IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)
e-ISSN: 2319-2402,p- ISSN: 2319-2399.Volume 13, Issue 12 Ser. I (December. 2019), PP 21-27
www.iosrjournals.org

Mapping Area Suitable For Rice Framing Using Remote Sensing And Gis In Suru Local Government Area Of Kebbi State.

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Abstract: *Mapping is a processing of delinating an area either on, under or above the earth surface, mapping of an area for the pupose of rice farming is not a common phenomeno in Nigeria. This work therefore seeks to use the Remote sensing and Geographic Information Sysytem (GIS) to map area suitable for rice farming within Suru Local Government Area of Kebbi State. Soil test was carried out in Thirty (30) different locations, Eighteen (18) of which meet up with both the physical and Chemical criterial for determing area suitable for rice farming. Suru local government was carved out of the map of kebbi state, Landsat 8 OLI was download from USGS, the study area was clipped, processed and classified into two board categories using supervied classification, the Area suitable for rice farming delinated as Silt Clay area and the unsuitable area which covers water bodies, roads, forest and other soil that does not meet up the conditions for determining suitable area delinated as others. The result shows that 34.34% (520,799,000m^2 =52079.9 Hectares) of the total landmass can be used for rice farming. If all other conditions are favorable, about 7,811,985bags of rice will be harvested, an equivalent ofOne Hundred and Thirty- Two Billion, Eight Hundred and Three Million, Seven Hundred and forty-five Thousand Naira (N132, 803,745,000.00) if a bag of 50Kg rice is sold for N17,000.00 each. This is a huge source of revenue generation for the State. Ground truth was carried to conform the result obtained from the classification. 9 out of the 10 location proved that the result obtained is true. It is recommended that the government of the State should consider using this method for mapping all other sources of revenue generation for sustainable development.*

Keyword: *- Rice Farming, Remote Sensing, GIS, Soil*

Date of Submission: 28-11-2019 Date of acceptance: 13-12-2019

I. Introduction

In the early ‘50s, before the discovery of oil in 1956 and its full exploitation between the late ‘60s and early ‘70s, Nigeria economy is run purely on Agriculture; production of Cotton, Groundnut and mostly cereal food in the North, Cocoa, yam, and other in the South west, Oil, rubber and the likes in the South East and in the Middle belt majorly yam and rice. From 1975, the county began to import common food such as rice, cassava and other stable food for consummation. Since then the Agricultural sector has being witnessing setbacks, around the closure of the ‘90s, the government began to privatize most of its own company and industries as a result of the bum in the oil sector and the abandonment of the Agricultural sector, some of the Company/ Industries sold are communication(NITEL), transportation (Railways and Airways), Power (NEPA) etc. Between the 20th and 21st century Austerity was introduced, a policy involving an increase in tax, cutting down on expenditure or both. This attempt was to curb or reduce hard times, but rather drives the country’s economy to a stiffer end.

Grace (2018) stated that the total landmass of Nigeria is about 77.7% of which 33.3% is arable, out of the 33.3%, 7.4% occupies permanent crops and 9.0% forest. As far as 2014, 70% of the non oil sector contribution to the country’s GDP is through agriculture. Agriculture also serve as a major employer of labour and helps to alleviate poverty sincemajority of the population depend on income from Agriculture.

After the recovery from recession the Mohammad Buhari led administration has sought for ways of diversifying from the oil sector to other productive sectors for revenue generation, in so doing the Anchor Borrower Program (ABP) was introduced in 2015 this is to pull out peasant farmers from poverty and provide job opportunity for millions of youth.

As published by daily trust 2015, Governor Atiku Bagudu announced a plan to open up rice farming in the state in other to take advantage of the rich fadama land scape in the state which passes across many of the local government as part of the revolution to diversify the State’s economic and reduce the importation of rice into the country. This has attracted many investors into the State, and led to the establishment of WACOT rice Factory Company in Argungu. The Federal Government in an attempt to support the State launched different

programs at various times. It is therefore necessary to assist the government in mapping areas suitable for rice farming across the State.

Soil asset stock gives a knowledge into the possibilities and confinement of soil for its compelling abuse. Current devices, for example, Satellite Remote Sensing, Global Positioning System (GPS) and Geographical Information System (GIS) have been giving more up to date measurements to screen and oversee soil assets for their powerful usage. Particularly remote detecting systems that have decreased the field work to a significant degree and soil limits are more decisively outlined than in customary techniques. Henceforth it is a profoundly demonstrated innovation that is successful for mapping and portraying land assets. Thilagam and Sivasamy (2013).

Soil maps are vital sources of information for many environmental and agro-economic analysis related fields (Henverlink, 2006). Most information on soils includes topography, geology and land use. Land use mapping substantially depends on the availability of satellite imagery which provides vital information on current and historic land management activities. Mathe (2014)

Owonobi et al. (1990) consider fadama to be valleys of streams, waterways and lakes, which are generally cultivated during the dry season. It is typically a site of occupied throughout the year for farming especially when the environment is wet or there is a source of irrigation within the site. The site is always richer than the upland partner. (Mustapha et al., 2005; Singh and Babaji, 1990).

This work is considering mapping area suitable for rice farming in Suru Local Government Area using GIS and Remote Sensing approach

Statement of Problem

With the government diversify the economy and the launching of the Anchor Borrower scheme (ABP) on the 17th November 2015 by the president of Nigeria His excelency Muhammad Buhari, it is pertinent that the area for the planting of the rice be properly mapped, due to the non availability of soil map within the state and the rigor involved in the conventional methods of surveying and soil test which will be time consuming and expensive. The mapping will enable farmer have enough yield by locating the proper location for planting, allow the government monitor the area cultivated and determine the number of persons employed and/or beneficiaries during the program.The work therefore seek to address the problem of identifying and delinating the area suitable for rice farming within Suru Local Government of Kebbi State.

Aim

The aim is to identify and map area suitable for rice farming in Suru Local Government of Kebbi State using the Remote Sensing and GIS approach.

Objectives

- ✓ Download satelite image containing the study area.
- ✓ Sub-setting or clip the area concerned
- ✓ Pre-processing and Processing
- ✓ Preparation of Map of the Study Area.

Study Area

Suru is a Local Government Area in Kebbi State, Nigeria. Its central command is situated at Dakingari. It was created in 1991 out of Bunza LGA,by the General Ibrahim Badamosi Babangida administration. The town exists in Latitude 12° 05' 3.98"N and longitude 4° 01' 16.00" E andLatitude 12°28'33.09"N and longitude 04^0 14'54.05"E. It has a normal landmass of 1,516.475 km². Suru Local Government Area has a populace of 148,474 (2006)and 202,400 (projected, 2016), the polpulation comprise of a little above half of Female and 49.1% of Male, the working section containing both male and Female is 38.3%. They are major farmers, working throughout the year (both wet and dry season farming).

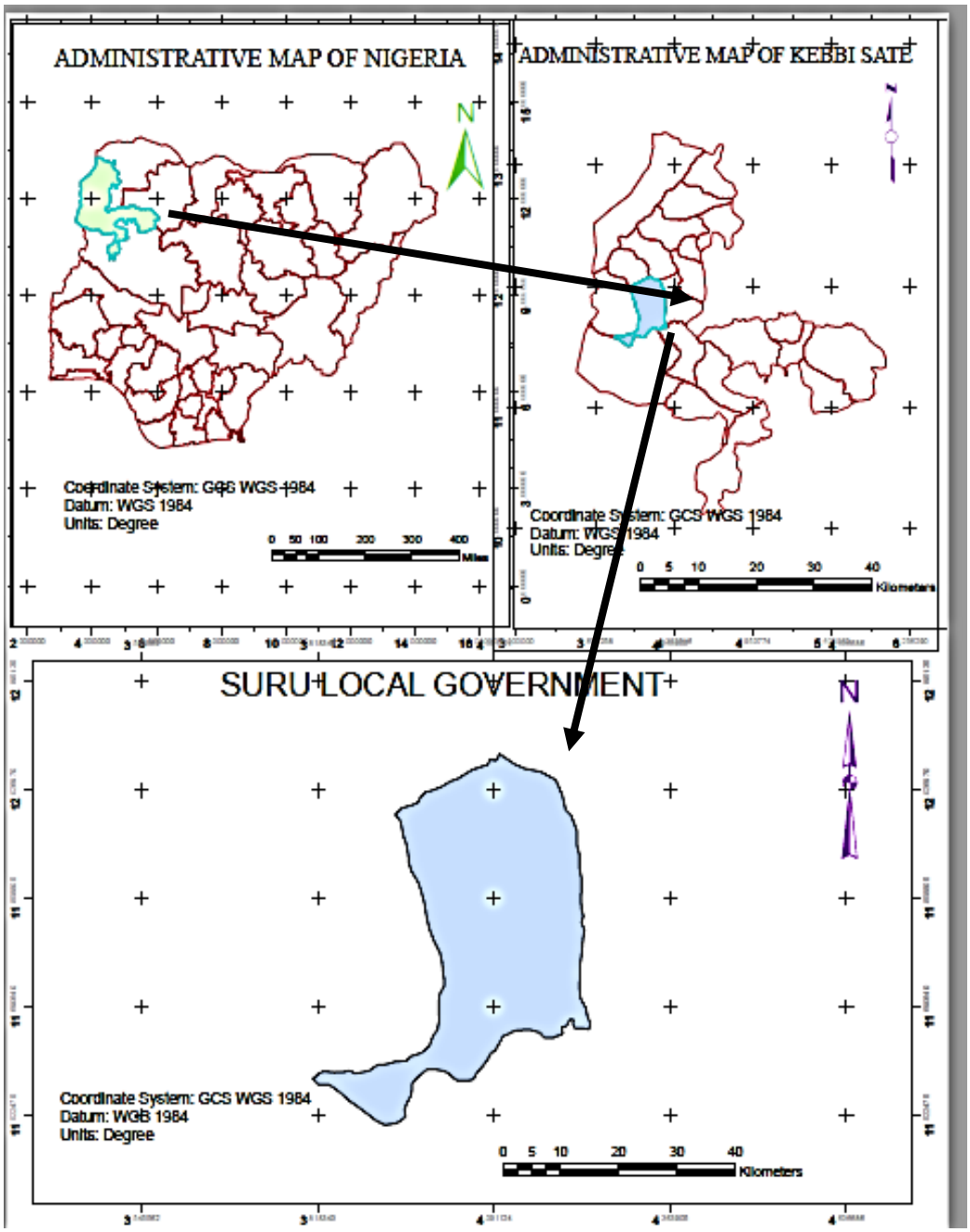

Figure 1:- Map of Nigeria showing Suru Local Government area.
Source: GIS data processing, October 2019

II. Methodology

Rice can grow in a wide range of soil, this range is streamlined to obtain the best area, using the following criteria

i. Flat land to allow even distribution of water
ii. Ability to retain water
iii. Silt clay, Silt Clay Loamy and Clay
iv. PH between 5-8
v. Mineral properties:- Nitrogen, Phosphorus, Potassium, Sulphur

Sample soils were obtained from 30 different location within the study area and tested for the PH and chemical properties. 18 of the locations have the properties and closely related, the coordinates of these locations were recorded, and this will help in creating training site for supervised classification

2.1 Data Source And The Method Of Acquisition

i. Landsat 8 OLI imagery of 2nd June, 2019 was downloaded from United States Geological Survey (USGS) earth explorer.
ii. Suru Local Government shapefile was obtained from the administrative shapefile of Nigeria

2.2 Importing Data Into Arcgis Environment

- ✓ Landsat 8 image 2019 was downloaded from USGS Earth explorer
- ✓ Arc map 10.2 was lunched and
- ✓ Data was added in to ArcGIS environment through add data icon by clicking connect folder icon and importing band 1, 2,3,4,5,6,7,8.
- ✓ A composite band was created by clicking windows icon and
- ✓ Image analysis was click band 1-7 was highlighted
- ✓ A composite icon was click down the image analysis window a composite band was successfully created.

2.3 Process Of Clipping Area Of Interest

- ✓ Kebbi state shape file was imported in to arc map as shown in figure 2
- ✓ Select feature was click and study area has been highlighted as shown in figure 2
- ✓ Arc toolbox was click, then data management =>raster=>raster processing and clip icon was click
- ✓ A clip window was open, input and output raster band was imputed
- ✓ Maintain clipping extent geometric dialog box was click to clip only the selected area.
- ✓ Then ok.
- ✓ The study area was automatically clipped out.

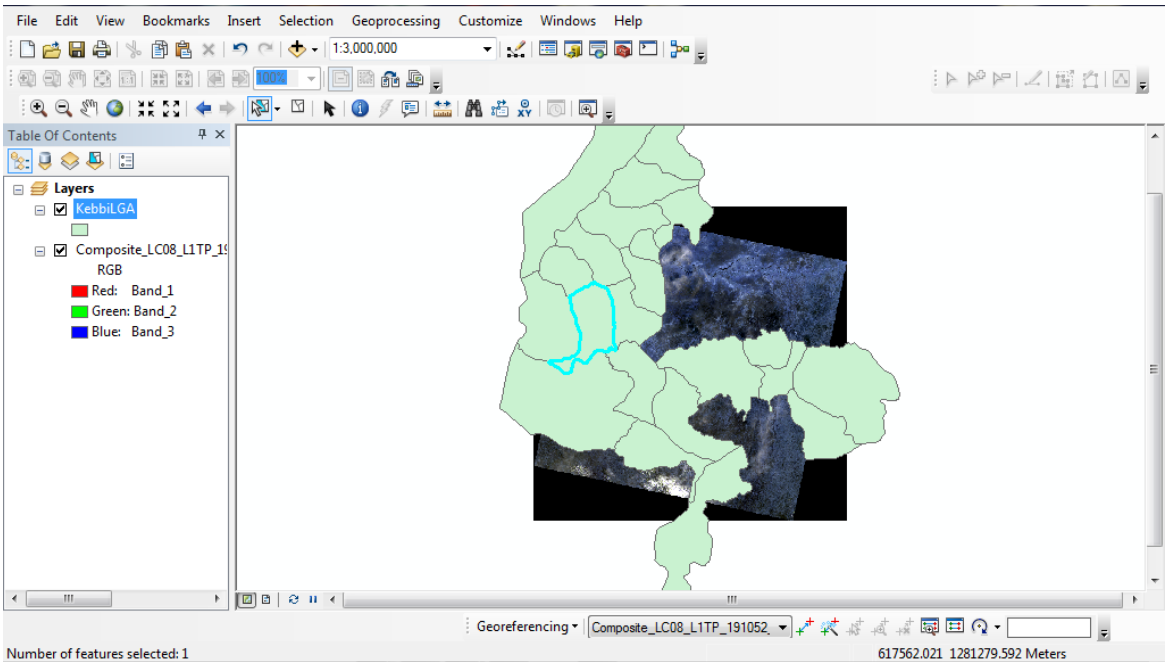

Figure 2 image showing the position of the study area
Source: GIS data processing, October 2019

2.4 Image Classification Process

- ✓ Image classification was done by right clicking on arc map environment,
- ✓ Image classification was click, image classification ribbon was open,
- ✓ Then training sample (also known as training Site) manager was click, a training sample manager open as shown in figure 3
- ✓ In other to classified the image, a polygon was selected (Supervised classification)
- ✓ The image was classified by drawing a polygon shape on the image as shown in figure 3 the image was classified into two; area suitable for rice farming levelled as Silt clay Soil and not suitable levelled others.
- ✓ After classification a signature file was created and was save in folder,
- ✓ Maximum livelihood clicked and window opens
- ✓ Signature file was imputed

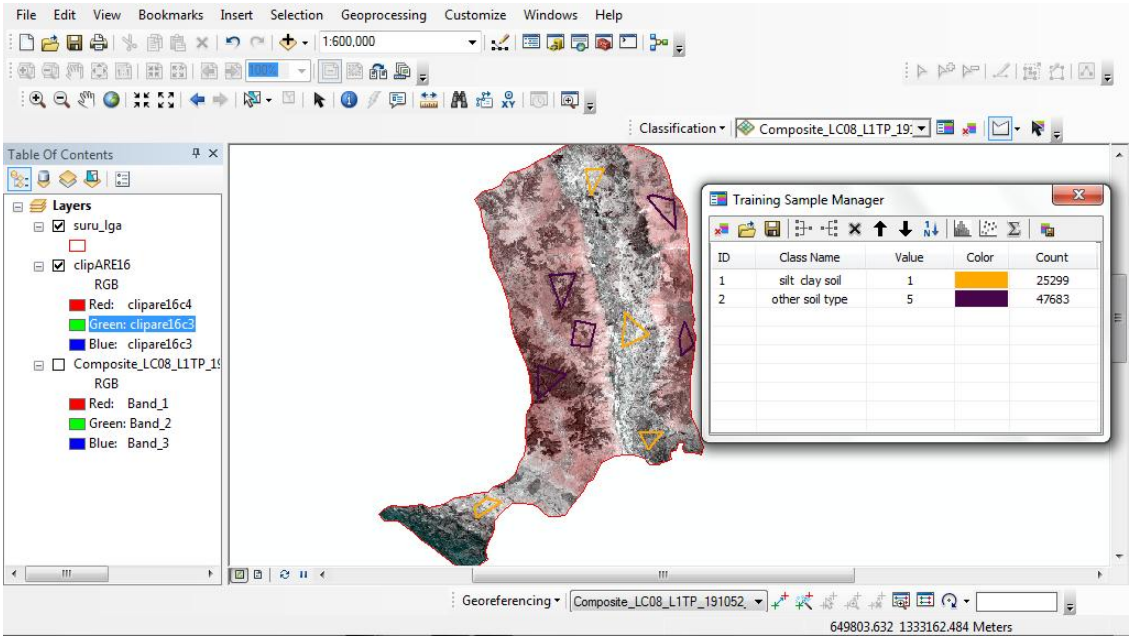

Figure 3 image show how the image was classified

Source: GIS data processing October, 2019

The area in pink colour in figure 4 represent location suitable for rice farming within Suru Local Government Area. While the blue colour represents area not suitable for rice farming these includes built area, roads, forest etc.

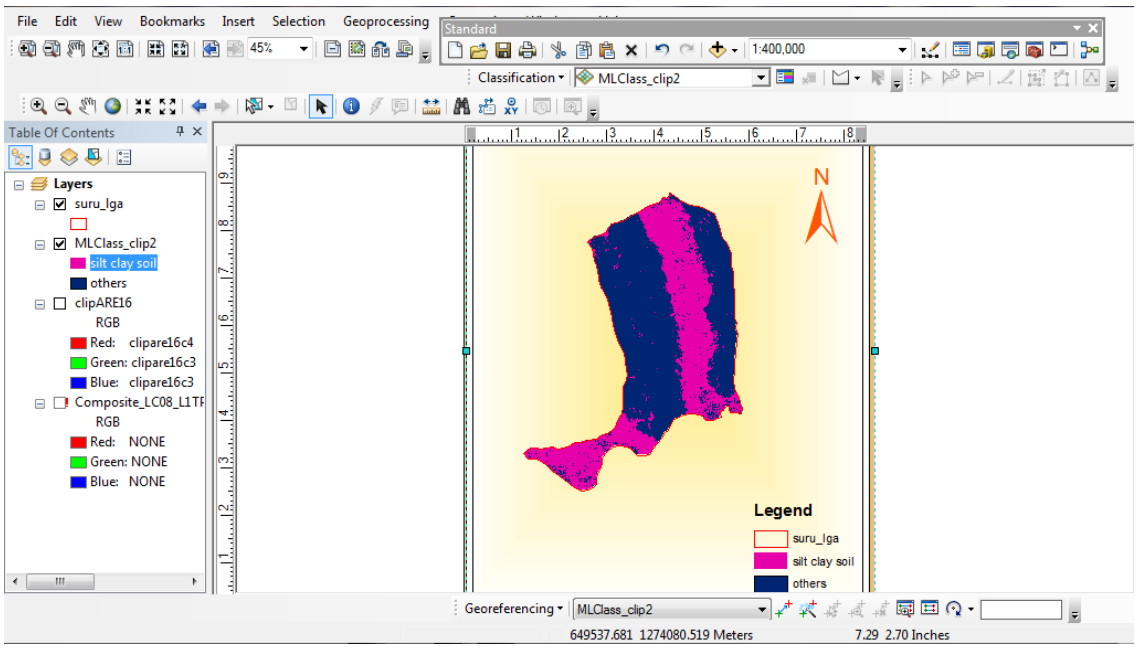

Figure 4: shows the classified image of the study area

Source: GIS data processing October, 2019

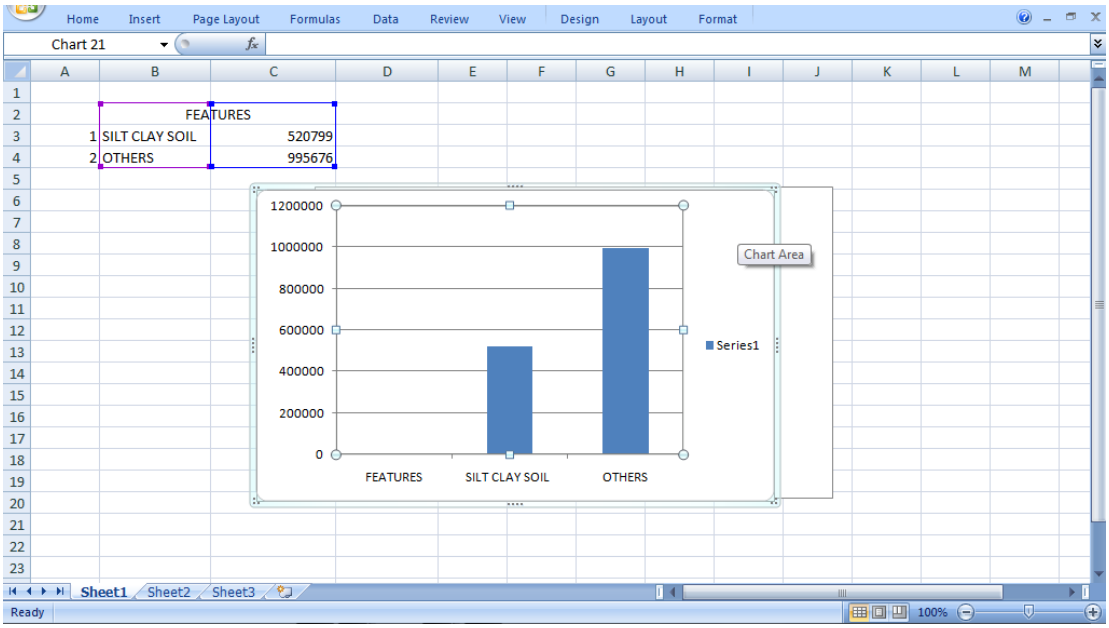

Figure 5 Pictorial view of the relationship between Suitable and Unsuitable area using Microsoft excel
Source: Author, Microsoft Excel graphic representation October, 2019

2.5 Ground Truth

Is the term used in sciences such as metrology, Cartography, Aerial photogrammetry, Satellite Imagery, and other related remote sensing techniques to correlate the relation between the Remote Sensing data and the real world.

The coordinates of ten (10) different locations were obtained from the classified image under the Silt Clay area andGPS handheld receiver was used to waypoint to the locations and the soil tested, the result favoured the Silt Clay with the exception of one. This shows that the area is well delineated.

III. Data Analysis

From the aforementioned, a total of 520,799,000m^2 (52079.9 Hectares) making 34.34% of the total land mass can be cultivated for rice farming. This figure translates to One million, One Hundred and fifty Seven Thousand Three Hundred and Thirty One plots of land (1,157,331 Plots).
1hecatre of land can produce 7.5tons or 7500Kg or 150bags of Local rice.
The total area = 52079.9H
Therefore from the area we can get 150bags X 52079.9 = 7,811,985bags all things being equal
As at November 2019, a bag of local rice in some of the market in Nigeria is as shown in table

S/N	Location of Market	Price ₦
1	Birnin Kebbi, Kebbi	17,000.00
2	Bodija, Ibadan	20,000.00
3	Minna, Niger	16,000.00
4	Garko, Kano	20,000.00
5	Gboko, Benue	11,000.00
6	Ughelli, Delta	23,000.00
7	Egbeda, Lagos	18,000.00
8	Umuahia, Abia	22,000.00

Table 1:- Price of Rice in some Nigeria Market
Source: - https://nigerianprice.com/price-of-rice-in-nigeria

Considering the price of rice in Birnin Kebbi N17, 000.00/bag X 7,811,985bags = N132, 803,745,000.00 (One Hundred and Thirty- Two Billion, Eight Hundred and Three Million, Seven Hundred and forty-five Thousand Naira) will be generated from rice farming within Suru local Government. This is a huge source of revenue generation for the State.

IV. Summary

With the advert of Remote sensing and Geographic Information System (GIS) complex problems in various fields have been made much easier. The use of these methods to map are suitable for rice farming is quite interesting, time saving and less rigorous.

The result obtained from the work shows that about of time can be saved, moneys obtained and a lot of the youths can be employed when the government is able to determine the extent of its resources.

4.1 Conclusions

In conclusion remote sensing and GIS techniques can be used to support digital soil mapping within Suru Local Government. However, there is need for the remote sensing experts to have some knowledge of soils and geology so as to understand how to map the soils. There are a variety of ways of mapping soils, with these advancement, this method is highly recommended.

4.2 Recommendations

i. The government can use this formation as a takeoff for the state to improve in its internally generated revenue.
ii. The rest local Government should be mapped not for only rice farming, but for other crops and mineral deposited since remote sensing can be used for mineral deposite detection.
iii. There is a need to train and retrain the staff of the State Ministry on the use of GIS and Remote Sensing.

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Surv. Adewale Adebayo. "Mapping Area Suitable For Rice Framing Using Remote Sensing And Gis In Suru Local Government Area Of Kebbi State." IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT) 13.12 (2019): 21-27.