SPATIAL CHARACTERISTICS OF CROPPING SYSTEMS IN THE TOLON DISTRICT OF GHANA THAT MITIGATE AGAINST ADVERSE EVENTS.

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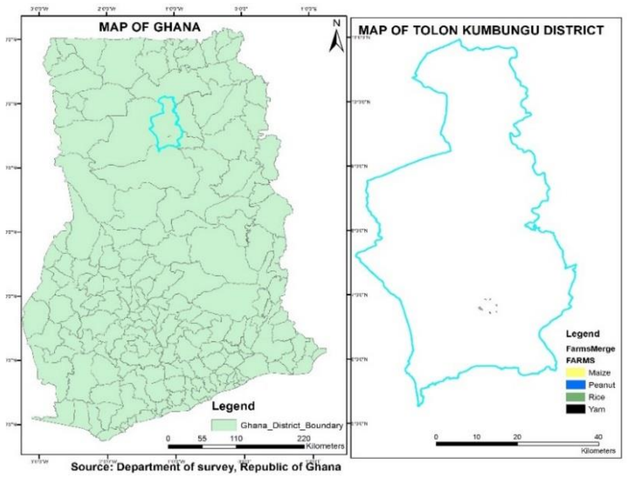
INTRODUCTION

Crop diversification is a common agricultural practice in Sub-Saharan Africa (SSA). It reduces the risk of complete crop failure as compared to mono cropping, and brings a high level of production stability (Francis, 1986). Crop diversification in SSA mostly consist of cereal-legume mixed cropping dominated by maize, millet, sorghum and wheat (van Duivenbooden, 2000). Drought, floods, changing weather patterns, seasonal bushfires and grazing livestock have been identified as common adverse events that affect farming/cropping systems in SSA. Coping and adaptation strategies which have traditionally included practices like shifting cultivation are no more easy options mainly due to population pressure. A household survey was therefore undertaken in six communities in the Tolon district of Ghana (Fig. 1) in order to identify the spatial characteristics of the cropping system that mitigate against adverse events.

Figure 1. Locator map of study area



Source: Department of survey, Republic of Ghana

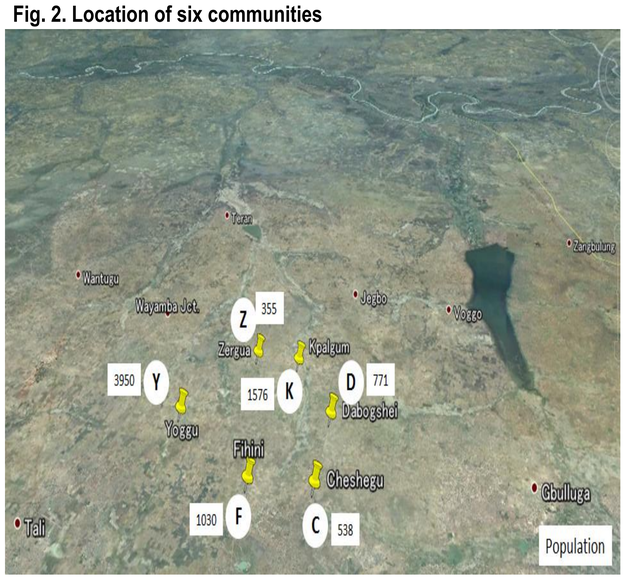
METHODOLOGY

A pre-tested, semi-structured questionnaire was used in collecting data from households in six communities [Fihini (F), Cheshegu (C), Dabogushei (D), Kpalgum (K), Zergua (Z), and Yoggu (Y)], of the Tolon district in northern Ghana (Fig. 2). GPS coordinates were taken from the four corners of each farmer's field. KML files created on Google Earth Pro were converted to Layer files by employing the KML to Layer conversion tool in the ArcToolbox. The layer files were then exported as shapefiles. The shape files were merged, symbolized to create a thematic map that shows the distribution, shape and size of the farms and communities across the landscape. Excel spreadsheet was used in data analyses and presentation of data in tables and figures.

Objective

- Identify the relationship between the spatial characteristics of the cropping systems and adverse events especially drought.

Fig. 2. Location of six communities



RESULTS

Five communities (D, F, K, Y and Z) share a common watershed used for rice cultivation which flows into the White Volta river whereas C has a distinct watershed that flows into the Botanga reservoir (Fig. 2). Rice fields are developed along these watersheds, whereas the fields for the other three crops appear scattered across the landscape. Rice farms occupied the lowest lying areas of the land scape whereas the other 3 crops occupy similar elevation (Table 1).

Farmers in the Tolon district identified drought as a major adverse event affecting farm operations and livelihoods. All respondents recognized drought as a phenomenon that occurs once every three years. Figure 3 shows 31 low rainfall years in a 110 (1901 – 2011) year period, almost corresponding to farmer assertions.

Although intercropping is the traditional and most frequently applied multiple cropping system in SSA, famers in the Tolon district of Ghana were found growing four major crops on four different parcels of land that were not always close to each other (Fig.6) This cropping system was identified as spatial diversification (Obeng 2005).

All respondents (100%) in C, D and Z cultivated maize, followed by yam and groundnut which were grown by 78% and 75% of respondents respectively (Fig 4). Overall, only 64% of respondents cultivated rice, but this figure was particularly low (30%) in F and Y (Figure 4).

Data on farm size were obtained in two different ways: 1. farmers declaration of farm sizes during the interview section and 2. calculation in ArcGIS based on the coordinates obtained from farmer's field measurements. The correlation coefficient between the two sets of area data was very low (R = 0.24), suggesting that most of the farmers had very poor perception of their farm sizes.

Averagely, farm sizes were below two acres for, Groundnut, Maize and Rice and below one acre for yam. The farm sizes were in the order Groundnut>Maize>Rice>Yam (Figure 5).

Fig. 3. Annual rainfall in Tamale for 110 years

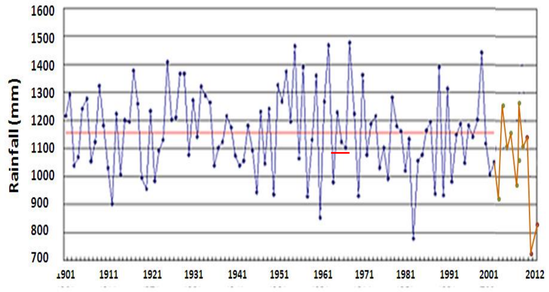


Table 1. Elevation of four major croplands (m)

	Maize	Yam	Groundnut	Rice
Fihini	182 ± 7.2	182 ± 7.5	185 ± 6.7	170 ± 3.3
Cheshegu	174 ± 6.1	174 ± 5.0	175 ± 6.6	170 ± 3.5
Dabogshei	170 ± 4.4	170 ± 3.6	170 ± 4.8	165 ± 4.0
Kpalgium	160 ± 5.2	160 ± 4.7	161 ± 6.1	156 ± 2.9
Zergua	162 ± 6.6	162 ± 6.0	162 ± 6.6	145 ± 3.2
Yoggu	177 ± 8.5	177 ± 8.7	178 ± 8.9	166 ± 12

Data are shown with average ± standard deviation

Total cultivated area was in the order Maize>Groundnut>Rice>Yam. More land area is dedicated to maize because the crop is the main staple of the area. Small scale farmers in SSA produce first, for household consumption before selling the surplus. However, in terms of average land size, the main cash crop of these communities, groundnut, is allotted parcels of land similar in size to maize. These farmers appear to be placing the same premium on household consumption and income.

Figure 7 shows the unique ecology of rice, occurring only along the watershed. However, Figures 6 shows that other crop farms, mainly yam and maize farms are encroaching into this unique landform maybe as a result of drought. The encroachment appears to be an adaptation strategy to drought because maize and yam are the main staple crops of these communities. In years of less than normal precipitation, these water sheds provide much needed moisture not only for rice but also for staples.

Fig. 4. Cultivation rate of four major crops by community

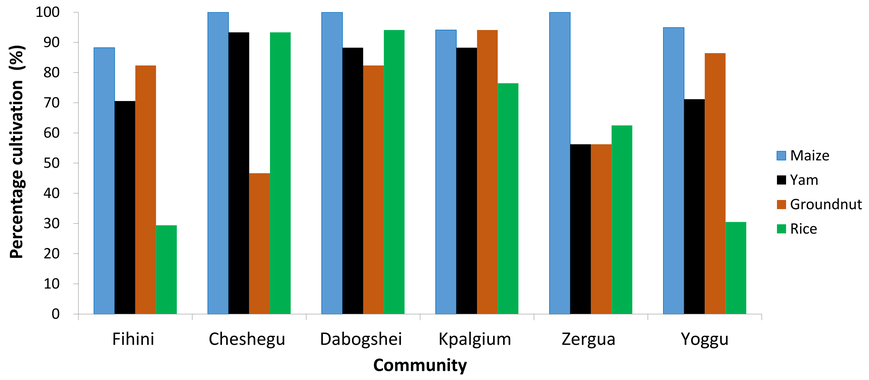


Fig. 5. Average land size of four major crops in acres

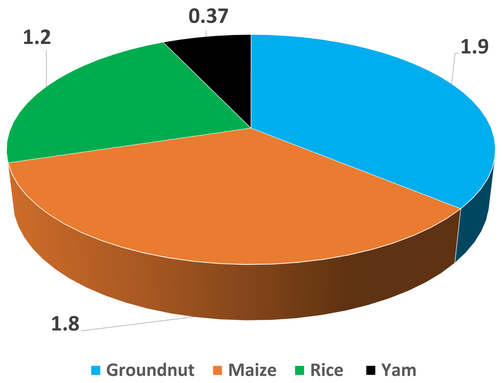


Fig. 6. Farms of the four major crops

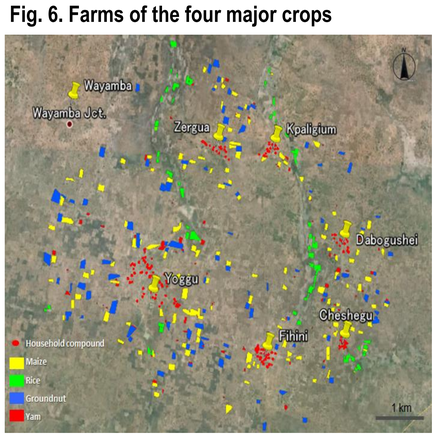
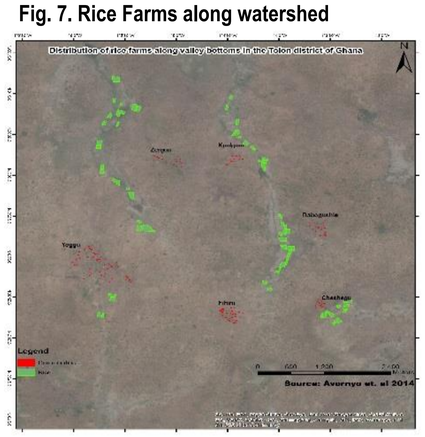


Fig. 7. Rice Farms along watershed



CONCLUSION

- Farmers identified drought as the main adverse event affecting cropping
- Although farmers in the Tolon district grow a wide range of crops, four (maize, groundnut, yam and rice) could be described as major.
- The four major crops are usually grown on distinct parcels of land that are not always close to each other. This cropping system is described as spatial multiple cropping.
- Farmers allocate similar land sizes to both staple crops and cash crops.
- While all crops appeared scattered across the landscape, rice farms occurred along the narrow watersheds.
- Staple crops like maize and groundnuts are encroaching the unique rice ecology probably as an adaptation strategy to mitigate the adverse impact of drought.

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