Land Suitability Analysis for Maize Farming in Yewa South Local Government Area, Ogun State.

Ayodele Oduwole*, Olawale I. Ridwan.

*Department of Surveying and Geoinformatics, Faculty of Environmental Studies, Federal Polytechnic Ilaro, Ogun State

DOI: 10.29322/IJSRP.13.01.2023.p13302
http://dx.doi.org/10.29322/IJSRP.13.01.2023.p13302

Paper Received Date: 18th November 2022
Paper Acceptance Date: 27th December 2022
Paper Publication Date: 6th January 2023

Abstract- Land suitability for Crop (maize) suitability involve the use MCDM Pair-wise comparison AHP. The reason of this work was to use the GIS application and the AHP analysis method to determine whether the land was suitable for the production of agricultural crops. The FAO guideline for land evaluation's method served as the foundation for the land's suitability class evaluation. Slope, soil moisture, soil type, soil texture, precipitation, temperature, and the study area's current land use were all taken into account when determining whether or not a piece of land was suitable for crop production. The strategies, which were utilized to gauge and normalized the factors were pair-wise examination and weighted analysis. After assessing the physical suitability of the land for agricultural crops. Based on FAO guidelines, this map was classified into five suitability classes.

Index Terms- Land suitability, Crop suitability, MCDM, Pair-wise comparison, AHP

I. Introduction

The procedure of choosing the highly suitable area for a specific use—forest, agriculture, recreation, etc. is the hallmark of land use suitability analysis, based on a number of different rate (Cengiz & Akbulak, 2009);2010; Akbulak);2006; Al-Shalabi, Mansor, Ahmed, & Shiriff);According to Akinci, Ozalp, and Turgut (2013), Land Suitability Analysis (LSA) is a GIS-based procedure used to decide whether or not a particular surroundings is suitable for a potential work. In other words, it reveals whether or not a region is suitable based on its intrinsic characteristics. Additionally, a wide range of criteria, including social, economic, and environmental considerations, were taken into account during this analysis. The rational cropping system is used to evaluate the suitability of a piece of land in order to maximize its use for a particular purpose (FAO, 1976). The suitability is a amount of where good the standard of a land section squint the needful of a specific conformation of land operation and is also a basis of crop necessity and land features (FAO 1976). The question, "Where should I grow?" can be answered by using suitability analysis. Several criteria need to be evaluated in order to determine whether or not a region is suitable for a particular practice (Belka, 2005).When a group of replacement needs to be judge according to the criteria that are incompatible and conflicting, multi-criteria decision making (MCDM) or multi-criteria evaluation (MCE) has been advanced to upgrade spatial decision making MCE is a useful tool for problems with making decisions based on multiple criteria (Malczewski J., 2006). Its goal is to look into a variety of choices in light of multiple criteria and goals (Cover, 1991). Boolean overlay and modeling for land suitability analysis are two recent GIS-based land suitability analysis perspective. In any case, these approaches come up short on distinct component for integrating the leader's inclinations into the GIS techniques (Malczewski J. ,2006). By combining MCE and GIS techniques, this issue could be resolved. Land-use managers and planners can upgrade decision-making steps by integrating the GIS and MCE (Malczewski J., 1999). Assessment factors can be calculated using GIS, whereas MCE combines all of them to land suitability maps. applying a multi-criteria evaluation strategy based on GIS (Baniya, 2008), evaluated whether Nepal's land was suitable for vegetable crops. He discovered that the MCE and GIS are useful tools for integrating environmental and socio economic data. Likewise, it is a guaranteed instrument for recognizing the strength and constraint of land for green yields. (The suitability of the land for the cultivation of sugarcane and cassava crops in Thailand's Kanchanaburi part was evaluated (Kanlaya, 2009). MCDM combined with the FAO framework (1976) was used to evaluate suitable areas for soil site suitability for growing these crops in order to accomplish this objective. Khoi (2010) used a GIS-based multi-criteria evaluation method to identify appropriate cropland environment in the Vietnam's Tam Dao National Park District. Using the significant mobile of soil chemical and physical specifications by the MCE method, this study used Analytical Hierarchy Process (AHP) combined with GIS to assess the suitability of the agricultural environment in the study area for some rabi crops like wheat mustard, barley, and sugarcane as well as some kharif crops like rice, cotton, maize, pearl millet, and sorghum. Multi-crop suitability maps for rabi and kharif crops have also been created to increase crop adaptability. Land suitability perform a crucial act in current agriculture because each region of the Earth's landscape has unique characteristics that make it more suitable for particular uses than others. An assessment of an area's suitability for a specific use of the land in a specific area is known as a land suitability analysis. The primary goal is to determine which locations are best suited to particular agricultural uses. Recent studies (Ahamed, GopalRao, & Murthy, 2000) have shown that numerical modeling techniques are effective tools in the field of land suitability. The land capacity evaluation evaluates and characterizes land growth section from a broader perspective by not taking into account the nature of their use. There are characterized groups going from I to VIII (Landon, 1991).This group is useful because a part of the soils are good for some crops but also bad for others; Consequently, precise classifications of land uses are required. According to Syst, Van, & Debaveye (1991), it could be expressed not only in terms of the various crops produced, but also in terms of how these particular crops are produced. The land use types must be defined in light of production (crop rotations) and management factors, such as farm size, available capital, labor, farm power, and technical know-how, according to Syst, Van, and Debaveye (1991).The capability of a part of land to sustainably support crop making is referred to as land suitability. The 4th International Congress of ECSSS, EUROSOIL, Bari, Italy, 2012 prepare details about the limitations and chances for making use of the land, thereby guiding conclusion regarding the best use of the resources. Two necessary prerequisites for planning and developing land use. Additionally, this kind of analysis enables decision-makers, for example: the land users, land use planners, also agricultural support services, to make crop management plan that are competent of overcoming these limitation and increasing productiveness. For any reasonableness examination, suitable base information is required (for the most part satellite information or air-photographs, geographical guides and topical guides and the field information). The various qualities of the land that can be taken into account for suitable pattern include the current land-use/land cover, slope, closeness to a transit network, flood risk, and condition of the ground water, among other things (Sunil, 1998). The suitability of a site for future urban development is influenced by its characteristics, such as its current land use, availability of water, road accessibility, flood risk, etc. A gain and weighing system is used to evaluate the different methods of suitability to determine the overall suitability. By adding all of the layers that affect the suitability of the site, a suitable site is determined. It is noted that extensive research has been conducted on the GIS-based multi-criteria evaluation (MCE) procedures for land suitability analysis (Miller 1998, Joerin et al.).2001, Malczewski, 2006) for the improvement of land. MCE is part of the highly viable aspects discussed in numerous studies on the land suitability analysis by GIS (Steiner 2000, Store 2001, Youssef 2010), and it has been extensively used as a multi-criteria evaluation procedure (Saaty 1985, Saaty 2003). According to the literature (Collins, 2001, Mohit 2006, Chandio 2009), GIS-based land suitability analysis methods are also needed by decision makers, engineers, and planners to produce a substructure for land improvement. By utilizing land-use suitability models for development purposes, it can mitigate well-known threats to hillside communities. GIS has demonstrated its value in resolving spatial issues. It is a computer networked composite of software, hardware, databases, people, and processes that connect disparate sets of data that might be seperated over space in extremely different data holdings. From these data holdings, relationships can be identified and decisions made. It is designed as a Multi-Criteria Decision Making (MCDM) system in a GIS environment. In order to combine factors in a land suitability analysis for potential land uses, various MCDM approaches are developed and create a standard suitability. A specific group of local data is make use of selecting suitable environments. A site's suitability for a particular type of land use is influenced by its characteristics, such as slopes, availability of water, interval to employment, growth of costs, geology, geomorphology, and etc. The scoring and weighing system are used to determine the overall suitability of the various aspects of suitability.

Remote sensing is part of the outstanding equipment for directory and analysis of surroundings and its resources, due to its different capability of distributing the concise view of a big area of the earth's surfaces and its ability of tedious range. Its multispectral ability produce proper disparity uniting different natural characteristics where as its tedious coverage produces details on the dynamic switch come about over the surface of the earth and the natural environment (Oduwole & Kayode, 2019)

1.1 Factors that influence crop suitability analysis

There are numerous factors that influence crop planting and growth, but it is impossible to take them all into account. The following factors were selected to assess the suitable of land-devoted agricultural products in light of the actual situation in Nigeria and the conditions under which crops grow. Based on other research and the Food and Agriculture Organization of the United Nations (FAO) Suitability Level

1.1.1 Topography

Topography and the common evolution of soil are closely related. The thickness of the dirt layer diminishes with the increment of the incline point and increments with the decline of the incline point. In addition, areas with steep slopes are more likely to experience soil erosion, which makes the loss of soil nutrients even worse. Slopes, on the other hand, have a immediate effect on agricultural production and management, and steeper slopes make it difficult to use machinery for production. So, slopes have a direct impact on the thickness of the soil, the nutrients in the soil, agricultural productivity, and the suitability of the land for crop growth. The western portion of Jilin Province is composed of plains, while the eastern portion is mountainous. The slope has a significant impact on crop planting conditions because of the undulating landforms.

1.2.2 Physical Soil Characteristics

The texture of the soil possess a significant effect on crop growth and plays a remarkable performance in the transport and regulation of air and water in the soil. This fundamentally infect the suitability of the soil for the growth of plant roots. Soil texture and its capacity for drainage are strongly correlated. The dirt with a superior seepage limit will prompt a quick loss of water and supplements in the dirt, coming about in lacking water and supplement supply. The retention of excess water in the soil will obstruct air flow, resulting in a lack of oxygen supply to the roots and carbon dioxide retention, affecting crop growth. The dirt kinds are different in Jilin Region, and there are enormous holes in soil surface and waste limit between various locales; However, the influences of some factors on cropland's suitability fall within the high suitability range. In the study area, where the soil depth is greater than 100 centimeters and the CaCO3 proportion is less than

10 percent, these components are not extracted into account because the area falls within the high suitability ranges for various crops.

1.2.3 Soil Fertility Characteristics

Ph has a significant impact on the availableness of soil nutrients, crop growth, and productivity. In addition, pH influences numerous physical, chemical, and biological reactions in the soil, either directly or indirectly, and the ideal pH ranges for various crops vary significantly. The amount of organic matter in the soil is represented by organic carbon (OC).In addition to providing microorganisms with essential nutrients and energy, OC is an excellent source of nutrients for crops. The soil's content varies depending on elevation, slope, and precipitation. The quantity of OC is relatively low in places with high altitudes, steep slopes, and a lot of rain. In the process of crop growth, nitrogen (N), phosphorus (P), and potassium (K) are all necessary components. Nitrogen is necessary for the growth of plant and take part in a significant role in the growth and development of stems and leaves. Root development, flowering, and fruiting all require phosphorus. In addition, in soils that are either acidic or alkaline, crop growth will require more phosphorus. Fruit growth, disease resistance, and crop photosynthesis all depend on potassium. As a result, it is necessary to consider NPK as a factor in cropland suitability.

1.2.4. Characteristics of the Climate

The climate has a significant impact on agricultural production, primarily in terms of heat, moisture, and sunshine. In terms of heat, the growing period and ripening of crops are determined by the average temperature throughout the crop growth season. Crop growth and yields are affected by the amount of precipitation. Crop yields and quality are significantly influenced by sunshine.

1.2.5. Location Condition

Water sources have a significant impact on agricultural cultivation, and he distance from a water source is likewise a component that effects the nature of agrarian land, particularly for rice development, which requires more water. The degree to which agricultural crops are suitable increases with distance from the water source.

II. Study Area

The Yewa South Local Government in Ogun State, Nigeria, serves as the study area. In Ogun State, the Yewa South Local Government is located between the longitudes 2°47′24″E and 3°6′48″E and the latitudes 6°37′46″N and 6°55′42″N. Ifo and Ado – Odo/Ota Local Governments are to the east, Ipokia Local Government is to the west, and Yewa North is to the north.It has a population of 150,850 and a total land area of 629.38 square kilometers.

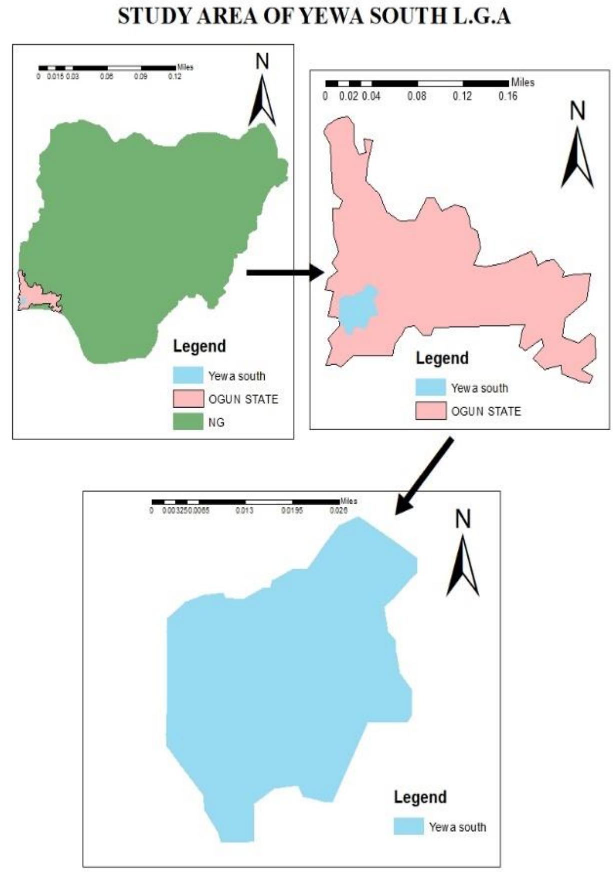

Figure 1: The study area ma

III. Materials and Strategy

This study utilized GIS and AHP strategy for investigation. The evaluating model's weights were derived using AHP. In a spatial analysis operation, a GIS overlay was also utilized to join the various map layers of soil to identify the best lands for maize

3.1 Land Suitability Evaluation

The FAO guideline (FAO 1976) served as the foundation for the method that was utilized to assess the suitability of the land for the manufacturing of agricultural crops. The procedures used were as follows in simplified form:

3.1.1 Choosing The Qualities Of Land And The Characteristics Of Land

The qualities of land required for sustained production define the requirements for land use. Land use is directly influenced by the complex quality of the land. The interaction of a number of land characteristics and measurable characteristics determines the majority of land qualities. The requirements of crops, for instance, determine the texture of the soil. just a small number of the qualities of land need to be chosen as evaluation in any given project.

3.1.2 Identifying Environmental and Climatic Factors

The non-living climatic factors that are responsible for determining an area's climatic conditions are referred to as climatic factors. Temperature and precipitation are significant aspects of the climate. Temperature and precipitation are the necessary climatic factors for this study. According to Carr MH (2007), agriculture is defined as "comprises the thorough scope of agricultural land uses and can be specialized depending on one's region and the features of lands to be establish there

3.2 Data Acquired

The following criteria are used in this study: Slope, DEM, Topography wetness index, Aspect, soil type, texture, moisture, precipitation, temperature, major and minor roads, and used land cover are all components of the soil

3.2.1 Digital Elevation Model

This capability explains whether the topography of the environment is satisfactory for growing maize. The capability classes, which reveal some information about the possibility, were introduced by Verdoodt and Van Ranst (2003), of environmentally friendly ways to use agricultural land in a particular environment. This capacity is based not only on the possibility of erosion but also on the depth of the soil, which is an essential characteristic for the production of crops and vegetation. The study area's topography is categorized as flat, moderate, or steep in this study. Slopes to determine which is best for growing maize. The DEM of this study area was downloaded from USGS Earth Explorer for this study. One of the most important aspects of agricultural diversity and production is elevation. From the coast to the interior, elevation increases.

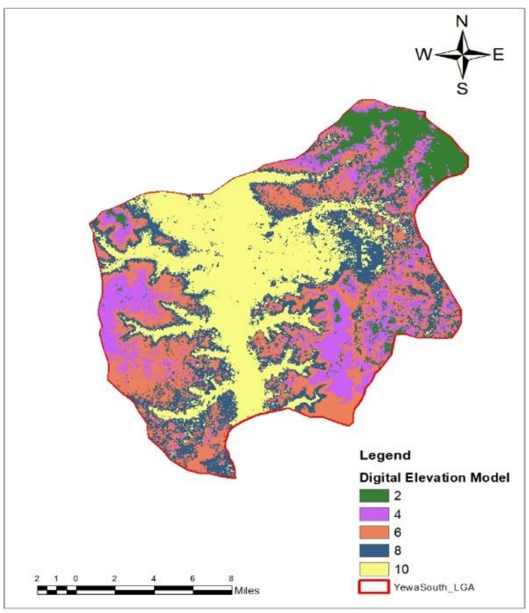

Figure 2: Digital Elevation Map Of Yewa South Local Government

3.2.2 Slope

The slope is an indicator of the soil's geomorphological characteristics or the topography of the area. The target region's slope map was created using a DEM.A higher slope indicates a steeper topography, while a lower slope indicates a flatter terrain. The study area had a slope that ranged from less than 3% to more than 43%.

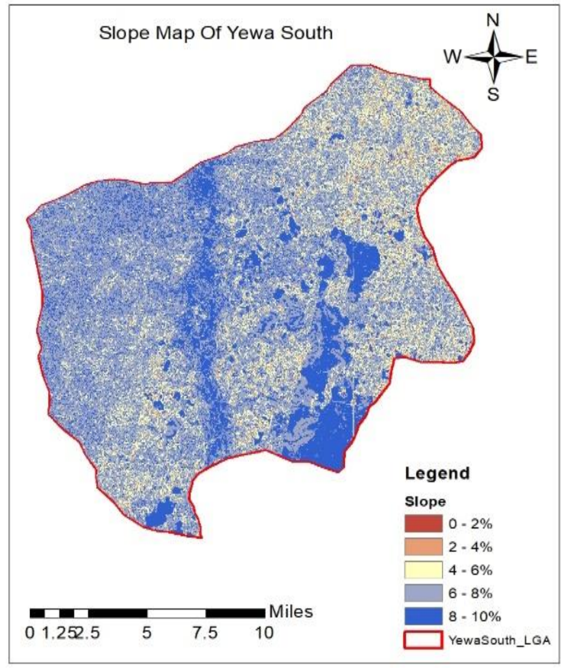

Figure 3: The Slope Map Of Yewa South Local Government

3.2.3 Soil Texture

The soil is the assist layer that provides support and the ways through which water and nutrients are made quickly available to the plant on the slope map of the Yewa South Local Government (Samaila and Ezeaku, 2007). The world digital soil map, which was downloaded from the FAO soil map, was used to create the soil texture in this study area. The study area's soil texture was evaluated and categorized as loam, clay loam, and sandy loam. Class of texture: coarse sand (S), sandy loam (SL), medium silt loam (SiL), and clay loam (CL).

Textural group	Textural class
Coarse	Sand (S) Sandy Loam (SL) Loam (L
Medium	Silt Loam (SiL) Clay Loam (CL)
Fine	Clay (C) or Silt Clay(SiC) Heavy Clay(C)

Table 1: Soil texture class

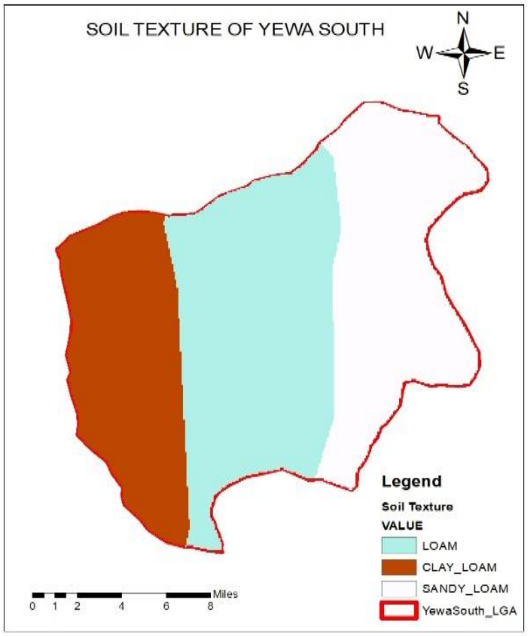

Figure 4: The Soil Texture Map Of Yewa South Local Government

3.2.4 Soil Type

The type of soil influences the potential for crop production on the land. As a result, it was used as one criterion in the creation of the crop suitability map for the study area. because crops grown in production cannot thrive in any kind of soil. The world digital soil map, which was downloaded from the FAO soil map, was make used to get the type of soil in this study area. There are two main groups of soil in this study area's soil pattern: Distric Regosols and Distric Nitosols

Nitisols are deep, well-drained red tropical soils that have diffuse horizon boundaries, a subsurface horizon with more than 30% clay, and moderate to strong angular blocky structure elements that easily break apart into the distinctive shiny, polyhedric (or "nutty") elements.

Regosol is part of the 30 soil groups in the Food and Agriculture Organization's (FAO) classification system. Regosols are characterized by a lack of significant soil horizon (layer) formation due to dry or cold climates and a shallow, medium- to fine-textured, unconsolidated parent material that may be alluvial.

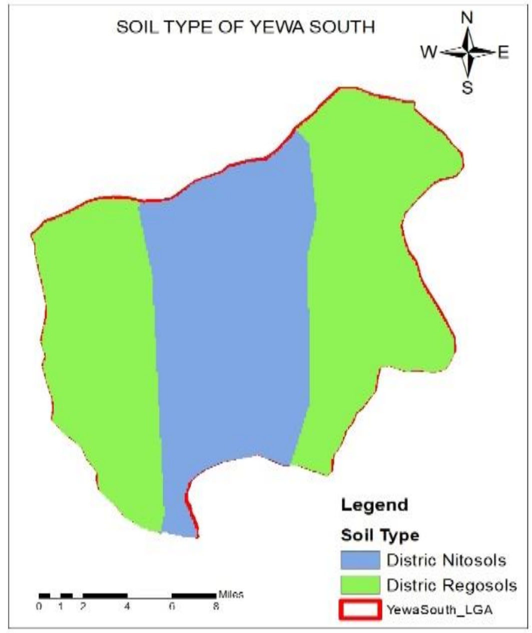

Figure 5: The Soil Type Map Of Yewa South Local Government

3.2.5 Land Use/ Land Cover

The built-up areas and industrial zone, forest and wood land, agricultural land, and water (river) are the types of land use and land cover in the study area. The study area's used land cover was downloaded from USGS Earth.

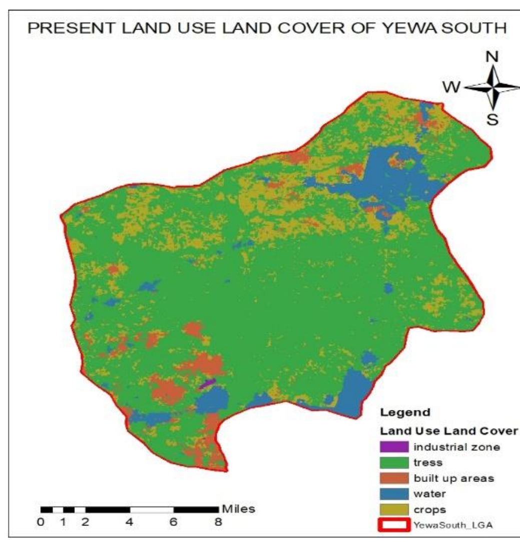

Figure 6: Land Use/ Land Cover Map of Yewa South Local Government

3.2.6 Aspect

Crop production relies heavily on aspect. Ecosystem changes are caused by aspect. It is connected to the variety of plants, the distribution of plant species, the length of vegetation, and crop yield. Sunlight is necessary for plants to carry out their physical and metabolic functions. At the point when plants benefit from daylight, they sprout, foster their organs and give natural product (Bundle et al.1998;Yimer and co.2006). The elevation data were used to create the aspect map, as shown in Figure 7

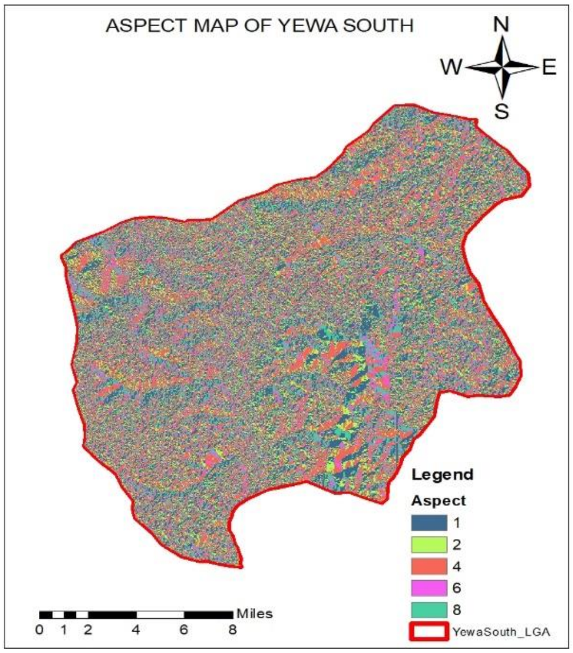

Figure 7: The Aspect Map Of Yewa South Local Government

3.2.7 Topography Wetness Index

The area's topography wetness index indicates a region's propensity to accumulate water.It basically tells us how likely it is that something will get wet.

The formular for topography wetness index:

DEM→Fill DEM→Flow Direction→Flow Accumulation→Slope In Degree→Radians Of Slope= (Slope In Degree"1.570796)/90→Tan Slope= Con (Slope>0, Tan[Slope], 0.001)→Flow Accumulation Scaled=(Flow Accumulation+1) "Cell Size→Twi=Ln(Flow Accumulation Scaled/Tan Slope)

Fill DEM

Add your DEM raster to your study area, then go to arc tools box and click on spatial analyze tools then select hydrology, under the hydrology double click on fill then add DEM at input surface raster, click on environment then go processing extent and select area of interest then press ok, by doing that fill has been completed.

Flow Direction

The flow direction of the study area was achieved by selecting hydrology in the arc tools box, the fill DEM was added at input surface raster, then click ok.

Flow Accumulation

The study area flow accumulation was achieved by clicking on flow accumulation on hydrology then the flow direction is added at the input flow direction raster, then the output accumulation raster was rename and click ok.

Slope in Degree

This is achieved by selecting surface, then the slope was selected and the input raster is fill dem, the output raster was also rename and the output measurement is in degree then click ok.

Radians of Slope

This is achieved under maths algebra and raster calculator was selected, then (slope "1.570796)/90 is added to the raster calculator, the output raster was named as radian of slope then click ok.

Tan Slope

The tan slope is achieved under maths algebra and raster calculator was selected, then Con (Slope>0, Tan[Slope], 0.001) is added to the raster calculator, the output raster was named as tan slope then click ok.

Flow Accumulation

The flow accumulation was done under raster calculator and (Flow Accumulation+1) "Cell Size was added and output raster is named as apslope, then click ok

Topography Wetness Index

The topography wetness index of the study area was achieved under raster calculator and Ln("Apslope/Tan Slope") was added and out raster is named as topography wetness index (TWI) and then click ok.

Topographic Wetness Index (TWI) combine the water supply from upslope watershed and downslope water drainage for each cell in a DEM

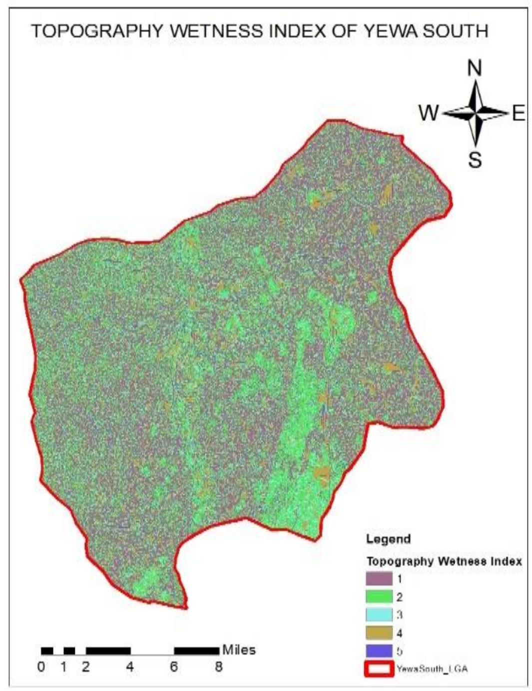

Figure 8: Topography Wetness Index Map of Yewa South Local Government Area

3.2.8 Temperature and Rainfall

Crops need specific requirements of temperature and rainfall for growth. The global digital temperature and rainfall data downloaded from the Climate Research Unit (CRU) served as the basis for the creation of this study's temperature and rainfall data.

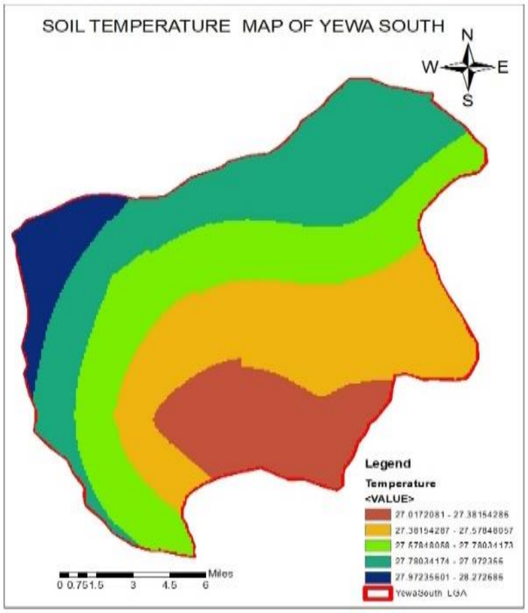

Figure 9: Temperature Map of Yewa South Local Government

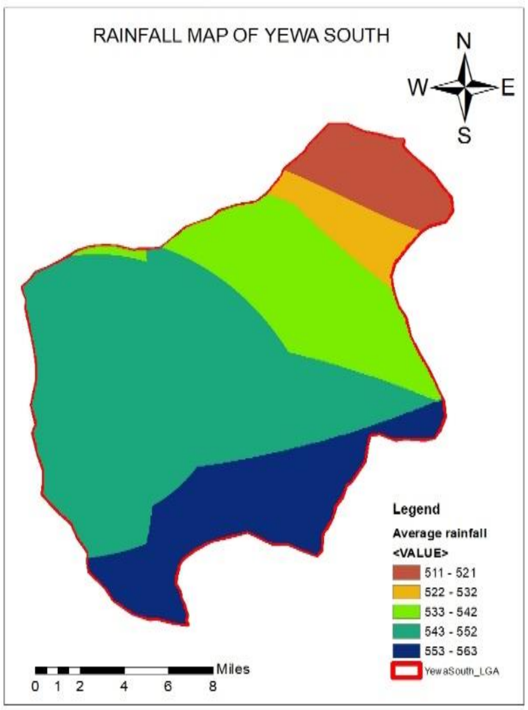

Figure 10: Rainfall Map of Yewa South Local Government

3.2.9 Soil Moisture

Soil moisture is known as the amount of water in the soil. The soil's pores hold the water in place In relation to the growth of the plant, soil water is the most major component. The dirt dampness for the review region was downloaded from NASA EARTH Information Site. The water in the soil serves as a nutrient for the soil.

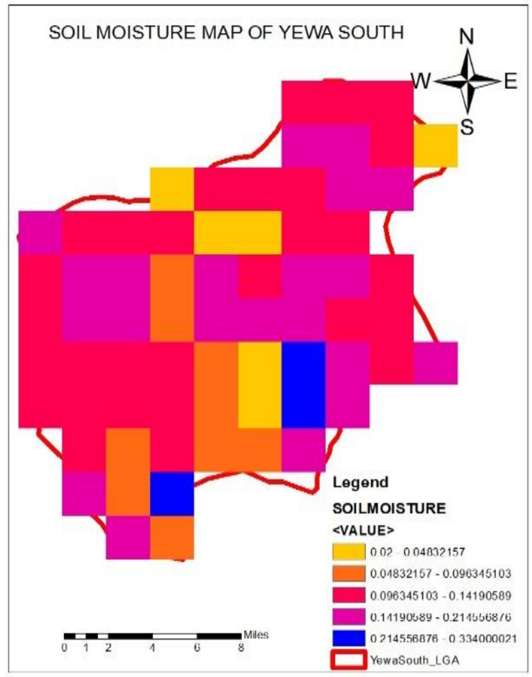

Figure 11: Soil Moisture Map of Yewa South Local Government

3.3 Digitization

For the process of digitization, new layers are created in the Arc Catalog by creating a personal geo-database. From the personal geo-database (this personal geo-database is renamed to reveal different features from the study area map), new features for major road and river were then created for various features on the digitized map.

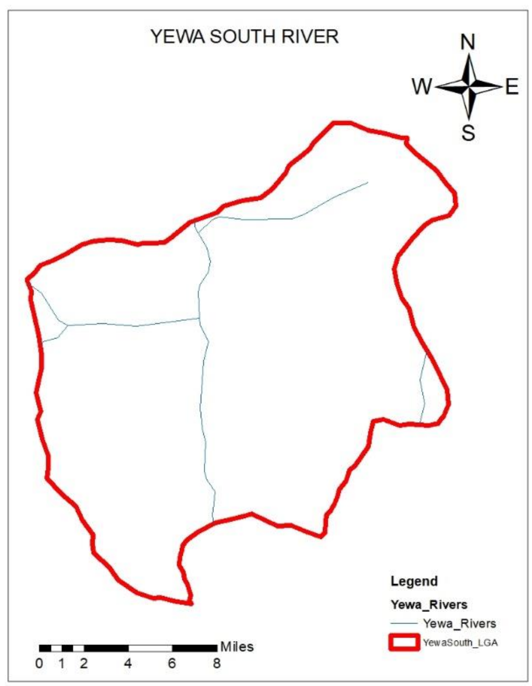

Figure 12: Map of Yewa South River

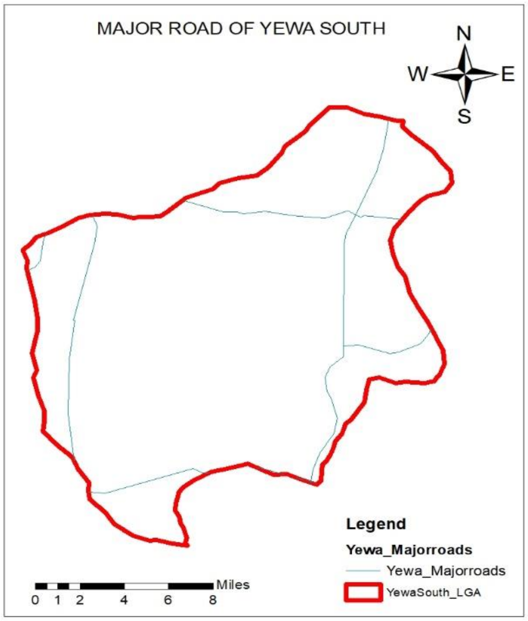

Figure 13: Major Road of Yewa South

3.4 Buffering

A multiple ring buffer operation was performed for road and river from the ArcMap window, arc tools box was selected and analysis tools was clicked on, then multiple ring buffer was selected and the input features was added (road or river).

The distances for river are in the range of 500,1000,2000,3000,4500 and the distances for road are in the range of 500,1000,1500,2000,2500, buffer unit is in meters**.**

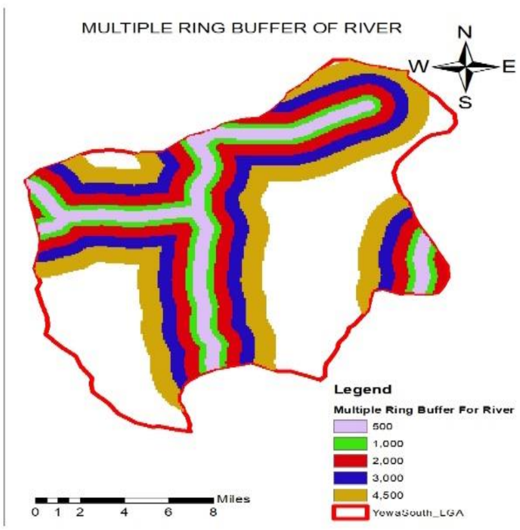

Figure 14: Multiple Ring Buffer Map for River

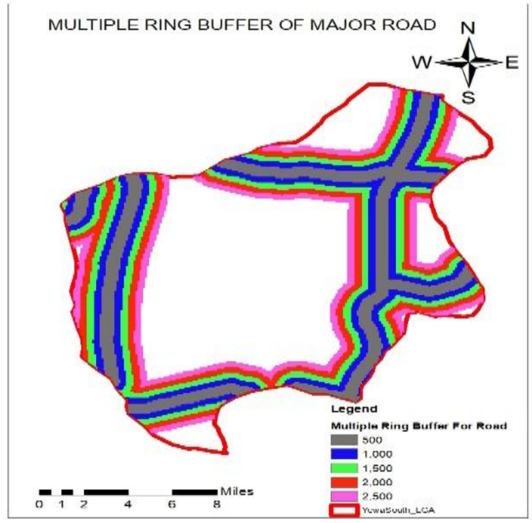

Figure 15: Multiple Ring Buffer Map for Road

3.5 Analytical Hierrachical Process

The Analytical hierarchical process is a multi-criteria decision-making procedure that was created by (Saaty, 1990).In the primary stage, the choice components are ventured into an order that incorporates three classes comprising of the top class **(**objectives), the working class (measures), and the base class (options).The selection of goals involves the highest class in the hierarchy. The criteria are set by the middle class, while alternative choices are set by the bottom class. Each factor pair's comparisons were represented as integer values ranging from 1 (equal importance) to 9 (extreme difference), where a higher number indicated that one factor was more significant than another.

Relative important	**Definition**	**Description**
1	Equally important	Two factor contributing uniformly to the predefined goal
2	Less moderate	Experience and judgement are less moderate In favor of one as compared to another
3	Moderately important	Experience and judgment are negligibly in favor of one as compared to he another.
4	Less strong important	Experience and judgment are less strong in

		Favor of one as compared to another
5	Strongly important	Experience and judgment that are very significant are strongly favorable toward one over another.
6	Less very important	Experience and judgement are less very strongly In favor of one as compared to another
7	Very strong important	Experience and judgments very strongly favor one over the another. Its necessity is revealed in practice.
8	Less extremely important	Experience and judgment are Less extremely important in favor of one as compared to another.
9	Extremely important	The sign favoring one as compared to the other parameter is of the maximum possible validity

Table 2: showing the description of ranking

The weight of twelve parameters was calculated to determine the priority of the criteria in relation to one another, influencing the final suitability map for the maize crop. The land-use suitability for maize was evaluated and analyzed using the AHP method, which is regarded as one of the best MCDA methods currently available. According to the AHP preference scale, the pairwise comparison matrix was created based on the relative importance of one criterion over another in determining the parameter weights.

	Ranking or Criteria Comparison Matrix (C)											
CRITERIA	PPT	DEM	SLOPE	Soil Type	TWI	Soil texture	Soil moisture	Aspect	Temperature	major Road	River	LULC
PPT	1.00	7.00	7.00	7.00	6.00	5.00	5.00	3.00	2.00	2.00	2.00	2.00
DEM	0.14	1.00	2.00	2.00	2.00	2.00	4.00	5.00	2.00	3.00	6.00	8.00
Slope	0.14	0.50	1.00	3.00	2.00	3.00	4.00	3.00	2.00	3.00	5.00	7.00
Soil Type	0.14	0.50	0.33	1.00	3.00	3.00	5.00	2.00	2.00	2.00	4.00	8.00
TWI	0.17	0.50	0.50	0.33	1.00	2.00	3.00	3.00	2.00	2.00	4.00	4.00
Soil texture	0.20	0.50	0.33	0.33	0.50	1.00	3.00	2.00	2.00	2.00	6.00	6.00
Soil moisture	0.20	0.25	0.25	0.20	0.33	0.33	1.00	5.00	2.00	2.00	5.00	6.00
Aspect	0.33	0.20	0.33	0.50	0.33	0.50	0.20	1.00	2.00	2.00	4.00	4.00
Temperature	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	1.00	2.00	4.00	5.00
Major road	0.50	0.33	0.33	0.50	0.50	0.50	0.50	0.50	0.50	1.00	5.00	6.00
River	0.50	0.17	0.20	0.25	0.25	0.17	0.20	0.25	0.25	0.20	1.00	5.00
LULC	0.50	0.13	0.14	0.13	0.25	0.17	0.17	0.25	0.20	0.17	0.20	1.00
Sum	4.33	11.58	12.93	15.74	16.67	18.17	26.57	25.50	17.95	21.37	46.20	62.00

Table 1: Showing the ranking or criteria comparison matrix

	Normalized Criteria comparison Matrix (C)													
Criteria	PPT	DEM	SLOPE	Soil Type	TWI	Soil texture	Soil moisture	Aspect	Temperature	Major road	River	LULC	Average	*Weight*
PPT	0.23	0.60	0.54	0.44	0.36	0.28	0.19	0.12	0.11	0.09	0.04	0.03	0.25	25.36
DEM	0.03	0.09	0.15	0.13	0.12	0.11	0.15	0.20	0.11	0.14	0.13	0.13	0.12	12.41
SLOPE	0.03	0.04	0.08	0.19	0.12	0.17	0.15	0.12	0.11	0.14	0.11	0.11	0.11	11.42
Soil Type	0.03	0.04	0.03	0.06	0.18	0.17	0.19	0.08	0.11	0.09	0.09	0.13	0.10	9.98
TWI	0.04	0.04	0.04	0.02	0.06	0.11	0.11	0.12	0.11	0.09	0.09	0.06	0.07	7.49
Soil texture	0.05	0.04	0.03	0.02	0.03	0.06	0.11	0.08	0.11	0.09	0.13	0.10	0.07	7.04
Soli moisture	0.05	0.02	**0.02**	0.01	0.02	0.02	0.04	0.20	0.11	0.09	0.11	0.10	0.07	6.52
Aspect	0.08	0.02	**0.03**	0.03	0.02	0.03	0.01	0.04	0.11	0.09	0.09	0.06	0.05	5.02
Temperature	0.12	0.04	**0.04**	0.03	0.03	0.03	0.02	0.02	0.06	0.09	0.09	0.08	0.05	5.35
Major road	0.12	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.03	0.05	0.11	0.10	0.05	4.81
River	0.12	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.08	0.03	2.74
LULC	0.12	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.02	0.02	1.87
Sum	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	100.00

Table 2: Showing the Normalized criteria comparison matirix

3.6 RECLASSIFICATION OF CRITERIA

Reclassification of criteria are done to explain the data in raster form by either switching a new single value or classify the ranges of values into single values. This was done to show the Normalized criteria comparison in matirix. Each criterion's raster map was rearranged into five classes: very suitable (S1), very suitable (S2), moderately suitable (S3), slightly suitable (S4), and unsuitable (N).Using the criteria used to classify the raster data, a new value was added to each of the five classifications based on FAO recommendations.

All of the criteria were reclassified into five classes using spatial analyst tools for the reclassified operation.

3.7 Weighted Overlay

One of the spatial GIS operations is weighted overlay analysis. Using overlay analysis, attribute and spatial data are combined. Information about each map feature is called an attribute.)This is accomplished through overlay analysis, which derives or infers an attribute for one layer by combining data from two distinct GIS layers.

The "Weighted Overlay" tool used all reclassified layers as inputs, giving each layer an equal influence percentage.

A suitable final map was created using the final layer. One method of modeling suitability is weighted overlay. For this analysis, ArcGIS uses the following procedure. In the suitability analysis, a weight is assign to each raster layer. A accepted suitability scale is used to reclassify raster values. After raster layers are overlaid, a suitability value is calculated by dividing the suitability value of each raster cell by the weight of its layer.

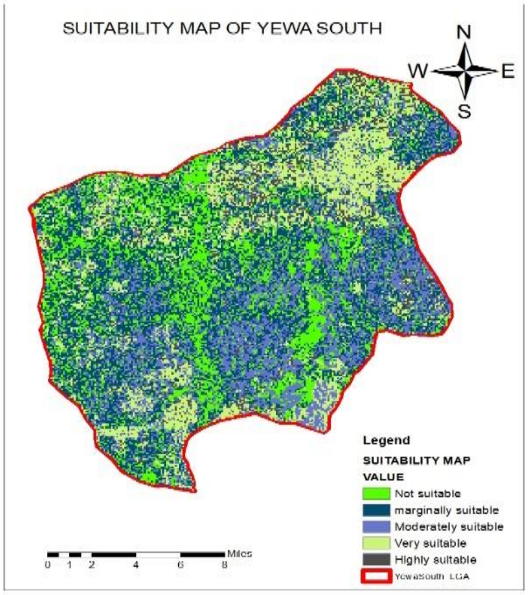

Figure 16: Suitability Map Of Yewa South Local Government

IV. Conclusion

The assessment of actual land characteristics of the review region shows that the review region has a potential for farming crops. The slope of the land, precipitation, temperature, soil moisture, soil texture, soil type, and land use and land cover were all taken into account when determining the study area's land suitability. The structure of the suitability issue is designed to fit within the framework of decision-making. In order to make it easier to incorporate expert knowledge from various fields, the criteria are arranged in a hierarchy. Because of the complexity of the decision-making process, the criteria are arranged in a hierarchy in stages

First Research Inquiry: What are the necessary assessment measures to evaluate the yield land appropriateness model ?

Based on the crop-specific soil, climate, and topographical data, the FAO (1976) provided a framework for crop land suitability analysis in terms of suitability classes from highly suitable to not suitable. The study has utilized the same framework with the addition of a larger number of parameters, such as environmental factors that influence the activity's sustainable use of the land.

Second Research Inquiry: Where and how should the expertise be incorporated?

Any kind of this project can benefit from the expert knowledge gleaned from previous research.

Third Research inquiry: What are the characteristics of the land and its qualities for maize growth?

Land use is directly influenced by the complex quality of the land. The interaction of a number of land characteristics and measurable characteristics determines the majority of land qualities. Literature identifies the land qualities and characteristics necessary for maize growth. Crop requirements, for instance, determine the soil texture, digital elevation model, slope, temperature, precipitation, and soil moisture.

V. Recommendation

The current study focuses on a single, dominant crop in the area under investigation. More crops can be considered using the same method. The Yewa South's physical suitability for agricultural crop production has been evaluated and shows great potential.

Adherence with moral standards

Conflict of interest The authors announce that they do not have any conflicts of interest

References

[1] Cengiz, T., & Akbulak, C. (2009). Application of analytical hierarchy process and geographic information systems in land-use suitability evaluation: a case study of Dumrek village (Canakkale, Turkey). Int J Sustain Dev World Ecol 16(4), 286-294.

[2] Fao. (1976). A framework for land evaluation . Soils bullettin 32, food and agriculture organization of the united nations, rome, italy.

[3] Belka, K. (2005). Multicriteria analysis and GIS application in the selection of sustainable motor way corridor. Masters thesis submitted to linkopings universitet institutionen for datavetenskap.

[4] Malczewski, J. (2006). GIS based multcriteria decision analysis: A survey of the literature. j. Geogr. Inform. Sci.,20, 703-726.

[5] Cover. (1991). multi criteria decision making. method of multi criteria decision making.

[6] Malczewski, J. (1999). New York, USA: Wiley and Sons inc.

[7] Baniya, N. (2008). land suitability evaluation using for vegetable crops in kathmandu valley. thesis submitted to humboldt university of berlin.

[8] Kanlaya, T. S. (2009). Integration of land evaluation and the analytical hierrachical process method for energy crops in kanchanaburi,thailand. science asia,53, 170-177.

[9] Khoi, D. a. (2010). delineation of suitable cropland areas using GIS based multicriteria evaluation approach in the tam Dao National Park Region, Vietman. Sustainability, 2, 2024-2043.

[10] Fao. (1976). A framework for land evaluation . Soils bullettin 32, food and agriculture organization of the united nations, rome, italy.

[11] Carr MH, Z. P. (2007). Smart land used analysis. the LUCIS model.

[12] Verdoodt A, V. R. (2003). a large-scale land suitability classification for rwanda. Ghent: Ghent university.

[13] Saaty, t. (1990). how to make a decision. the analytic hierarchy process, 9-26.

[14] Ahamed, N., GopalRao , K., & Murthy , J. (2000). GIS-based Fuzzy membership model for crop-land suitability analysis. Agrcultural Systems, ESRI Press.

[15] Landon, J. (1991). Booker Tropical Soil Manual. Longman Scientific and Technical, 474.

[16] Syst, I., Van, R. E., & Debaveye, J. (1991). Land evaluaton, part I. Princples in land evaluation and crop production calculations,. General administration for development cooperation, Brussels,, 40.

[17] Oduwole, A., & Kayode, O. V. (2019). Evaluation of dump site suitability and solid waste disposal in awotan ido local government, area, ibadan. 7th national environmental conference, federal polytechnic ilaro. ogun state.

[18] H. Akinci et al.(2013) Agricultural land use suitability analysis using GIS and AHP technique comput. Electron. Agric.

[19] Amiri et al, F. (2012). Application of geographic information systems in landuse suitability evaluation for beekeeping: a case study of Vahregan watershed (Iran) Afr. J. Agric. Res.

[20] Silva, S et al, (2014) Biogas plants site selection integrating Multi-criteria Decision Aid methods and GIS techniques: a case study in a Portuguese region Biomass Bioenergy.

[21] Yalew et al, S.G. (2016) AgriSuit: a web-based GIS-MCDA framework for agricultural land suitability assessment. Comput. Electron. Agri.

[22] Y.S. Liu et al. (2006) GIS-Based assessment of land suitability for optimalallocation in the Qinling Mountains, China. Pedosphere.

[23] Chen et al, H. (2010) Comprehensive evaluation of tobacco ecological suitability of Henan province based on GIS agricultural sciences in China. Agric. Sci. China.

[24] Kazemi, H. et al. (2016) Developing a land evaluation model for faba bean cultivation using geographic information system and multi-criteria analysis (A case study: Gonbad-Kavous region, Iran). Ecol. Indic.

[25] Maleki et al. (2017) Development of a land use suitability model for saffron (Crocus sativus L.) cultivation by multi-criteria evaluation and spatial analysis. Ecol. Eng.

AUTHORS

First Author – Ayodele ODUWOLE, Department of Surveying and Geoinformatics, Faculty of Environmental Studies, Federal Polytechnic Ilaro, Ogun State
Second Author – Olawale I. RIDWAN, Department of Surveying and Geoinformatics, Faculty of Environmental Studies, Federal Polytechnic Ilaro, Ogun State