow downstream and usually become flooded during heavy downpour coupled with the spillage of the Bagre dam thereby affecting farming communities situated along the banks of these water bodies (IESS, 2012).

Climate

The climate of the two districts is uniformly the same and characterized by semi-arid with an annual rainfall of about 956 mm which ranges between 682-1310 mm (Weber, 1996). The districts record two seasons in a year, that is the rainy season and the dry season. The rainy season normally starts in May and ends in November when farming activities are pronounced (Weber, 1996). This is followed by a long dry season lasting about 6 to 7 months (GSS, 2014). The annual rainfall pattern in the districts varies from season to season. It has been observed lately that the period of the dry seems to be increasing as a result of the late onset of the rain and early stoppage (Logan *et al.*, 2013).

The districts are interrupted by erratic rainfall patterns and seasonal variability thereby exposing the area to dry spells, droughts, and floods (Nicholson, 2005). Flooding in the districts is closely linked to heavy rainfall which usually reaches its peak between August and September coupled with the spillage of excess water from the Bagre dam. The floods normally destroy farmlands and make smallholder farmers risk being food insecure.

Soil

The districts are characterized by different types of soils which in general have low nutritional content as a result of bush burning, land degradation, and overgrazing (Yiran, 2008). The nutritional deficiency can also be attributed to continuous human activities in the soil which weakens and exposes it to erosion and leaching. According to Senayah *et al.* (2005) the erosion of the soil has affected the thickness of the topsoil over the past years. The continuous destruction of the topsoil through inappropriate farming practices has resulted in frequent soil erosion and leaching which have affected its nutritional levels and made it less productive for agricultural activities (Obeng, 2000). It has been identified that soil within the White Volta catchment area are highly fertile and support the cultivation of different types of crop including maize, sorghum, and millet. Because of this, most farming activities in the two districts are common along the river banks both in the rainy and dry seasons (Obeng, 2000). However, it has been observed that these soil are liable to seasonal flooding due to easy saturation during period of heavy rainfall which affects the cultivation of crops in these areas (Donkoh *et al.*, 2013).

Economic Activities

Small-scale agriculture is the main economic activity in the area which employ not less than 60% of the people (GSS, 2014). The agricultural system in the area is rain-fed dependent although some small and medium-scale irrigation schemes are practiced along the White Volta catchment in the dry season (Delaney, 2012; Sidibe *et al.*, 2016). As a result of the heavily dependent on rainfall, most agricultural activities are carried out in the rainy season between May and October with little or no farming in the dry season. Crops cultivated in the wet season include cereals, watermelon, tomatoes, and vegetables with animals like chicken, guinea fowls, goats, sheep, and cattle rear in large quantities. Because of the heavy reliance on rainfall as indicated earlier, any changes in the weather events like floods will result in production loss.

Apart from the production of crops and the rearing of animals, other economic sectors employ a large number of people. These sectors include; small-scale mining, quarrying, construction works, weaving, pottery, blacksmith, brewing, shea butter processing, rice processing, leather works etc., (GSS, 2014). According to Yiran (2014) other indigenes also resort to seasonal migration to southern Ghana to work during the dry season as a source of employment and return to their place of origin when the wet season starts to farm.

Data Collection

Qualitative interviews were adopted as the approach for data collection because of the exploratory nature of the

study. The approach was adopted because of the interest in exploring how flood-recession agriculture can be used to promote food security in the area. Semi-structured interviews with five communities in the two districts were purposively sampled for the study. The communities included; Kubore, Googo, Yarigu, Yaligu, and Nafkoliga. These communities are experiencing rapid rate of desertification, deforestation and also lack access to fertile land, except soil along the White Volta river basin for farming (Yiran *et al.*, 2022). The participants for the interview were smallholder farmers, government institutions like the Ministry of Food and Agriculture, NGOs involved in food production and businessmen/women involved in food supplies and distributions. In all, 30 participants were selected using purposive and snowball sampling techniques. Since the study adopted a qualitative approach, which meant that data were going to be obtained from in-depth interviews and focus group discussions, the sample size was deemed appropriate because it will provide more depth to the results. The interviews were carried out until theoretical saturation was reached and no new ideas were generated again from the interview sessions.

Again, five focus group discussions were held with smallholder farmers to ascertain their views on the potential of flood recession agriculture to ensure food security. In choosing the discussants, a consultation was done with the opinion leaders to ensure that the participants chosen are the true representation of the people in terms of the type of crops cultivated, gender, tribal balance, and the farming system practice. However, three discussions were carried out since saturation was reached after the third discussion. The discussion was done with a facilitator who maintained a friendly atmosphere for both men and women to express their views freely. The medium of communication used in the discussions was the Kusaal language which is widely spoken and understood by the majority of people in the area (Asamoah, 2018). More so, regular field visits were undertaken to obtain firsthand information about the issue under investigation and in each visit, photographs were taken.

Data Analysis

Data on the interview guides, focus group discussions and field observation diary was analyzed using a qualitative thematic approach. Data on the in-depth interviews and focus group discussions were transcribed into English. Also, observation notes were recorded in the form of a research diary. The data was then sifted and sorted into meaningful classifications. A coding system was developed for the data. After the coding was done, the data was put into themes based on the issue under study. The categorization of the data into themes was done. Observational notes were also coded and put into themes supported by the photographs taken.

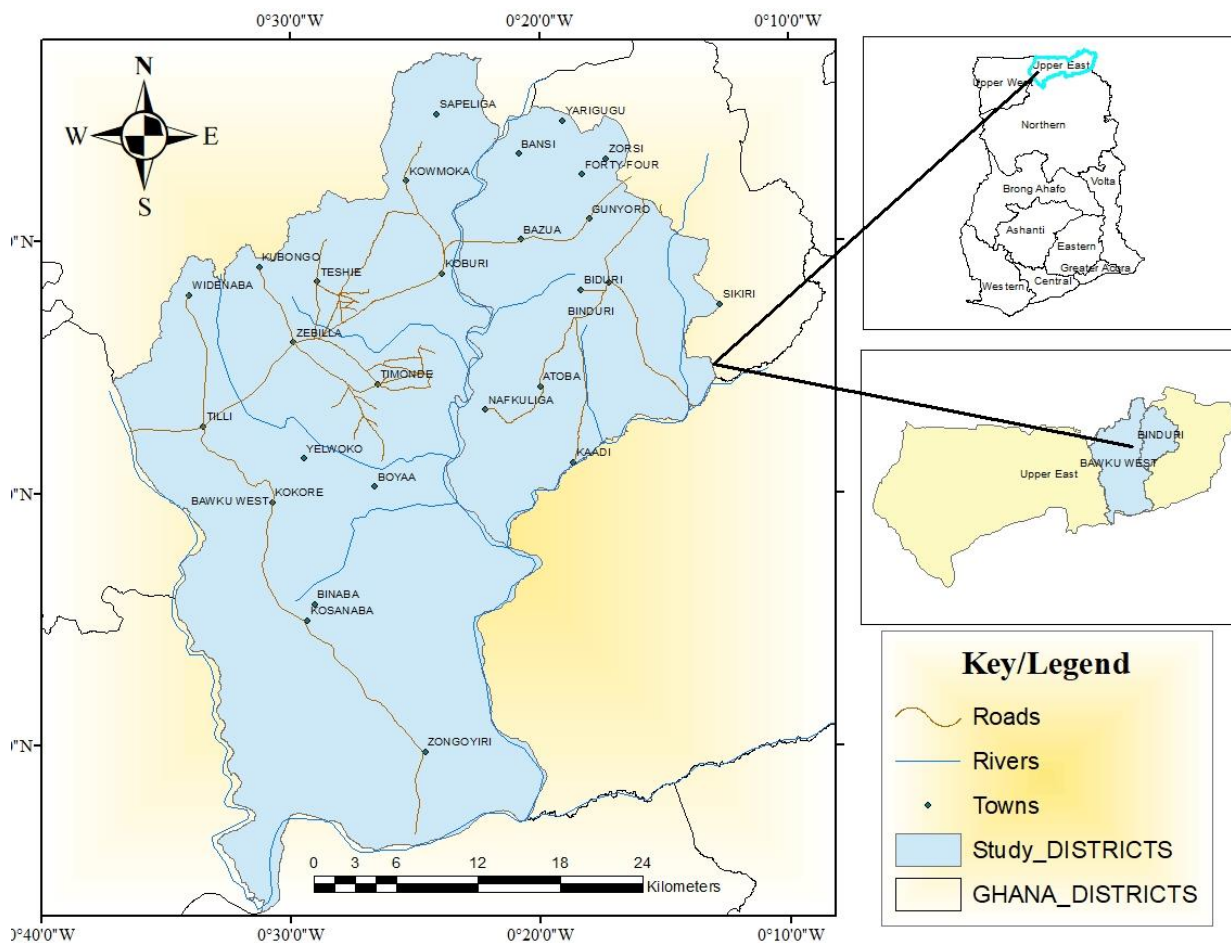


Fig. 1: Map of the study area

Results and Discussion

The data obtained from the field about flood recession farming in the Sudan ecological zone were analyzed qualitatively. Dry season farming has been identified by the government as a means of reducing rural poverty and ensuring development. In assessing the flood recession farming in the area, two indicators were looked at. These parameters included the nature of the soil, period of farming activities and source of water supply. These parameters were analyzed because they have the potential to affect food production in the area.

Nature of Soil and Flood Recession Farming

The geological feature of the area was analyzed to ascertain how the nature of the soil favor crop production, especially in the dry season. Data obtained from the Ghana Geological Survey revealed that the zone is characterized predominantly by Paleozoic rocks which originate from the Voltain sedimentary basin. This gives the topography of the area a relatively gentle sloping landscape of less than one percent (Sidibe *et al.*, 2016).

According to Obeng (2000), the zone is made up of several types of soil. These include major soil such as Black and Brown Clays, Savannah Lithosols, Groundwater Laterites, Savannah Ochrosols, Rubrisols, Gleisols and Alluvisols. From the report, it was noted that the catchment area of the White Volta basin is dominated by black and brown clay soil which is suitable for the cultivation of crops such as maize, sorghum, tomatoes, onions and beans. These soils contain natural soil fertility which promotes the cultivation of the above crop. During an interview with a 43-year-old farmer at Googo, he indicated that the soil in the river basin contains the right amount of nutrients for the production of crop. According to him, the annual flooding in the area further enhances the fertility of the soil by depositing alluvial debris every year which favors dry-season farming. From the study, it was established that the area supports dry season farming and smallholder farmers can take advantage of the fertile nature of the soil by engaging in the production of different types of food crops which could promote households' food security, especially in the lean season.

Period of Farming

After analyzing the nature of the soil in the area, it was prudent to identify the period of the flood recession farming and how that could bring about food security in the area. From the study, the respondents opined that this system of farming usually takes place in the dry season. It was observed that two types of flood recession farming were done in the area based on the crop cultivated. The cultivation of any of these crops depended on the gestation period and the level of moisture content needed. During the discussion session with the farmers, they indicated that crop like maize and rice are usually planted before the floods set in. In an interview with a 58-year-old farmer at Yarigu, he stated that “before we plant any crop, we have to assess whether the crop can mature early before the heavy rains set in or not. Also, can the crop mature fast for us to depend on to survive since most households do not always have food to eat during this period? All these are taken into consideration before any planting is done”. This assertion confirms the report by Asamoah (2018) who opine that farmers use local knowledge to determine when to plant and which type of crop to be planted. Figure 2 shows a maize (zea maize) farm at Nafkoliga which belongs to the early maturing variety.

The challenge some farmers face with this method of production was the fact that some of the crops have a long gestation period. As a result, they are not able to produce food before the floods. During the focus group discussions, the farmers lamented that they don't have access to the new variety of crops with shorter gestation periods. According to them, they were told that they will make them available for everyone to access but since then they have not heard from the agriculture officers again. In their view, those that are sold at the open market are too costly for them to afford. Also, they are not able to determine whether they are the new variety or not since some people take advantage of their inability to differentiate the two and sell bad seedlings in the market. The Ministry of Food and Agricultural Directors in both districts explained that the government has supplied "Wandata" seed (a short duration and early maturing maize crop variety) to farmers in the district. But, they were quick to state that most of the farmers have not gotten it and that plans are underway to ensure that every farmer has access to these new varieties. According to them, the aim is to avert the associated crop losses due to annual flooding.

The second type of crop cultivation takes place after the floods. These crops usually take the form of vegetables like okro, onions, cabbage, watermelon, etc. Fig. 3 shows a cabbage farm in Kubore which was planted after the 2021 flood incident in the area. After harvest, these crops are sold to buy food and other farm implements for the next planting season. The farmers indicated that the yield obtained from the dry season farming is better than what they usually get from the rainy season. In

their view, if they are given the necessary support from the government and NGOs, they would be able to increase food production in the area. Their statement corroborates the report by Quaye (2008) which revealed that about 358 hectares of land in the upper-east region are under cropping.

As indicated earlier, almost all the crops cultivated in the dry season in all the communities are for commercial purposes and the proceeds are used to buy food and other farm implements. The participants noted that the income obtained from these farming activities is mostly used to buy food to sustain their families, especially in the lean season. According to the participants, about 70% of the earnings from these farming activities go into purchasing food for household consumption. During an interview with a 43 years old man who cultivates cabbage in Yarigu, he explained that “when the right farming practices are applied on these two acres farm, I can earn up to about five thousand Ghana Cedis, half of which would be used to purchase food”.

The respondents explained that the practice has helped to improve their ability to access food during the period of food insecurity. They stated that engaging in this system of farming is a way of reducing the effects of the flood on their food insecurity since in most cases, they earn more from this farming practice than rain-fed agriculture. This finding confirms the work of (Armah *et al.*, 2010) that rural poverty and food security can be achieved through flood recession agriculture.

Water Source for Farming

This section discusses the sources and mode of water supply to the crops during the farming process. The importance of this section is informed by the fact that access to quality and frequent water supply will help improve crop yield (Ishaku *et al.*, 2011). The main source of water for the dry season is the White Volta River. As a result, the catchment area of the river has seen intense farming both in the dry and wet seasons. Farmers use pumping machines supported by a long tube to draw water from the river to irrigate their crops. However, the water level in the river fluctuates from time to time making it difficult for them to engage in large-scale farming. Figure 4 and 5 show crop production along the bank of the White Volta River in Kubore and Yaligu respectively.

The continuous farming in the catchment area of the river has exposed the area to soil erosion thereby aggravating the extent of the flood situation in the area. This has resulted in siltation of the river bed making it difficult for the river to contain large volumes of water during the rainy season. This suggests that there is a need to find an alternative means of conserving the flood waters in the wet season which could be used for farming in the dry season.



Fig. 2: Maize farm at Nafkoliga



Fig. 3: Cabbage farm in Kubore Source Fieldwork (2022)



Fig. 4: Farmer drawing water from the white volta river using a host



Fig. 5: Crops planted along the a

Again, dug-outs were another source of water for irrigational activities in some communities because they could be found in almost every community, especially during the dry season. Though they came in their numbers, most of the dug-outs were dried up, forcing farmers to dig at any space at their farms with the hope of getting water for their crops. However, these dug-outs were not common in the study communities since they were located along the White Volta River. The farmers, therefore, depend on the river for their farming activities except those who could not afford to buy pumping machines, had these dugouts as their source of water.

Despite the significance of the flood recession as a way to ensure food security, the system of farming has not been given much attention in Ghana. Much emphasis has been given to other irrigation systems, especially the development of large-scale irrigation schemes which have a higher political resonance. This deficit of attention translates into a relative lack of coherent and reliable policies and research results on flood recession farming systems, especially in the study zone indicating that it has the potential to promote food security and curb the rural-urban migration in the country.

Agricultural Policy in Ghana

Policies development in the agricultural sector can be traced back to the colonial era. Policies enacted during the colonial era were geared toward improving and sustaining the production of cash crops (cocoa) which were in high demand in Britain (Seini, 2002). Little attention was paid to the production of consumable crops or the development of staple crops. This led to massive infrastructural development in the southern part of the country where climatic factors favor the production of these crops to the neglect of the northern portion of the country where such staple crops are not produced. Because of this, the northern territory became subsistence-based producing

only for consumption (Songsore, 1979). It was until the 1950s that the narrative changed when the colonial government took interest in food production in the north to alleviate the food shortages that were experienced in urban centers like Accra and Kumasi.

The government policy which is formulated by the Ministry of Food and Agriculture (MOFA) is "modernized agriculture culminating in a structurally transformed economy and evident in food security, employment opportunities and reduced poverty". In line with this policy, all governmental strategic frameworks and plans identify infrastructure development, agricultural research, and extension as focus areas of policy intervention to achieve greater agricultural productivity for improved livelihoods. The interventions take the form of subsidized fertilizer to farmers, establishing agriculture mechanization centers, and irrigation development programs.

Conclusion and Recommendation

This article contributes to the body of knowledge on the significance of flood recession farming in promoting food security in the Sudan ecological zone of the upper east region of Ghana. The research analyzed food security alleviation through recession farming in the two districts in the region. These two districts are considered the bread basket of the region since they contribute significantly to food production in the region and the country as a whole. It was noted that flood recession farming can contribute to sustainable food security in the zone because it provides profitable yield with a low environmental footprint. Due to the vast floodplains and gentle landscape of the area, recession farming is highly considerable. However, several biophysical, socio-economic, and institutional variables need to be considered to derive the full benefits from these farming practices. Based on the findings, the following recommendations were made:

- Farmers should be provided with improved seedlings with shorter gestation periods at affordable price
- Measures should be put in place to conserve excess water during the rainy season which can be used for dry-season farming
- Government and development partners should support farmers with farm inputs that can enhance their dry-season farming
- More investment should be made in harnessing underground water which supports the water in the White Volta to ensure dry-season farming

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Author's Contributions

All authors equally contributed to this study.

Ethics

The study maintained high integrity, transparency, and confidentiality and so there is no conflict of interest to be declared.

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