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Mapping and Identifying Suitable Sites for Aquaculture in Some Parts of Federal University of Technology Minna, Main Campus with the Aid of Geographical Information System

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Abstract

This study assessed and identified suitable sites for aquaculture in some part of Federal University of Technology Minna with the aid of Geographical Information System for twelve weeks (12) guided by four specific objectives: to provide baseline information on site selection for aquaculture using GIS, identify the ecological potentials of the area, develop a GIS database as a tool for management and make quality recommendations. The site identified was dug to 1.5m depth and the water level was measured and sampled weekly. The sample water was taken to WAFT laboratory for analysis. The result from the seven sample site indicated that the water retainability level ranges from 35.3 -100cm and sites A, C, D and F were the most suitable for aquaculture. The analysis ofwater quality parameters showed the ranges for temperature 26.3-27.5^{0}C, hydrogen ion concentration (pH) 5.38-6.42, Dissolved oxygen (DO) 5.55-7.12mg/l, hardness 18.02-181.16 mg/l, alkalinity 39-99 mg/l, Total dissolved solid 27.94-183.58 mg/l, turbidity 25.4-638 mg/l, Nitrate 3.72-61.66 mg/l and conductivity 41-187 uhos/cm^3. This indicated that all the physico-chemical parameters except for Nitrates were within the ideal ranges recommended.

Key words: Suitable sites, Water quality parameters and GIS.

Introduction

Commercial aquaculture gained global attention not only due to its role in strengthening the economy of a country but also due to sudden collapse of industries in some country. This has resulted in great need for the acquisition of suitable land. Selecting the right site for aquatic farming operation is vital as it can greatly influence economic viability if properly chosen. Remote Sensing and Geographical Information System (G.I.S) capacity can be valuable in identifying potentially suitable aquaculture sites. This study was on the use of Geographical Information System (GIS) to assess and identify suitable sites for aquaculture.

Materials and Methods

The materials used for the experiment are presented in tabular for in Table 1 below.

Table 1: Material Types and source of data for the research analyses.

Data	Type	Year	Sources
Topography map	Hard copy	1992	Works Department F.U.T.Minna
Spot image	Environmental monitoring satellite	2010	Global land cover facility(GLCF)
Geographical position system	Garman etrex	2008	Department of surveying and Geoinformation
Ruler	T-square	2010	-
NOKIA	5300	2008	-
Water quality	Bottles and plastics	2010	WAFT Laboratory F.U.T Minna

Study area:

Gidan Kwano main campus of Federal University of Technology Minna, Niger State lies on latitude 9^0 41´N and longitude 6^{0}31´E within the Southern Guinea savanna Vegetation zone with a sub- humid tropical climate, is an area with great potential site for aquaculture due to its swampy nature, access to some River tributaries, and good soil fertility.

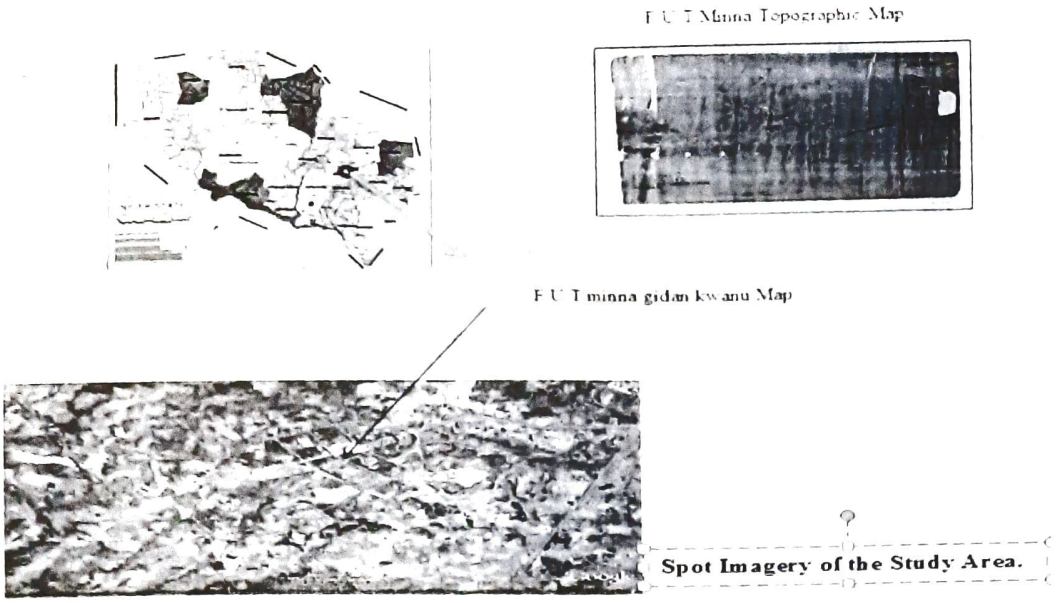

Figure I: Niger state indicating the study area GidanKwano F.U.T MMinna

The sites identified were dug to 1.5m depth, soil types were identified (Figure 1) and the water levels were measured and sampled weekly. The water samples were taken to WAFT laboratory for analysis of physico-chemical parameters. For Ammonia kijwaldahi distillatration apparatus was used. Nitrate–Nitrogen, phenol disulphric acid method was employed and concentration extrapolated from standard curve. While for Phoshate-Phoshorus, titration and ascorbic acid method was used, concentration was also extrapolated from standard curve. In the case of Alkalinity and Hardness, samples were titrated and the end point (colour) of each was observed then the total concentration was calculated.

$$\text{Total alkalinity (mg/l)} = \frac{\text{volume of titrate x morality (M) x 100}}{\text{Volume of sample}}$$

$$\text{Total hardness (mg/1 as } caco_3\text{)} = \frac{\text{Volume EDTA x N x 100}}{\text{Volume of sample}}$$

Results and Discussion

From the result, three (3) basic soil types were identified; loamy, clay and loamy/sandy. The water retainability level ranged from 35.3 -100. Site A, C and D had the same water retainability level of 100cm, Site B decreased from week 10 to 12 and site E decreased from week 9 to 12 while in site F, the water level increased from week 1 to week 8 and then remained stable (Figure 2). This showed that Sites A, C, D and F were suitable for fish farming, where the stocking of the pond could commence during the period of low water volume due to the fact that for fishes at the fingerling stage, much water is not required in order to conserve the energy needed for swimming to get the feed at the higher height of water (floating feeds). As the fish grews, the water volume increased as shown in the data collected.

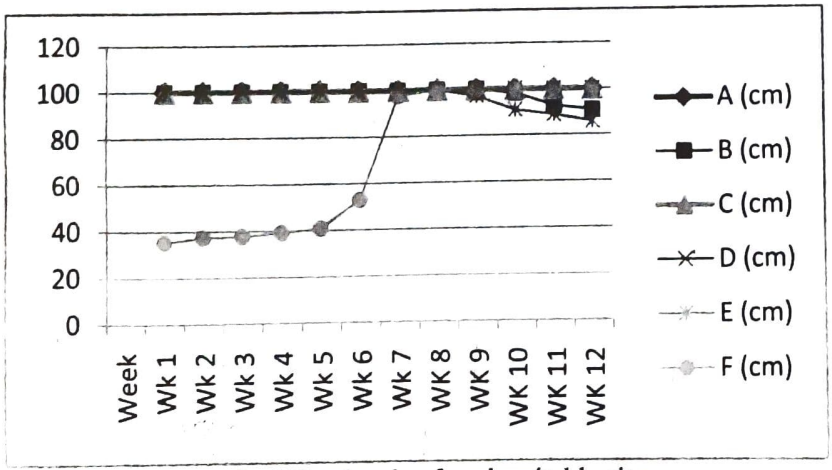

Figure 2: Water retainability levels of each suitable site

Table 2: Mean Values of Physico-chemical parameters of Water from each suitable site.

	Temp (°c)	pH (mg/l)	DO (mg/l)	Hardness (mg/l)	Alkalinity (mg/l)	Nitrate (mg/l)	Conductivity (uhos/cm^3)	TDS	Turbidity
Spot A	26.3	6.04	6.63	181.16	76	13.67	123	183.58	125
Spot B	27.4	5.94	5.73	18.02	44	29.01	187	274.10	601
Spot C	27.4	5.38	5.55	61.05	52	11.77	41	27.47	87.5
Spot D	27.6	5.95	7.12	75.06	99	29.48	124	83.08	25.4
Spot E	27.5	5.59	6.48	56.06	51	3.72	94	63.65	34.1
Spot F	27.5	5.49	6.07	40.04	39	61.66	55	36.85	638
Danzaria	27.5	6.42	6.10	67.06	68	13.94	102	68.34	56.2

GIS Mapping Of Suitable Sites In The Study Area.

Catfish or Tilapia mature to table size within six months, at about that time water volume will drop while the fish will be ready for harvest and another stocking can commence. But for stocking at sites E and B to be successful, other sources of water will be required at adult stage. The water temperature ranged from 26.3-27.5°C, Hydrogen ion concentration (pH) 5.38-6.42mg/l, Dissolved oxygen (DO) 5.55-7.12 mg/l, Hardness 18.02-181.16 mg/l, Alkalinity 39-99 mg/l, Total dissolved solid 27.94-183.58 mg/l, turbidity 25.4-638 mg/l, Nitrate 3.72-61.66 mg/l and conductivity 41-187 uhos/cm^3 (Table 1). This indicated all the physico-chemical parameters were within the ideal ranges recommended by other authors Boyd (1989), Boyd and Tucker (1998), APHA (1990), EPA (2002), except for Nitrates that was above recommended range.

References

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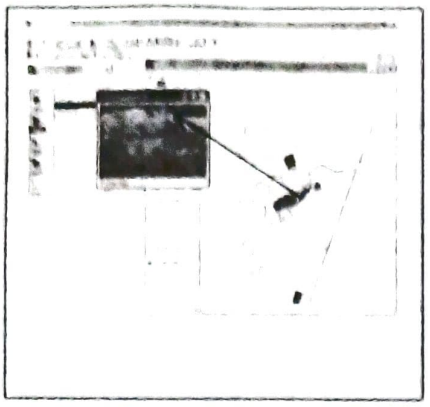


Plate I: Site A: located behind school of ICT building

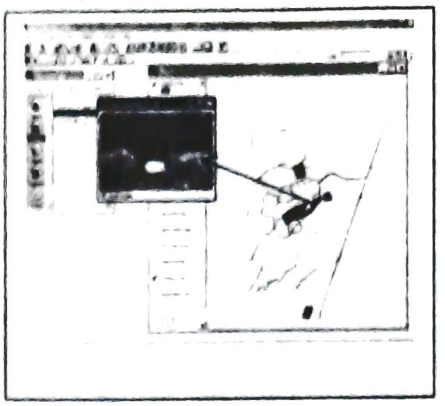


Plate II: Site B: located behind the school of agriculture.

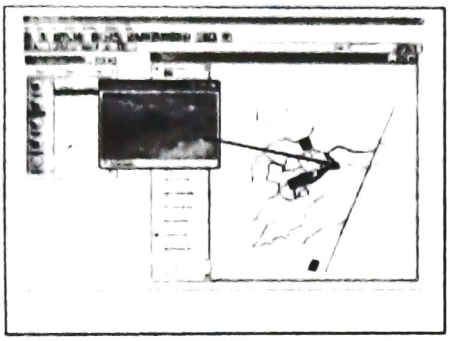


Plate III: Site C: located around the works department.

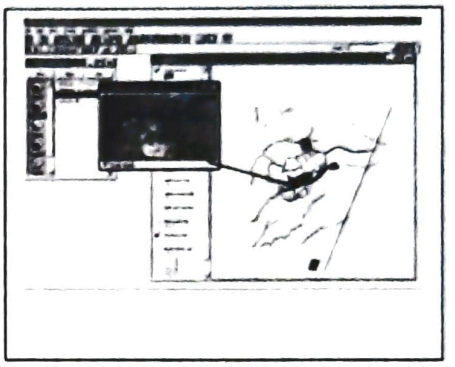
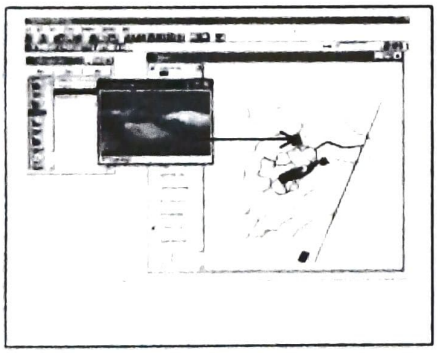
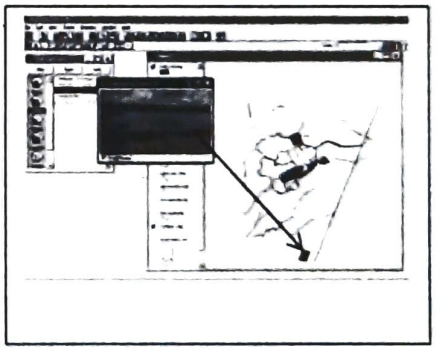


Plate IV: Site D: located at the old senate building.



PlateV: Site E: Opposite the Mosque



PlateVI: Site F: Dan-zaria