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# Assessment of Land Suitability for Diversifying from Millet Farming into Other Farm Products in Wamakko Local Government Area, Sokoto State, Nigeria

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**Abstract** **Review Article**

This study assesses the suitability of land for agricultural diversification from predominant millet cultivation to other farm products in Wamakko Local Government Area, Sokoto State, Nigeria. Utilizing a GIS-based Multi-Criteria Decision Analysis (MCDA), key biophysical parameters such as soil type, slope, rainfall, temperature, and elevation were analyzed. The research aims to identify areas with optimal conditions for cultivating alternative crops like maize, cassava, and guinea corn to enhance food security, improve farmer livelihoods, and promote sustainable agricultural practices. Preliminary findings indicate significant variations in land suitability across the region, identifying specific zones for optimal diversification. This assessment provides crucial information for policymakers, agricultural extension workers, and farmers to make informed decisions regarding crop choices and land resource allocation, thereby fostering resilient agricultural systems in the face of changing environmental and economic conditions.

**Keywords:** Land Suitability, Agricultural Diversification, Millet Farming, GIS, Maize, Cassava, Guinea Corn.



## ACRONYMS:

GIS - Geographic Information System
MCDA - Multi-Criteria Decision Analysis

## 1. INTRODUCTION:

Agriculture forms the backbone of Nigeria's economy, and in the north-western region, millet is a staple crop traditionally cultivated in large quantities. However, over-reliance on a single crop has made many farming communities vulnerable to challenges such as declining yields, erratic rainfall, and market instability. Wamakko Local Government Area, like many other rural regions, is experiencing a push for agricultural diversification to build resilience and improve food security.

The rationale behind this study is to assess the biophysical suitability of land in Wamakko LGA for diversification from millet farming to other viable farm products, particularly maize, cassava, and guinea corn. These crops have strong market demand, offer nutritional value, and can adapt to the local climate conditions if appropriately sited.

The objective of this study is to map and evaluate land suitability using spatial techniques. This includes analyzing parameters such as elevation, slope, rainfall, temperature, and soil attributes. The findings will guide farmers, policy-makers, and extension workers in making informed decisions that align with both land capability and socio-economic benefits.

## 2. MATERIALS AND METHODS:

### 2.1 Study Area:

Wamakko LGA is located in Sokoto State, Northwestern Nigeria, and lies between latitudes 13°01′ and 13°15′ N and longitudes 5°03′ and 5°20′ E. The area is characterized by tropical semi-arid climate with an average annual rainfall of 600–800 mm and temperatures ranging from 21°C to 42°C. Millet dominates the agricultural landscape, though opportunities exist for cultivating a range of other crops.

### 2.2 Data Collection:

The study employed secondary data sourced from multiple platforms. Climatic data were obtained from the Nigerian Meteorological Agency (NiMet), topographic and soil

data from the Nigerian Geological Survey Agency (NGSA), and land cover data from satellite imagery via Google Earth Engine. Key parameters include rainfall, temperature, elevation, slope, soil pH, and soil texture.

## 2.3 Identification of Alternative Crops:

Based on adaptability and local preferences, maize, cassava, and guinea corn were selected for assessment. These crops are known to perform well under semi-arid conditions and possess commercial value.

## 2.4 Land Suitability Assessment:

A multi-criteria approach based on FAO guidelines was adopted. Each criterion was standardized and reclassified into suitability classes using GIS tools. A weighted overlay analysis was conducted, assigning weights to parameters based on their influence on crop performance.
Suitability classes used included:
- Highly Suitable (S1)
- Moderately Suitable (S2)
- Marginally Suitable (S3)
- Not Suitable (N)

## 2.5 Data Processing:

Spatial analysis was performed using QGIS 3.26. Data layers were rasterized, normalized, and integrated into the MCDA framework. The final output was a land suitability map for each crop, supported by spatial statistics.

# 3. RESULTS AND DISCUSSION:

## 3.1 Overview of Biophysical Conditions:

The study revealed that the Wamakko area exhibits considerable diversity in soil texture, ranging from sandy loam in the east to clayey soils in the west. Elevation varies between 250–300 meters above sea level, and slope is generally gentle (<5%), supporting mechanized farming.

## 3.2 Suitability for Maize:

The assessment shows that about 40% of land in Wamakko LGA is highly suitable (S1) for maize due to favorable rainfall distribution and loamy soil. Another 35% is moderately suitable (S2), while the remaining land is marginal (S3) or unsuitable (N) due to slope and drainage issues.

## 3.3 Suitability for Cassava:

Cassava requires well-drained soils and moderate rainfall. The suitability map reveals that 30% of the area falls under S1, while another 45% qualifies as S2. Notably, swampy and low-elevation zones were marked unsuitable.

## 3.4 Suitability for Guinea Corn:

Guinea corn, being drought-tolerant, showed wider suitability. About 50% of Wamakko LGA is highly suitable, particularly in upland zones with sandy-loam soil. These findings reinforce its potential as a dependable crop for diversification.

## 3.5 Composite Suitability:

Overlaying the suitability maps showed that the north-central region of Wamakko is a hotspot for diversification, suitable for all three crops. This aligns with farmers' field reports and provides an evidence-based direction for integrated crop planning.

## 3.6 Implications:

The results support the hypothesis that Wamakko LGA has land capable of supporting crop diversification from millet farming. This can enhance food security, income, and resilience. However, adoption depends on access to credit, extension services, and market access.

## 3.7 Limitations:

This study did not account for socio-economic variables in the modeling process, which are equally important for successful diversification. Future studies should incorporate these aspects.

# 4. RECOGNITION:

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