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Application Of Geogrpahical Information System (Gis) On Climate Change And The Detection Of Riverbodies Area Suitable For Industrial And Agricultural Purposes

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ABSTRACT
A GIS-based framework helps us gain a scientific understanding of earth systems at a truly global scale and leads to more thoughtful, informed decision making.
This paper seeks to show the use of GIS in climate change, the results for this work is shown in figures, ithas to do with the use of GPS to locate places on earth. This work shows the use GPS to find areas suitable for commercial and industrial purposes considering its closeness to river bodies and also its nearness to major commercial areas in Anambra state, size and population. The purpose of this study is to find a suitable area to channel industrial waste.The GIS performs various functions, namely; data capture, data management, data manipulation and preserving and utilizing inherent characteristics of spatial data. The GIS stores two types of data found on the map; the geographical definitions and attributes or qualities of those features. There are two broad methods used to store such data in a GIS: raster and vector.
It is beneficial to use the GIS technique in siting locations because it helps to study geologic features, analyze soils and strata, assess seismic information, and or create three dimensional (3D) displays of geographic faetures. GIS can be also used to analyze rock information characteristics and identifying the best dam site location. The administrative map shows the various local governments of anambra state and also the locations of these local government areas on the google earth map indicated with the red inverted oval shape, from the above figure its being deduced that some of the local governments cuts across the river niger, which brings us closer to the aim of this work.
Considering the data provided above, it will be profitable, if the industry is situated in a location closer to the commercial area, with higher population and a vast area of land.From the data collected, one can conclude that the location with the shortest distance to commercial area (Onitsha) is Odekpe, the area with the highest population alongside Atani is Odekpe, the location with the highest area which is 453km^2 is Odekpe with Atani which happens to be in the same Local Government Area.
Keywords: *GIS, Climate change, Riverbird , Agriculture and Industrial area*

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I. INTRODUCTION

A **Geographic Information System** (**GIS**) is a system designed to capture, store, manipulate, analyze, manage, and present spatial or geographical data. GIS applications are tools that allow users to create interactive queries (user-created searches), analyze spatial information, edit data in maps, and present the results of all these operations. GIS (more commonly GIS) sometimes refers to geographic information science (GIS), the science underlying geographic concepts, applications, and systems. Since the mid-1980s, geographic information systems have become valuable tool used to support a variety of city and regional planning functions.

GIS can refer to a number of different technologies, processes, techniques and methods. It is attached to many operations and has many applications related to engineering, planning, management, transport/logistics, insurance, telecommunications, and business. For that reason, GIS and location intelligence applications can be the foundation for many location-enabled services that rely on analysis and visualization.

GIS can relate unrelated information by using location as the key index variable. Locations or extents in the Earth space–time may be recorded as dates/times of occurrence, and x, y, and z coordinatesrepresenting, longitude, latitude, and elevation, respectively. All Earth-based spatial–temporal

location and extent references should be relatable to one another and ultimately to a "real" physical location or extent. This key characteristic of GIS has begun to open new avenues of scientific inquiry.

1.1 Climate Change is a Geographic Problem

Reducing the risks caused by climate change an immense challenges. Scientists, policy makers, developers, engineers, and many others have used geographic information system [GIS] technology to better understand a complex solution and offer some tangible solutions. technology offers a means to assess, plan and implement sustainable programs that can affect us 10,20 and 100 years into the future.

A GIS-based framework helps us gain a scientific understanding of earth systems at a truly global scale and leads to more thoughtful, informed decision making.

- deforestation analysis spurs successful reforestation programs and sustainable management.
- study of potential sea level rise leads to adaptive engineering projects.
- emissions assessment brings about research into alternative energy sources such as wind turbine sitting and residential solar roof top programs climate change is a geographic problem and we believe solving it takes a geographic solution GIS users represent a vast reservoir of knowledge, expertise, and best practices in applying this cornerstone technology to the science of climate change and understanding its impact on natural and human systems.[3]

Stopping deforestation and growing new forests, particularly in the tropics are the easiest and fastest ways for society to reduce carbon dioxide in the atmosphere and mitigate global warming. GIS is one of the key elements of the forest carbon monitoring system needed by tropical developing countries to manage this forests.[6]

This work seeks to contribute to the use of GIS in climate change, this is a stress less and more comfortable approach in locating places on the earth. This work aimed at using GPS, GIS and Google map in collecting earth data inform of images and maps.

II. LITERATURE REVIEW

2.1 The Geo-Informatics System(GIS)

Geo-Informatics System [GIS] is a frontier in science, which integrates space science, survey and mapping science, geography, information science, computer science, environmental science and management science. The GIS is not only capable of managing data, text information and graph but also of integrating and analyzing spatial data from different sources, with diverse formats, structures, projections or resolution levels with the aid of computer. Thus, it is a new and effective technical system in complex processing and analysis of spatial data. [5,15]

The GIS performs various functions, namely; data capture, data management, data manipulation and preserving and utilizing inherent characteristics of spatial data. The GIS stores two types of data found on the map; the geographical definitions and attributes or qualities of those features. There are two broad methods used to store such data in a GIS: raster and vector. [5]

2.1.1 Raster

A raster is a grid based representation of data where spatial features and attributes are merged into a unified data file. Each cell (pixel) describes the condition of space at that location: Each cell has a numeric value:

- Feature identifier
- Qualitative attribute code (categories differ in kind rather than quality)
- Quantitative attribute

The quality of a raster image is determined by the total number of pixels (resolution) and the amount of information in each pixel (often called colour depth).

2.1.2 Vector

Vector layers are composed of parts, which are linked to form the lines and areal boundaries of polygons. The points are encoded with latitude and longitude (X,Y) coordinates. Vector representation is feature orientated as they described features, spatially referenced entities with distinct boundaries. [13]

2.2 Components of GIS

The GIS is a computer system for collecting, storing, manipulating, and displaying geographic information. There are many definitions for GIS. However, the major characteristics are the geographic (spatial) analysis functions that provide means for deriving new information based on locations. The GIS integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information. It stores information about the world as a collection of thematic layers that can be linked together geographically. the GIS allows viewing, interpreting and visualizing data in many ways that reveal relationships, patterns and trends in the form of maps.[8]

The GIS performs various functions, namely, data capture, data management, data manipulation and analysis, and the presentation of results n both graphic and report form, with a particular emphasis on preserving and utilizing inherent characteristics of spatial data. [13]

- The computer system (hardware and operating system).
- The software (learning the concepts, capabilities, limitations and interface of GIS software have educational value in itself. the GIS is a tool that is increasingly being used in diverse fields of work, from local government to global scientific research)
- Spatial analysis is the most important function of the GIS, which makes it distinct from other computer based graphics software. The spatial analysis provides the functions such as spatial interpolation, buffering and overlay operations, and network analysis.
- Data management and analysis procedures: After data are collected and integrated, the GIS provides facilities for effective data management, which include data integrity, storage and retrieval, maintenance and updating abilities.
- The people to operate the GIS.
- The methods or the process for getting data into the computer. This is one of the most important step and we can say: *GIS without data is a car without fuel*.

2.3 Brief History of GIS.

Two dimensional GIS began in the computer aided map-making in the 1960s, and now it has gone deep into every application field. it is essentially based on an abstract symbolic system, so it cannot provide the original feeling of nature to people and it is difficult to overcome the shortcoming[4]. However, three dimensional GIS can solve the problem with the development of virtual reality technology, the concept of "digital earth" has been put forward and three dimensional GIS become new technology to promote spatial analysis and expand information representation in GIS by processing elevation data, three dimensional GIS can display the landform and objects in three dimensional to create an obvious scene. The display usage can also meet the demand for management, analysis, estimation, decision and visualization.

The 1960s saw many new form of geographic data and mapping software's with computer cartography, the first basic GIS concepts were developed during the late 1950s and 1960s. linked software's modules rather than stand hare program, preceded GIS early influential data sets were the world data bank files. The vector topological arc / node data started at the Harvard university GIS was significantly altered by both PCS and the WCS. During the 1980s new GIS s/w could better exploit more advanced h/w. user interface developments led to GIS vastly improved during the 1990s. [10]

2.4 How to Use GIS for Climate Change.

Climate change it's a major problem in recent years and it is a geographic problem and we can solve it by providing geo-spatial solution. From many days, GIS technology is useful for environment understanding in strategic decision making and climate change monitoring also important in predictions of disaster risks in forest and agriculture sections. Worldwide scientists, researchers, different policy makers rely on scientific analysis of GIS data and its data base management functionality. GIS professionals with varied expertise, knowledge and having experience of best practices for implementing this advancetechnology to climate change monitoring, carbon management, in disaster management.this valuable technology is important for identification of current and future risks and vulnerabilities of climate change and also helpful for design and implementation adaptation operations.

Skillful expertise is required for the climate change detection through GIS techniques. different information , ex-pests, plant genetic resources and crop production and then these data, united with the environmental data sets, such as land cover, weather for measurement of their current distribution and potential future estimated distribution under various scenarios of climate change. Many environmental analysts using this technology for understanding such climate complex issues and offering some important solutions. In understanding global scale earth system and for taking strategic decisions, GIS base framework is very useful:

- successful reforestation program can be possible to implement due to deforestation identification on maps.
- adoptive engineering projects leads from study of potential sea level rise.
- optional energy sources or residential solar roof top program and wind turbine sitting is implemented because of assessment of carbon emissions.[14]

2.4.1 Geospatial Tools for Climate Change

The GIS has been applied in climate change related studies such as land cover and land use, glacier and snow cover mapping, air quality mapping, and modelling relationships between climate change and increasing natural hazards and the influence of extreme weather events in livelihoods. The GIS enables to visualize the

changes in its inter-linkages in the form of maps so that gaps and priority areas can be easily identified. The GIS is extensively used for making inventories and mapping monitoring vegetation, glaciers and snow cover across landscapes, in order to better understand the impact of climate change.

The Geo-Spatial technology provides powerful tools for decision making related to climate change adaptation, allowing us to measure, model, and monitor, manage and mitigate its impacts. To avoid a dramatic disruption of society due to climate change, it is imperative that Geo-Spatial technology is in place to manage and minimize the many inevitable impacts.

Recently, Geographical Information System (GIS) have been used to understand the impact of global change at the global, regional and local scales by utilizing a broad range of social, economic and climate data and by combining this data with up-to-date information from the earth observation satellites. [3,2,7]. There are a lot of applications of GIS, one of them is using it in the development of weather data into GIS. [4,9,11,12]. Display of meteorological data: the first goal in GIS meteorology is to convert meteorological data information to "GIS negotiable" formats. The following table summarizes the relationships of weather data to GIS formats (or shape), but it is not intended to be exhaustive.

2.4.2 Spatial and Attribute Data in GIS for Climate Change

Arc GIS is in general used here to predict the impact on global warming and climate change in a certain country. Arc GIS consist of the following:

- arc catalogue
- arc map
- arc tool box
- arc scene
- arc global
- work station
- desktop administration
- arc reader.[12]

III. MATERIALS AND METHODS

3.1 Study Area

Anambra state is in south-eastern Nigeria and lies between latitude 5° 40′ 00″ n and 6° 50′ 00″ n and longitude 6° 40′ 00″ e and 7° 20′ 00″ e. it is bounded by delta state to the west, Imo state and Rivers state to the south, Enugu state to the east and Kogi state to the north. It has three senatorial districts, namely Anambra north, Anambra central and Anambra south. The state is made up of 21 local governments as shown in the map below:

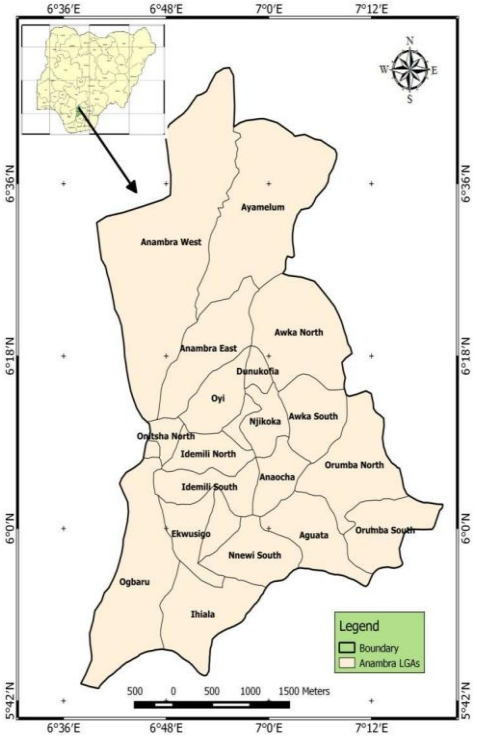

Fig: 1

Fig: 2

Administrative Map of Anambra State showing its Local Government Areas

The administrative map [Fig:1] shows the various local governments of anambra state while [Fig: 2] shows the locations of these local government areas on the google earth map indicatedd with the red inverted oval shape, from the above figure its being deduced that some of the local governmentscuts across the river niger, which brings us closer to the aim of this work.

3.2 Data collection

The Google earth map, GIS, GPS is used to collect data from the earth, this medium of data collection helps to show distances on the earth

Fig 3: 3D Animation

Fig4: 2D Animation

Distances between Atani, Odekpe and Eke

[Fig: 3] shows the thin serrated line in between delta and Anambra which indicates the border of the two states, the broad blue lines indicates the spreading across of the river Niger. [Fig: 4] gives a clearer picture of these locations on the earth map. From these two figures it can be said that Eke, Odekpe and Atani (all in Anambra state) are closer to river bodies(River Niger).

ODEKPE in Ogbaru(Anambra) is about 214 mi (345 Km) south of Abuja, the country's capital city with 6.048 and 6.738 (Lat./Lng.). Estimated population is 223, 317 with area 453 km^2- density; 652.3/km^2

Eke (Awgbu) a town in Orumba north local government, estimated population of 120, 000 as at 2006, with coordinates 5.54 and 6.52 (Lat./Lng.)[1]. The total population of this local government is 228,600 with 297 km^2 and density 769.7/km^2(2016).

Atani which is also a town in Ogbaru is believed to possess commercial quantities of unexploited crude oil. The population has grown to an estimates 230,000. [16]

[Fig 5]: The distances between Onitsha, Eke, Atani and Odekpe.

When comparing the distances from Atani, Odekpe and Eke from Onitsha which is the major commercial area in Anambra state and Nigeria at large, the following facts kilometres were obtained:Odekpe to Onitsha is 8.14 Km, Eke to Onitsha is 8.65 Km, while Atani to Onitsha is 14.2 Km.

IV. RESULT AND DISCUSSION

4.1 Result

With the data collected from chapter 3, the following information obtained are presented below:

Name of town	EKE	ATANI	ODEKPE
Population	228,600	230,000	230,000
Area(km2)	297	453	453
Distance(Km)	8.65	14.2	8.14

Tab.1: Comparing the three (3) areas of study

4.2 Discussion

Considering the data provided above, it will be profitable, if the industry is situated in a location closer to the commercial area, with higher population and a vast area of land.

V. CONCLUSION AND RECOMMENDATION

5.1 Conclusion

From the data collected, one can conclude that the location with the shortest distance to commercial area(Onitsha) is Odekpe, the area with the highest population alongside Atani is Odekpe, the location with the highest area which is 453km^2 is Odekpe with Atani which happens to be in the same Local Government Area.

5.2 Recommendation

I hereby recommend that in situating a commercial area closer to river bodies in order to discharge industrial waste in Anambra state, Odekpe a town in Ogbaru Local Government is best suitable.

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