Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 6, Issue, 03, pp.5419-5424, March, 2014

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

LAND CAPABILITY CLASSIFICATION AND LAND USE IN AN AGRO-ECOLOGICAL AREA FRINGING RIVER BENUE, NIGERIA

***James Ochepo Adikwu**

Department Research and Statistics, Benue State Universal Basic Education Board Headquarters, Makurdi, Nigeria

ARTICLE INFO

Article History:
Received 05th December, 2013
Received in revised form
20th January, 2014
Accepted 14th February, 2014
Published online 25th March, 2014

Key words:

Land,
River Benue,
Agro-ecology,
Capability class.

ABSTRACT

Although land capability assessment provides a ranking of the ability of an area to support a range of agricultural activities on a sustainable basis people in most parts of the world show less interest than apathy to it. More often than not, farmers in most nations depend on local knowledge of land capability identification; employing especially vegetation type parameter rather than empirical studies of soils together with other attributes of the land. In Nigeria, the demand for good understanding of the physical characteristics of land, its inherent qualities and farm management practices in the nation to maximize profits in agricultural investments in recent times is great. This study is undertaken in Obagaji Area in that spirit. Some specific materials used include compass, spade, pickaxe, trowel, tape measure, containers for soil samples, soil auger and note book. The primary sources of data for this study are the farmers and their farms while maps: 1:250000 map of Nigerian Vegetation and Land use covering 1976/1993/95 periods on four adjoining sheets;-64:Markurdi are the secondary sources. Data analysis involved the use of descriptive statistics. The data collected for this study include soil field texture, general thickness of soil profile, soil erosion hazards, water logging and flooding, land use and farm management practices. Soil sample collected at root depth were analyzed for texture, permeability and internal drainage. The land capability map was prepared based on the observed general textural characteristics and depth of the soil, degree of slope and erosion hazards. The maps were prepared based on the guidelines for soil profile description presented by the Food and Agricultural Organization of the United Nations. Class II is the dominant soil class in the study area, while loamy soil is the commonest soil textural class. Generally, the soils are both non-alkaline and non-saline. Obagaji area is a farming region where a large number of farmlands are left unused while many others are underutilised, only a negligible number are intensively cultivated. Emphasis has been on extensive farming system rather than intensive system.

INTRODUCTION

People in most parts of the world show less interest than apathy to land capability classification for agricultural purposes; although the need for adequate knowledge of land capability classes in an agricultural area cannot be over emphasized (FAO, 1996). Land capability assessment provides a ranking of the ability of an area to support a range of agricultural activities on a sustainable basis. More often than not, farmers in most nations depend on local knowledge of land capability identification; employing especially vegetation type parameter rather than empirical studies of soils together with other attributes of the land. Consequently, many nations hardly research and or document the land capability classes of all the dispersed agricultural regions therein, during their match for food security. Upton (1997) and Harris, *et al.* (1996) espoused that the need to sensitise people worldwide to the importance and procedures of land capability analysis has become imperative, in view of the current food security demand. Without mincing words, knowledge of land capability classes could facilitate farmers' effort in making food production match needs consistently. In Nigeria, the demand for good understanding of the physical characteristics of land, its inherent qualities and farm management practices in the nation to maximize profits in agricultural investments in recent times is great. This stems from the need to achieve self sufficiency in food production through agricultural intensification in the country (Olowolafe and Nyagba, 1999). Land capability map is one of the basic documents for this purpose. For agricultural planning, it is particularly suitable because it gives direct information regarding the soil potentialities of different areas. Such maps usually contain vital information on the distribution, potential and constraints of soil that are useful in designing the most appropriate soil management systems. Knowledge of land capability classes also provides hints to when to control soil erosion, extent and complexities of

Corresponding author: James Ochepo Adikwu
Department Research and Statistics, Benue State Universal Basic Education Board Headquarters, Makurdi, Nigeria

conservation problems and how to mitigate their effects. Most importantly, land capability classification has become more a classification of limitations; which is essential in determining the best land use for sustained crop production (FAO, 1996). Statistics indicate that the human population in Nigeria increases; consistently in inverse proportion to the availability of arable land in the country (NBS, 2008). Avoidable unnecessary competition for land in the nation increased progressively in the wake of accelerated development and diversification of human activities that manifested themselves in the concentration of population in favourable sites and the shift of people from the less favourable working environment. These factors have caused diverse conflicts and food insecurity in the country. However, more conflicts in the country arose because of insufficient information about: (i) the availability of good land in other places and (ii) the capability of coveted land for agriculture. In order to forestall the negative impacts of both food shortages and conflicts over land, much of recent land-use research efforts in Nigeria place premium on the investigation of the characteristics of land systems, their agricultural use status as well as productivity. Their objective is to ensure that the land capability classes in the dispersed agricultural regions in the country are presented to land users in a simple and friendly manner to achieve the agricultural millennium development goals. This study is undertaken in Obagaji Area in that spirit.

MATERIALS AND METHODS

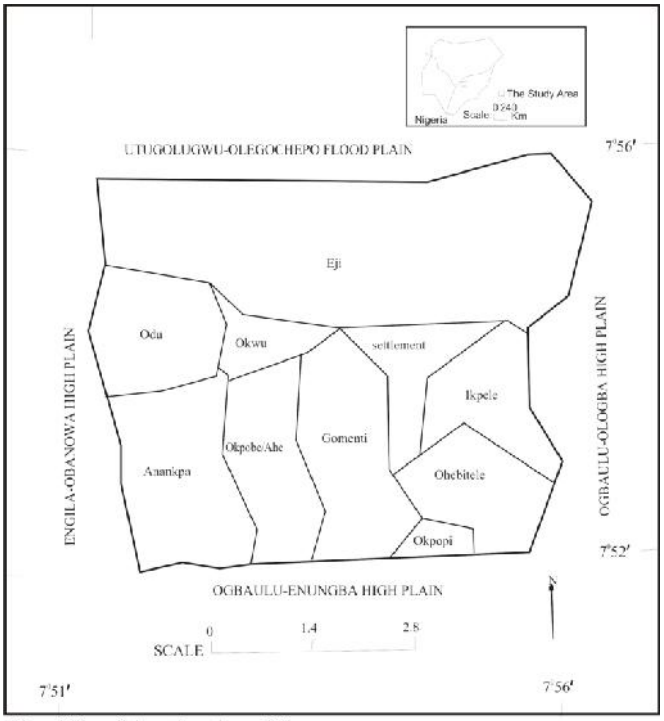
Obagaji Area (36900 hectares) lies between latitudes 7o51′N and 7o56′N and longitudes 7o52′E and 7o56′E (Figure 1). The area fringes the southern section of lower river Benue channel, Nigeria. The main relief divisions of the area are flood and high plains. Ferrasols and Hydromorphic are the major soil types in the region. The climate here is 'Aw' climate type, Koppen's classification with mixed leguminous wooded tropical guinea savanna vegetation. The data collected for this study include soil field texture, general thickness of soil profile, soil erosion hazards, water logging and flooding, land use and farm management practices. Soil sample collected at root depth were analyzed for texture, permeability and internal drainage. The land capability map was prepared based on the observed general textural characteristics and depth of the soil, degree of slope and erosion hazards.

The maps were prepared based on the guidelines for soil profile description presented by the Food and Agricultural Organization of the United Nations (1976 and 1996). Tables 1 and 2 present this clearly. In brief, the agricultural capability classification consists of two main components: the capability class and sub-class (FAO, 1976). The numbers are defined as follows:

Class 1 soils have slight limitations that restrict their use.

Class 2 soils have moderate limitations that restrict the choice of crop or that require moderate conservation practices.

Class 3 soils have severe limitations that restrict the choice of plants or that require special conservation practices, or both.



Figurel Obagaji Area: Location and Size

Class 4 soils have very severe limitations that restrict the choice of plants or that require very careful management, or both.

Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland or wild life habitat.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.

Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purpose, wildlife habitat, watershed, or esthetic purposes.

Capability subclasses are designated by adding a small letter e, w, s, or c to the class numerals, for example, 2e. The letter e shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; w shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); s shows that the soil is limited mainly because it is shallow, droughty, or stony; and c, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry. In class 1 there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by w, s, or c because the soils in class 5 are subject to little or no erosion. Some specific materials

used include compass, spade, pickaxe, trowel, tape measure, containers for soil samples, soil auger and note book. The primary sources of data for this study are the farmers and their farms while maps: 1:250000 map of Nigerian Vegetation and Land use covering 1976/1993/95 periods on four adjoining sheets;-64:Markurdi (MANR, 1995 a and b) are the secondary sources. Data analysis involved the use of descriptive statistics. Degree of agricultural intensity, otherwise termed frequency of cultivation (Boserup, 1965); rotation index (Rothenberg, 1983) and cropping index (Upton, 1997), was measured by duration of the crop-fallow cycle (in years), using the formula:

$$D = \frac{C}{C+F} \times \frac{100}{1}$$

Where D is the degree of agricultural intensity (frequency of cultivation); C is the cropping period and F is the fallow period. The crop-fallow cycle of 1:1 means, one year of cropping period to one year of fallow period, while 1:0 means, one year of cropping period and no year of fallow period (Turner II, Nahan and Potararo, 1977)

RESULTS AND DISCUSSION

The data analysis reveals three major soil classes in the area: I, II and III (Table 3 and Figure II). The analysis further shows that class II has most number of sub-classes (4); classes I and III have 2 and 3 subclasses respectively. The class II land class is clay loam dominated with pH value between 7.5 and 8.4. The loam fractions are confined to the low-lying areas. Developed on gentle slope, the non-alkaline and saline soils are moderately cultivated. Class III has some special characteristics. For instance, Eji (fadama) area, strewn with depressions of period water supply nearly level but the loamy soil has poor internal drainage. While the sandy soil of Ikpele region has coarse texture, rapid permeability, poor internal drainage and rapid surface run-off; the clay-loam soil of Ohebitele area has rapid surface run-off. The level of agricultural land use intensity varies significantly amongst the farming regions (Tables 4 and 5). Despite the availability of irrigable land and cultivable (potential) water in the area, in particular, Eji, farmers pay little or no attention to dry season–irrigated agriculture. Tables 4 and 5 further show that inter-cropping is the most common cropping system; others are inter-planting and mono cropping. Except in Eji farming region, farmers in the area grew many crops in association with one crop or the other. The degree of agricultural intensity of sampled fields in the study area is generally low. It is clear from Table 4 that the fallow period is most often longer than the cropping phase-4 against 3 years, with an average of 7 years mean duration of crop/ fallow cycle.

Table 1. Land Capability Legend

Characteristics	Legend	Characteristics	Legend
A soil textures and depth		D specific conditions	
(i) textural class		Textural hazard	T
Sand	S	Erosional hazard	E
Sandy loam	Sl	Salinity	S
Loamy sand	Is	Alkalinity	A
Loam	I	Acidic	Ac
Silt	S	E stoniness	
Silty loam	Sil	Gravelly	G
Sandy clay loam	scl	Slightly stony	St 1
Silty clay loam	sicl	Moderately stony	St2
Clay loam	Cl	Very stony	St3
Sandy clay	Sc	Excessively stony	St4
Silty clay	Sl	F soil moisture conditions	
Clay	C	Soil moisture replenishment	
(ii) depth, class and range		Water logging due to water table	W1
Very deep, >90cm	D5	Occasional flooding hazard	W2
Deep 45-90 cm	d4	G Farm management practices	
Moderately deep 22.5-<45 cm	d3	Good to moderately good	M1
Shallow, 7.5-<22.5 cm	d2	Moderate	M2
Very shallow, <7.5 cm	d1	Moderately poor	M3
B Slope		Poor	M4
Description and range (%)		Neglected barren land	M5
Level to nearly level(flat) 0-1	A	H Forest areas	
Very gentle >1-3	B	Thin or open forest	F1
Gently sloping >3-5	C	Moderately dense forest	F2
Moderately sloping >55-10	D	Dense forest	F3
Moderately strongly sloping >10-15	E	I wild vegetation	
Strongly sloping >15-25	F	Slight density of weeds and shrubs	V1
Moderately steep >25-33	G	Moderate density of weeds and shrubs	V2
Steep >33-50	H	Heavy density of weeds and shrubs	V3
C Erosion			
Description			
No or slight erosion	e1		
Moderate erosion	e2		
Moderately severe to severe erosion	e3		
Very severe erosion	e4		

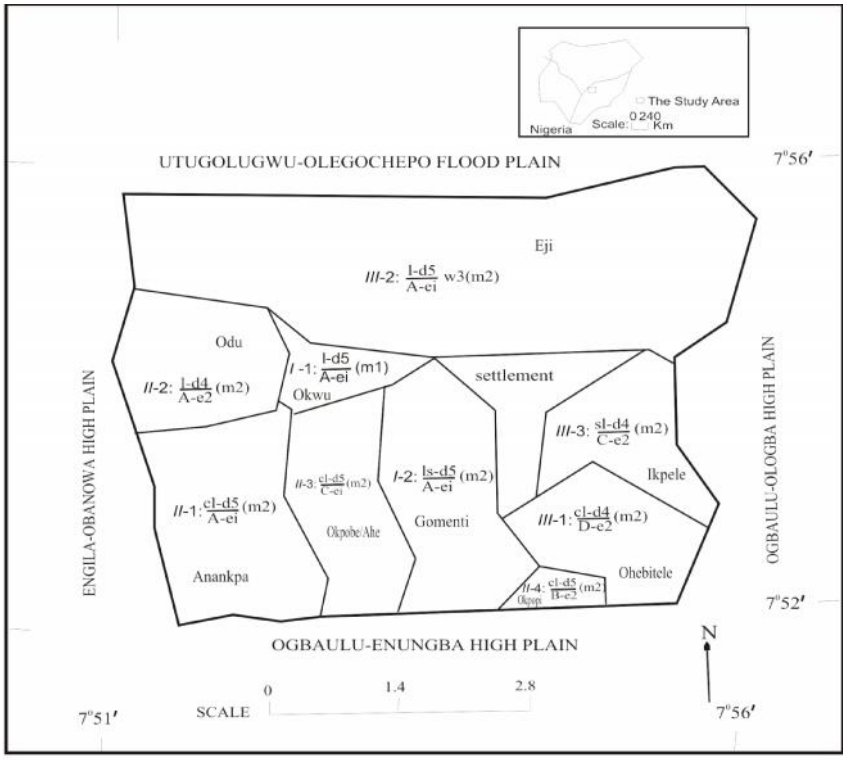
Source FAO (1976)

Table 2. Guide to Determining Best land Capability possible

Soil factors	Characteristics	Best land capability Possible
Texture	Fine	II
	Deep	I
	Medium	I
	Coarse	II
Depth	Deep	I
	Moderately deep	II
	Shallow	III
	Very shallow	IV
Erosion	Non to slight	I
	Moderate	II
	Severe	III
	Very severe	IV
Permeability	Rapid	III
	Slow	II
	Moderate	I
	Very slow	III
Internal drainage	Well drained	I
	Moderately well drained	II
	Imperfect	III
	Poorly drained	III
Surface drainage	Rapid	III
	Moderate	I

Table 3. Farming Regions and Land Capability classes

Farming Region	Texture	Depth	Erosion	Stoniness	Flood hazard	Surface run-off	Slope	Textural class	Farm care	Cap. Class	Cap. sub-class
Anankpa											
Major Class	Medium (I)	>90 cm d5(I)	Moderate e2 (II)	Gravelly (g)	Slight (I)	Slow (III)	Gentle (C)	Clay loam (cl)	M2	II	$II-1:\left(\frac{el-d5}{A-e1}(m2)\right)$
% observation	89	85	75	77	80	76	90	89	86	87	
Eji											
Major Class	Medium (I)	>90 cm d5(I)	Slight e1(I)	Nil	Moderat e (II)	Moderate (II)	Nearly Level (A)	Loam l	M2	III	$III-2:\left(\frac{el-d5}{A-e1}W3(m2)\right)$
% observation	89	65	70	81	68	69	80	75	80	89	
Gomenti											
Major Class	Medium (I)	>90 cm d5(I)	Slight e1(I)	Nil	Slight (I)	Moderate (II)	Nearly Level (A)	Loamy sand (ls)	M2	I	$I-2:\left(\frac{ls-d5}{A-e1}(m2)\right)$
% observation	89	83	74	85	68	72	88	95	70	82	
Ikpele											
Major Class	Coarse (II)	40-90cm d4 (II)	Moderate e2 (II)	Gravelly (g)	Slight (I)	Rapid (I)	Gentle (C)	Sandy loam (sl)	M2	III	$III-3:\left(\frac{sl-d4}{C-e2}(m2)\right)$
% observation	89	81	69	57	71	67	88	78	66	87	
Odu											
Major Class	Medium (I)	40-90cm d4 (II)	Moderate e2 (II)	Nil	Slight (I)	Slow (II)	Nearly Level (A)	Loam l	M2	II	$II-2:\left(\frac{l-d4}{A-eii}(m2)\right)$
% observation	89	70	67	61	88	63	75	80	85	84	
Ohebitele											
Major Class	Medium (I)	40-90cm d4 (II)	Moderate e2 (II)	Slightly stony (st1)	Slight (I)	Rapid (I)	Moderat e (D)	Clay loam (cl)	M2	III	$III-1:\left(\frac{el-d4}{D-e2}(m2)\right)$
% observation	89	75	60	60	62	65	60	60	75	89	
Okpobe/Ahe											
Major Class	Medium (I)	>90 cm d5(I)	Slight e1(I)	nil	Slight (I)	Moderate (II)	Gentle (C)	Clay loam (cl)	M2	II	$II-2:\left(\frac{el-d5}{C-e1}(m2)\right)$
% observation	89	78	80	63	84	78	78	75	68	81	
Okpopi											
Major Class	Medium (I)	>90 cm d5(I)	Moderate e2 (II)	nil	Slight (I)	Moderate (II)	Gentle (C)	Clay loam (cl)	M2	II	$II-4:\left(\frac{el-d5}{B-e2}(m2)\right)$
% observation	89	80	68	75	71	78	80	73	69	79	
Okwu											
Major Class	Medium (I)	>90 cm d5(I)	Slight e1(I)	nil	Slight (I)	Moderate (II)	Nearly Level (A)	Loam l	M1	I	$I-1:\left(\frac{l-d5}{A-e1}(m1)\right)$
% observation	89	90	85	97	85	87	92	98	95	90	



FigureII Obagaji Area: Land Capability Classes

Table 2. Cropping Systems

Farming Region	Land area Operated (ha)	Net area sown (ha)	Gross cropped area (ha)	One crop	Two crops	Three crops	Sole Cropping	Inter Planting	Inter Cropping	≥Four crops	Mean cultivation period (years)	Mean fallow period (years)	Mean frequency of cultivation (%)
Anankpa	210	118	128	30	85	100	30	95	100	10	3	3	50
Eji	210	126	150	208	0	0	208	0	0	0	4	3	57
Gomenti	195	150	155	30	35	124	30	70	24	35	3	2	60
Ikpele	140	67	72	10	40	60	10	48	60	8	3	4	43
Odu	150	77	80	10	19	70	10	24	70	5	3	3	50
Ohebitele	240	109	112	40	80	120	40	90	120	10	3	4	43
Okpobe/Ahe	195	65	68	10	18	118	10	22	118	4	3	3	50
Okpopi	200	66	68	8	36	70	8	37	72	3	3	3	50
Okwu	140	110	120	37	93	169	37	100	169	7	3	3	60

Table 3. Crop Association and Number of Fields

Crop Association	Farming region								
	Anankpa	Eji	Gomenti	Ikpele	Odu	Ohebitele	Okpobe/Ahe	Okpopi	Okwu
Beans/guinea corn and or maize	3	0	20	18	6	20	17	18	9
Beans only	-	6	2	0	0	0	0	0	5
Cassava/one or more of: guinea corn, maize and okra	48	0	30	11	17	52	37	18	50
Cassava only	1	0	2	0	0	20	0	0	10
Creep melon/one or more of: beniseed, maize and okra	10	0	20	10	0	10	0	4	18
Creep melon only	-	0	5	0	0	0	0	0	0
Guinea corn one or more of maize, millet and pigeon beans.	27	0	20	20	10	21	17	15	41
Guinea corn only	4	0	6	0	0	0	0	0	0
Okra /one or more of guinea corn, beans and maize	14	0	21	10	8	0	14	11	20
Okra only	4	0	6	0	0	0	0	0	0
Pepper /beans and or okra	27	0	20	9	8	28	15	9	42
Pepper only	5	10	0	0	0	0	0	0	0
Swamp rice/ any other crop	-	0	0	0	0	0	0	0	0
Swamp rice only	14	187	4	10	8	15	15	8	17
Upland rice/one or of: garden egg, cassava and guinea corn	16	0	20	4	5	24	10	8	17
Upland rice only	-	0	0	0	0	0	0	0	0
Yam/one or more of: maize, millet and pigeon beans, garden egg, cassava and guinea corn, pepper and okra	50	0	43	14	40	35	21	21	67
Yam only	2	5	5	12	2	25	4	5	10
Total	225	208	224	118	104	250	150	117	306

Conclusion and Recommendation

Class II is the dominant soil class in the study area, while loamy soil is the commonest soil textural class. Generally, the soils are both non-alkaline and non-saline. Obagaji area is a farming region where a large number of farmlands are left unused while many others are underutilised, only a negligible number are intensively cultivated. Emphasis has been on extensive farming system rather than intensive system. Based on the findings of this study, the people need the services of extension officers to educate farmers on the importance of sustainable land use and adopting small scale irrigated dry season agriculture to increase production quantity. As a corollary, to achieve sustained increase in food production on a long term basis in the soils, there is need for an integrated soil management package involving erosion controls, application of the right types and quantity of inorganic fertilizer, animal manure, crop residues and better cultural practices in the area.

REFERENCES

Boserup, E. 1965. The Conditions of Agricultural Growth: The Economics of Agricultural Change under Population Pressure. London: Allen and Unwin.

Food and Agriculture Organization (FAO). 1976. *A Framework for Land Evaluation*. Rome: Food and Agriculture Organization of the United Nations.

Food and Agriculture Organization (FAO). 1996. *Agro-Ecological Zoning; Guidelines*. FAO Soils Bulletin 73. Rome: Food and Agriculture Organization of the United Nations.

Harris, J. A, Birch, P. and Palmer, J. P. 1996. Land Restoration and Reclamation: Principles and Practice. Harlow: Longman.

MANR 1995 a. Nigeria Vegetation and Land Use 1976/78-Makurdi, Scale 1:250,000, Sheet 64. Abuja: Ministry of Agriculture and Natural Resources.

MANR 1995 b. Nigeria Vegetation and Land Use 1993/95-Makurdi, Scale1:250,000, Sheet 64. Abuja: Ministry of Agriculture and Natural Resources.

NBS, 2008. Annual Abstract of Statistics 2008. Abuja: National Bureau of Statistics, Independence Avenue, Central Business District.

Olowolafe, E. A. and Nyagba. L. 1999. Soil Constraints to Sustainable Crop Production in the Volcanic Areas of Jos Plateau, Nigeria. *Journal of Environmental Sciences*, 3(2), pp. 160-168.

Rothenberg, H. 1983. Farming Systems in the Tropics. Ausgabe: Oxford University Press.

Turner II, B .L, Nahan, R. O and Potararo, A. V. 1977. Population Pressure and Agricultural Intensity. *Annals of the Association of American Geographers.* 67 (3): pp. 384 – 396.

Turner II, B .L, Nahan, R. O and Potararo, A. V. 1977. Population Pressure and Agricultural Intensity. *Annals of the Association of American Geographers.* 67 (3): pp. 384 – 396.

Upton, M. 1997. The Economics of Tropical Farming Systems. New York: Cambridge University Press.

****