



Development of Drought Early Warning System (DEWS) in Nigeria: A Review of Progress, Challenges, and Future Directions

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ABSTRACT

Drought Early Warning Systems (DEWS) are important tools for reducing the impact of drought on agriculture, water resources, and food security. This review explores drought trends in Nigeria, assessing the progress, challenges, and future directions of DEWS development. Analysis of past drought occurrences reveals that Nigeria has experienced notable drought episodes in 1914, 1924, 1935, 1943, 1951-1954, 1972-1973, and 1991-1995, with the driest decades recorded between 1970 and 1990. The increasing trend of drought events is linked to climate change, land degradation, and poor water management. Nigeria's primary DEWS, managed by the Nigerian Meteorological Agency (NiMet), employs indices such as the Standardized Precipitation Index (SPI) and the Palmer Drought Severity Index. However, these systems face significant challenges, including data gaps, limited technological integration, and inadequate community participation. An analysis of past studies shows advancements in satellite-based vegetation health indices, climate modelling, and machine learning algorithms. However, DEWS effectiveness is hindered by institutional weaknesses, data limitations, and insufficient stakeholder engagement. Key challenges include governance, coordination, funding, and capacity building. Future research should focus on integrating local knowledge and indigenous practices, developing more complex and integrated DEWS models, improving data quality, and enhancing communication strategies. This review aims to inform policymakers, researchers, and practitioners about the need to strengthen DEWS to support drought resilience and sustainable development in Nigeria.

Keywords: *Drought Early Warning Systems, Nigeria, Climate change, Agriculture, Water Resources, Food Security*

1 INTRODUCTION

Drought is a complex phenomenon characterized by: "A period of abnormally low rainfall that leads to water scarcity and impacts on ecosystems, agriculture, and human societies." (World Meteorological Organization, 2019). Drought ranks first among all natural hazard, based on severity, duration, spatial extent, life/economic loss and other measures. (UNW-DPC). Droughts occur frequently in Nigeria, with an average of 2-3 events per decade (NIMET, 2020). 70% of Nigeria's land area (north) is drought-prone (Olusegun Adeaga, 2011). Drought duration varies from 2-12 months, with severe droughts lasting up to 24 months. Northern Nigeria (Sahel region) is more prone to droughts due to low rainfall and high evaporation rates (Ogunrinde et al., 2019), Southern Nigeria (humid region) experiences fewer droughts but is still vulnerable to water scarcity (Christopher et al., 2020). Climate change is projected to increase drought frequency and severity in Nigeria (IPCC, 2014), and rising temperatures and changing precipitation patterns exacerbate drought risks (NIMET, 2020).

Drought poses negative impacts. Agriculture Droughts reduce crop yields, leading to food insecurity and economic losses (Isreal, 2022). Water Resources Droughts reduce water availability, affecting human

consumption, livestock, and hydroelectric power generation (Nigeria Hydrological Services Agency, 2020), Health Droughts increase risk of water-borne diseases and heat-related illnesses (WHO, 2024), Economy Droughts impact GDP, particularly in agricultural and manufacturing sectors (CBN, 2020) and Livestock Droughts lead to livestock deaths, reduced milk and meat production (FMAWR, 2019). The consequences of these is that it leads to hunger and malnutrition, especially in rural areas (IFRC), internal migration, social tensions, and conflict (IOM, 2020), resulting in significant economic losses, (CBN, 2020). Environmental degradation: Droughts exacerbate desertification, soil erosion, and biodiversity loss (FMEnv, 2020). Some of the indicators of droughts are Rainfall anomalies, Soil moisture levels, Streamflow and water levels, Vegetation health indices and Crop yield and agricultural productivity.

Drought Early Warning Systems (DEWS) are critical for mitigating these impacts by providing timely warnings to reduce risks and losses (UNISDR, 2015; FAO, 2018). DEWS play a vital role in food security, water conservation, and climate adaptation (IPCC, 2014). However, existing systems in Nigeria face several challenges, including data gaps, limited technology integration, and inadequate community involvement.

The aim of this research is to assess the progress of current DEWS in Nigeria, identify existing gaps, evaluate