



Rainfall variability and drought characteristics in two agro-climatic zones: An assessment of climate change challenges in Africa

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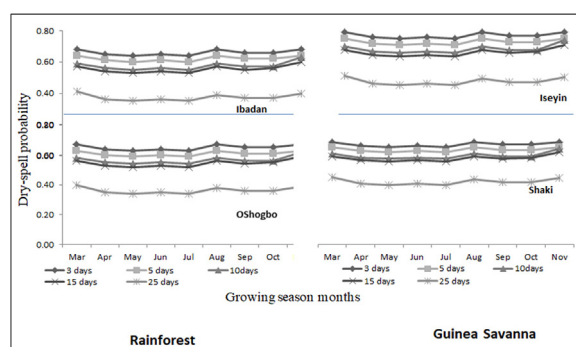
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HIGHLIGHTS

- Drought characteristics were linked to climate change.
- Seasonality statistics reveal more variable and drier growing seasons.
- Rainfall is less reliable recently in the growing months.
- Farmers' perceptions of drought fundamentally mirror climatic patterns.

GRAPHICAL ABSTRACT



ARTICLE INFO

Article history:

Received 23 December 2017

Received in revised form 6 February 2018

Accepted 16 February 2018

Available online xxxx

Editor: SCOTT SHERIDAN

Keywords:

Climate change
Drought characteristics
Perceptions of drought
Africa

ABSTRACT

This paper examines drought characteristics as an evidence of climate change in two agro-climatic zones of Nigeria and farmers' climate change perceptions of impacts and adaptation strategies. The results show high spatial and temporal rainfall variability for the stations. Consequently, there are several anomalies in rainfall in recent years but much more in the locations around the Guinea savanna. The inter-station and seasonality statistics reveal less variable and wetter early growing seasons and late growing seasons in the Rainforest zone, and more variable and drier growing seasons in other stations. The probability (p) of dry spells exceeding 3, 5 and 10 consecutive days is very high with $0.62 \leq p \leq 0.8$ in all the stations, though, the p -values for 10 day spells drop below 0.6 in Ibadan and Osogbo. The results further show that rainfall is much more reliable from the month of May until July with the coefficient of variance for rainy days < 0.30 , but less reliable in the months of March, August and October ($CV-RD > 0.30$), though $CV-RD$ appears higher in the month of August for all the stations. It is apparent that farmers' perceptions of drought fundamentally mirror climatic patterns from historical weather data. The study concludes that the adaptation facilities and equipment, hybrids of crops and animals are to be provided to farmers, at a subsidized price by the government, for them to cope with the current condition of climate change.

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1. Introduction

In many parts of Africa, drought is increasingly becoming a major challenge for agricultural production, with negative impacts on both crops and livestock. Several studies have shown that prolonged periods

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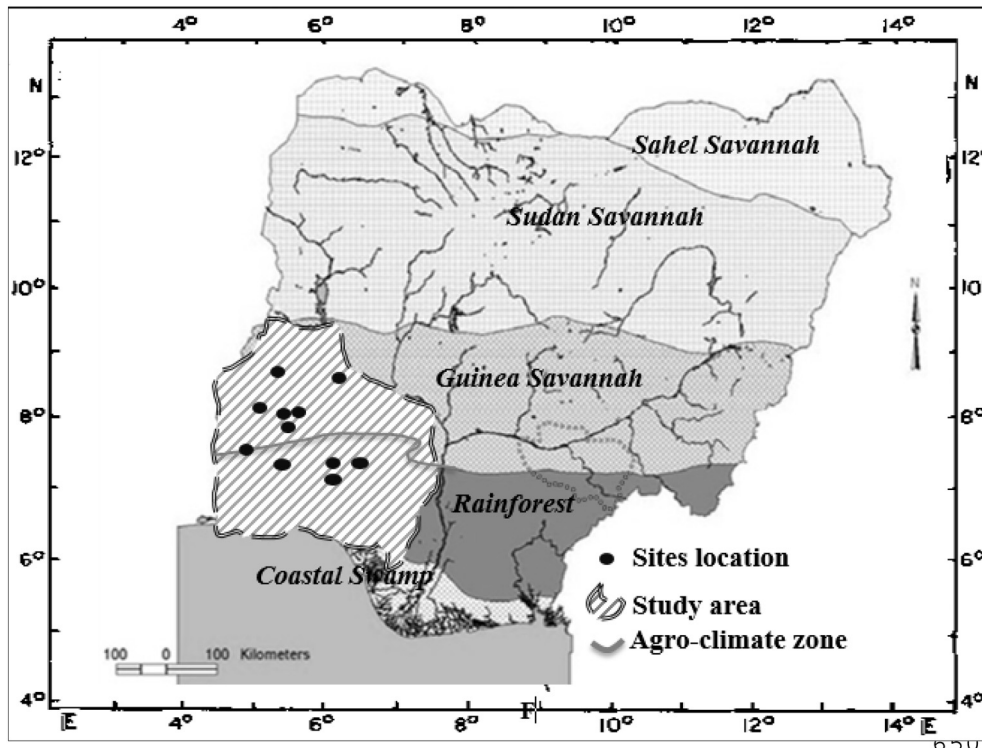


Fig. 1. Map of Southwestern Nigeria, showing the study area. Source: The map was produced by one of the authors (AA) using Quantum GIS 1.18 (<http://www.qgis.org/en/site/>).

of drought can devastate rural families in Africa since majority of them depend on agriculture for their food and income (Abaje et al., 2014; Amwata et al., 2016; Meze-Hausken, 2000; Mupangwa et al., 2011), and drought leads to crop loss and death of livestock (Ayanlade et al., 2010; Hellmuth et al., 2007; Njiru, 2012; Rusinamhodzi et al., 2012; Tambo and Abdoulaye, 2013). Recent studies have shown that drought is one of the climatic extreme events which are an insidious natural hazard, leading to water shortage, with notable adverse impacts on crops, livestock and income of rural farmers. Some of these studies have shown that drought has significant negative impacts on poorer farming communities who have less diversified livelihoods and few economic alternatives (Araujo et al., 2016; Ifeanyi-Obi, 2016; Rouault and Richard, 2003; Zhan et al., 2016). The level of impact of drought on agricultural communities varies, and depends on the socio-economic status of the communities, length and intensity of the drought.

Although there are many definitions of drought in the literature, this study focuses on agro-climatic drought— a prolonged period of

abnormally low rainfall resulting in a persistent shortage of water (Ogungbenro and Morakinyo, 2014; Omotosho et al., 2000; Sanogo et al., 2015; Wang, 2005). For smallholder farmers, who depend on rainfed agriculture in many parts of Nigeria, abnormal deficiencies in rainfall, dropping below what can be considered the drought threshold, have resulted in unfavourable conditions for agricultural production (Ogungbenro and Morakinyo, 2014; Oguntunde et al., 2011) Consequently, the cumulative rainfall deficit exceeds the drought threshold with pronounced impacts on agricultural production. Low crop productivity from drought conditions can lead to food insecurity, as demand for crops exceeds supply. When there is a prolonged dry spell and drought conditions persist, rural farmers pay dearly, since the majority of them are poor and vulnerable (Lybbert and Carter, 2015; Odekunle, 2004; Udmale et al., 2014; Zarafshani et al., 2012). Prolonged drought affects crop and livestock production and also leads to loss of household income of rural farmers relying mainly on rainfed agriculture in many parts of Africa (Omotosho et al., 2000; Sanogo et al., 2015).

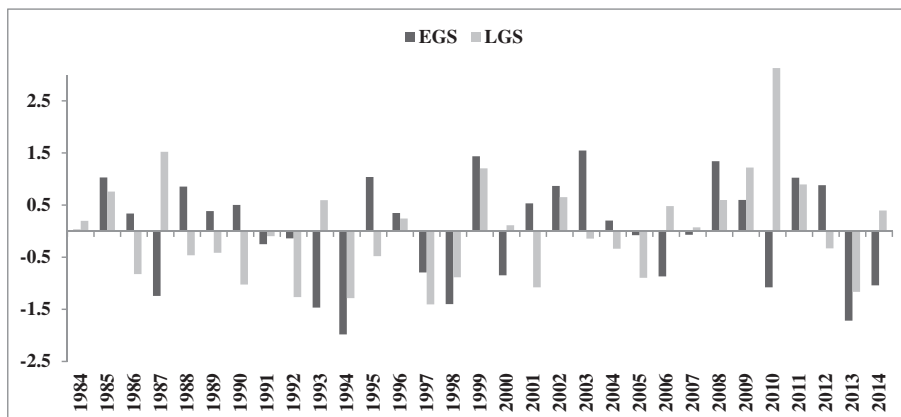


Fig. 2. Standardized anomalies of annual rainfall during 1984–2014 for two growing seasons in Ibadan. EGS represents early growing seasons while LGS represents late growing seasons.

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