

Analysis of the Geographic Characteristics Which Influenced the Distribution of Existing Traditional Settlements in the Cross-River Igbo Region Nigeria

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Abstract

The work investigated the geographic characteristics which influenced the distribution of existing traditional settlements in the Cross-River Igbo region of Nigeria. Out of 120 villages inhabiting the region, 12 villages were randomly selected, two villages chosen from each major area. Identifiably, 385, houses (170 males, 215 female houses) were selected in addition to 30 Obu houses. Results indicate that climatic attributes like; temperature, rainfall, wind system, solar radiation, and relative humidity, influence the distribution, of traditional settlements in the Cross-River Igbo region. Among other issues, it was recommended that critical understanding of geographic features will enable architects to design residential houses that can achieve indoor thermal conduciveness as, achieved by these traditional buildings.

Keywords: *Geographic Characteristics, Traditional Settlement, Rainfall, Temperature*

Introduction:

In recent years, the issue of reflecting local culture in contemporary architecture has attracted more attention. Many nations have started to review their own cultural features by carrying out studies in their "own" traditional values and principles. This process has exerted influence on the production of contemporary architecture and ignited heated debates (Nguyen, 2007: Rapoport, 1979: Whyte, 1977: Mitias, 1994). The built environment is at the very center of the identity of a community. It reflects the lifestyle, social organization, artistic practices, and the architectural adaptation to cultural and religious factors (WTO, 2005). It is a representation of a society's values and aspirations. Architecture, which is part of the built environment, is created for a number of reasons which includes: communication of information; establishment of identity, and encoding of value system (Rapoport, 1979). During the last decade, creation of local profiles and attempts to define the identity of the place was a major concern in many aspects of development. In line with the deliberate strategy, architecture constitutes an important component in a long-term ambition to create a profile of one's own and to shape an intentional narrative about the place of destination (Stromberg, 2008). Baudrillard (2003), states that architecture is a means of story-telling and narration, and provides the basis for understanding the identity of a people. In non-social usage, 'a people' is synonymous with the term 'nation'. However, sociologically, a people can be a nation, an ethnic group, a tribe but with a peculiar enduring interaction over time supported by a common culture. Though this definition may tend to overlap with the definition of social interaction, it is distinct in that the historical component is added or acquired. This enduringness gives rise to a concept of the set of relationships as external to any one

individual, with power and life of its own. The consequences of this overtime enduring interaction of people in the history of their material culture are both obvious and sublime (Bdem and Okonkwo, 2010). The present historical reality of architecture in Nigeria has remained that of significantly, two important periods; the pre-colonial or traditional period and post-colonial or modern period (Okonkwo, 2008). The pre-colonial period dates back to those periods before the first colonialists came to Africa. Traditional architecture progressed unhindered and unmolested. The colonial periods, refers to those periods after the colonialists had come and tampered with the progressing Nigerian traditional architecture and stunted its growth. The post-colonial Nigerian environment has been undergoing a radical transformation over the past 50 years in the social, economic, political and religious spheres. These changes have far reaching consequences on the very concept of living and on lifestyle. Generally, spatial needs, symbolic values, aesthetic conceptions, material preferences and the very nature of architectural form are affected by these developments. The concept of traditional Nigerian architecture therefore has to adopt a dynamic definition to survive the onslaught of modernization, westernization and urbanization brought about by colonization (Okonkwo, 2008, Edem, 2009). According to Sa'ad and Ogunsusi (1996), what would seem to the older generation of Nigerians of ages 50 and above as 'imported', foreign' or 'alien' have been culturally assimilated by the new generation and have become part of the tradition handed down by their fathers. The colonial architecture and urban structure which determine major characteristics of Nigerian architectural events and urban settlement characters are themselves rooted in western values, ecology and socio-economic development. The root-factors differ remarkably from their Nigerian equivalents which are manifested in the country's cultural traditions and housing development strategies (Aniakor, 1995).

The two divides and their nature pose strong questions for traditional residential architectural elements' analysis in any attempt to key in their definitive and deterministic features in the architectural historical process of any place or region in Nigeria. The architecture of a people means the constant form and qualities which are expressed by the consistent architectural elements and in the art of an individual or group (Ackerman and Terry, 1980). Though, architects' works are preserved for reasons other than their historical or biographical significance, they often lose all extrinsic evidence of their historical position so that no records survive of the architect's era or locale which produced them (Mitias, 1994), but verifiable consistency in surviving architectural elements of such architecture is capable of providing sufficient structural evidence for the history of the material culture of the people and the place. Without such material evidence, in time and space, it is impossible to plot the graph of consistency and change of that area prerequisite for the writing of any history (Rapport, 1979). The act of keying in development in building into the wider pattern of cultural achievements of each area or place is thus an uphill task in Nigeria. The colonial process actually constituted a dislocation of the traditional architecture with strong imposition of new way of creative assertion of spaces based on the political, economic and settlement systems guided by foreign building construction methods (Okonkwo, 1993; Odum, 1996). The crux of the subject of this study could then be located in concerted scientific research effort to identify and isolate the consistent architectural elements of the traditional residential architecture of the Cross River Igbo from the pattern of Nigeria's development relationship with the western architecture, which is seen to constitute some problems with respect to the relevance of the traditional architecture in the country's contemporary (post-colonial) architecture.

Geographical Location

The Igbo ethnic group occupies the south-east zone of the country, with their distinct and egalitarian political structure. Among the Igbo there are still varieties of architecture and a lot ethnic diversity which motivated Ford and Jones (1963), to remark in their research



FIGURE 1: MAP OF NIGERIA SHOWING THE 36 STATES.M ACMILLIAN,2007

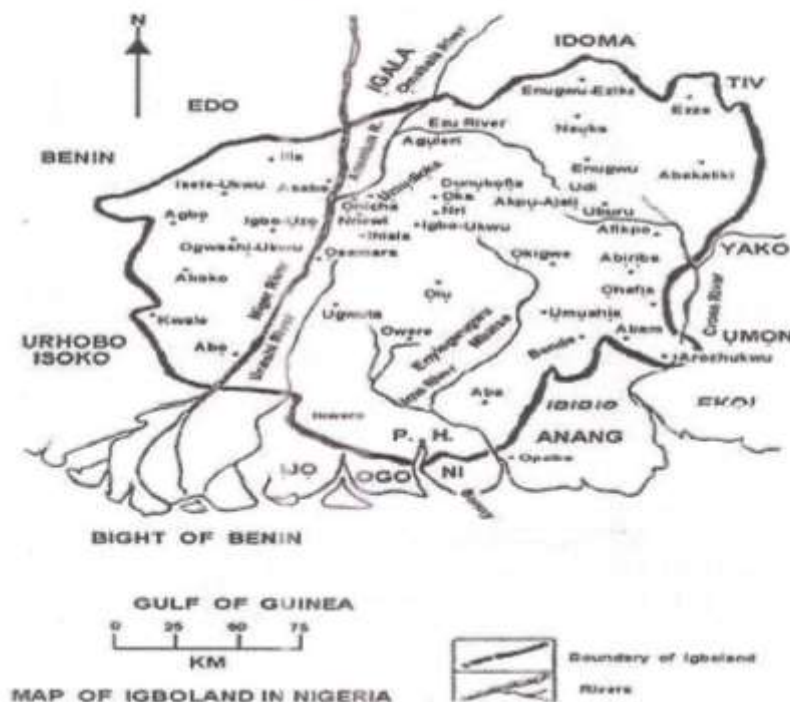


FIGURE 2: MAP OF IGBOLAND SHOWING THE STUDY AREA
SOURCE: Google search, 2013

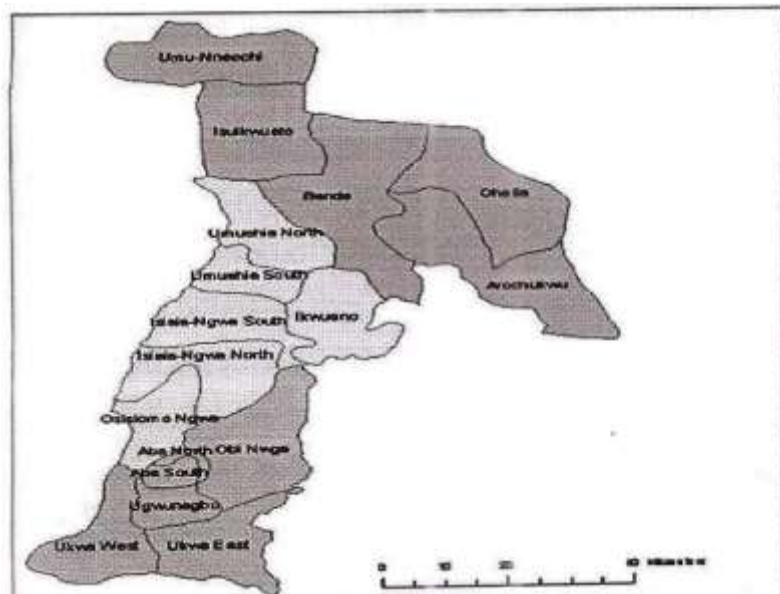


Figure 3: Map of Abia State Showing the Local Government Areas
Source: Google search, 2013

Month	Temp	Minimum temp	Rainfall
Jan	32	23	14.8
Feb	35	22	0.9
Mar	35	23	13.6
Apr	33	24	164.5
May	32	24	153.6
Jun	31	23	265.5
Jul	30	23	277.5
Aug	30	24	265.5
Sep	30	24	228.4
Oct	31	24	216.9
Nov	33	25	75.9
Dec	32	21	3.8
Mean			1680.6

Table: Climatic Information of The Study Area

SOURCE: ABSU GIS LABORATORY, 2009

report among the Igbo and the Ibibos that, the Igbos should be segregated for an authentic and thorough work to produce their history of architecture. They segregated the Igbos into followings divisions:

The Northern or Onitsha Igbo

The Southern or Owerri Igbo

The Western or Ngwa Igbo

The Eastern or Cross River Igbo

The North-eastern of Afikpo Igbo

Each of these five divisions can be found in the states of Igbo land, namely; Anambra, Imo,

Abia, Ebonyi, Enugu and Delta States. These states were known as the defunct East Central State (excluding Delta State). The Cross-River Igbo area comprises of the Ohafia, Abiriba, Nkporo, Abam, Edda and Arochukwu. They are found in three local government areas namely; Ohafia, Afikpo south and Arochukwu Local Government Areas. Precisely, the study area can be located in Abia and Ebonyi States. The Cross-River Igbo area is bounded in the north by the Afikpo Local Government Area in Ebonyi State; in the east by the Ibibio in Akwa Ibom State, in the west by the Isiukwuato Local Government Area in Abia State.

The Cross-River Igbo has a population of 527,868 people (NPC, 2006). They are found in three Local Government Areas; two in Abia; Ohafia and Arochukwu and one in Ebonyi State, Afikpo South Local Government Area. The Populations is distributed according to the three local government Areas of Abia State thus; Ohafia L.G.A = 245,987; Arochukwu LGA= 169,339; Ebonyi State; Afikpo South LGA= 157,542. (FGN official Gazette, 2009)

The entire Igbo land occupy a landmass of 16,000, square miles (Macmillan, 2008) Abia State is one of the third generations of states created by one of the military governments that ruled Nigeria from 1966 to 1999. It was created out of the former Imo State that made up the 36 states in Nigeria (figure 1, 2 and 3). It is politically divided into three senatorial zones namely; Abia North, Abia South and Abia Central, with 17 Local Government areas. Abia North Senatorial zone.

Methodology:

Research design adopted for the work is mixed research design, combining descriptive and quantitative techniques in data retrials and analyses.

Population of study:

Population of study is part of the Research Methods that consists of a collective of group of individuals or object of interest with a common charactertics which the researcher is interested in (Uji, 2009). This was further defined by Kenner and Taylor (1979) as the aggregate of elements from which the sample is actually selected. In this research, the target population is the people of Cross River Igbo which comprised of the followings;

The Ohafia – 26 Villages

The Abiriba – 17 Villages

The Nkporo – 8 Villages

The Abam – 26 Villages

The Arochukwu – 18 Villages

The Edda – 25 Villages

Total population of villages is 120 villages by random sampling two villages were selected from each of the six communities that make up the study area. The target population therefore, the twelve villages selected from the 120 villages.

In each of the selected villages, two kindred compounds (Ezi) and two to five Obu (meeting halls) were selected in each kindred compound, there are at least ten patrilineal compounds (Utuga-ezi). A patrilineal compound is comprised of at least, ten

Research design for the work was based on description and questionnaire research design.

Table 1: Number of Male, Female and Obu Houses Studied

VILLAGE	NO. OF KINDRED COMPOUNDS	NO. OF MALE HOUSES	NO. OF FEMALE HOUSES	NO. OF OBU HOUSES
AKANU OHAFIA	2	18	20	3
ASAGA OHAFIA	2	17	21	3
BIYOM ABIRIBA	2	14	18	2
AGBOJI ABIRIBA	2	15	19	3
OBUOFIA NKPORO	2	10	15	2
ELUGHU NKPORO	2	12	16	2
AMAEKE ABAM	2	15	18	3
IDIMA ABAM	2	12	17	2
AGBAGWU AROCHUKWU	2	16	20	3
AMUVI AROCHUKWU	2	14	18	2
ORIENTA EDDA	2	12	15	2
OWUTU EDDA	2	15	18	3
TOTAL	24	170	215	30

Table 2: The Population of Study in The Six Communities

NOS	COMMUNITIES	NUMBER OF KINDRED COMPOUNDS	NO. OF MALE HOUSES	NO. OF FEMALE HOUSES	NO. OF OBU HOUSES
1.	OHAFIA	4	35	41	6
2.	ABIRIBA	4	29	37	5
3.	NKPORO	4	22	31	4
4.	ABAM	4	27	35	5
5.	ARUCHUKWU	4	30	38	5
6.	EDDA	4	27	33	5
	TOTAL	24	170	215	30

Source; Obasi, 2016

And ten female houses in the cluster settlement. The target populations male are the two kindred compounds from the twelve villages selected from the 120 villages that make up the six communities. The total number of kindred Compounds studied is twenty-four. Each of the compounds has different number of male and female houses, and their Obu houses. Total number of the kindred compounds studied is twenty-four, total number of male houses is one hundred and seventy that of female houses is two hundred and fifteen and thirty Obu houses. The Compositions of the houses and the analysis are as follows; (Tables 1 & 2)

This study is undertaken to investigate those consistent architectural elements found in the residential houses of the Cross-River Igbo that can be used to document their architectural history. In research survey, (that is explanatory and historical) there are two types of populations, the target population and the accessible population.

Sample and Sampling Techniques

According to Uji (2009) one way of obtaining information about a target group under study is to collect the required information from all the members of the group called a population. However, if the group is large, as is the case in this study of consistent elements of the traditional residential architecture of the Cross-River Igbo, (12 villages from two states) this approach will be tedious, expensive and impractical. A cheaper and faster way of going about the problem is to collect the information from only some members of the group, in such a way that their response and characteristics reflect those of the group from which they are drawn. This procedure is the principle of sampling. Samples according to Uji (2009) are meant to reflect the populations from which they are drawn with varying degrees of accuracy. In this research, random sampling technique was adopted. According to Uji (2009) this is the sampling in which each Person / object in the population has an equal or, at least, a chance of being selected.

Result and Discussion:

What gives character to the architecture of a given area is mainly determined by the natural conditions of the place, most of all by the climate and the building materials available in the environment (Dmoschowski, 1990). In Cross River Igbo area, the climate and geographic characteristics, has great influence on the residential architecture of the people both in character and content of their house forms. There are four major influences on the residential architecture of the Cross-River Igbo, one of such influences is the climate of the place, others include; culture, economy and politics. In this research questions, the influence of the climate on the traditional residential architecture of the area will be in focus.

Climatic Influence

Temperature: One of the most significant influences on traditional architecture is the micro-climate of the area in which the building is situated. Buildings in cold climate invariably have higher thermal mass or significant amounts of insulation. In tropical countries such as Nigeria, the greatest thermal gain occurs through the roof of a house, solar energy affects significantly the interior of buildings one way, and to reduce the heat flux results in the use of radiant barrier which reduces the heat flux through radiation (Onyeaju, Chukwuocha and Ekuma, 2011). They are usually sealed in order to prevent heat and openings such as windows tend to be small or non-existent. Buildings in warm climate by contrast, tend to be constructed of good height and allow significant cross ventilation through openings in the fabrics of the building (Sa'ad, 2009). In the Cross River Igbo area, temperature is relatively high, the mean and maximum temperatures, however, are usually more than 28°C while the minimum temperatures are 24°C. Being in the rainforest zone, the months with the highest temperatures are February and March, which are just before the period of the cloud-dust forms in June- October. But contrary to the assertions of Sa'ad (2009), the traditional residential buildings of the people of Cross River Igbo although they are constructed with much height, they purposely do not allow any form of cross-ventilation through openings in the fabrics of their buildings. Observations made by the researcher on the male and female houses and building forms, show that there is no form of cross-ventilation in the fabrics of their buildings. No openings in the approach elevations but a very small window opening at the

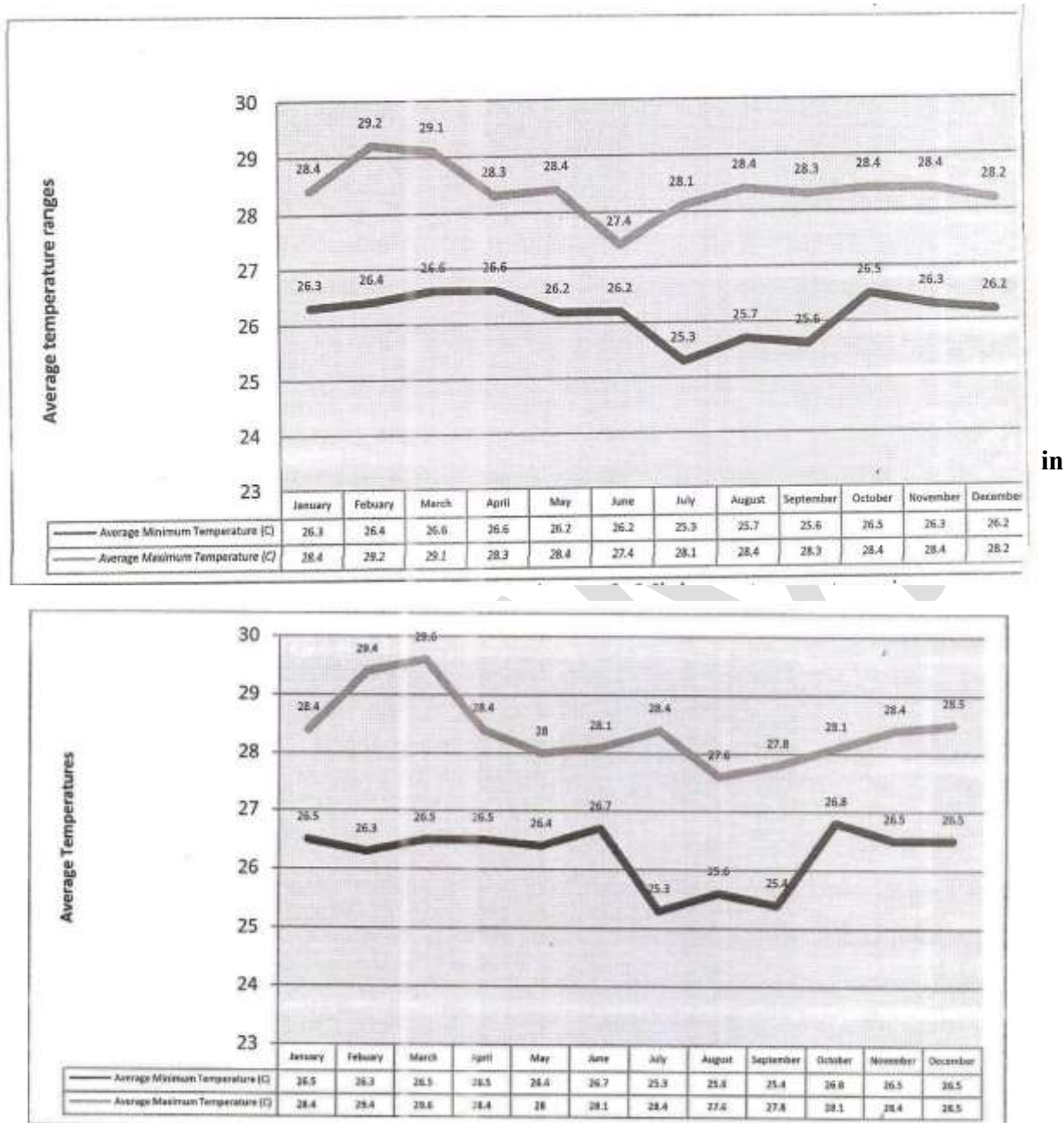


Figure 5: Line Charts Showing Mean Daily Maximum & Minimum Temperatures in South East Nigeria Abia & Imo States (2004 – 2005)



Plate 1: Small Window at The Back (Azoforo Of A Male House At Abam)



Plate 2: Small Window at The Side of a Female House at Nkporo

back elevations, at the man's sleeping room and the room of the grown-up girls at the Azoforo (backyard). (Plate 1 & 2) Moreover, the very low eave of the residential houses reduces the flow of air and lighting across the sitting room and the rooms. But this lack of cross ventilation is balanced by the mud and wattle walls which cools the inside of the houses. Moreover, the raffia palm mats used as roof cover absorbs the tropical insulation (the rate of solar radiation received per unit area) and insulates the building from the heat of the sun. As security conscious people, the residential houses are a reflection of the world view of the people. The researcher observed, and from the discussions with the focused group

discussion (FGD), that the main reason for the lack of openings in the fabric of their residential houses, is as a security measure to prevent assailants from entering the buildings through the openings. The small windows opened at the rear side of the buildings overlooking the Azoforo is done to allow light into the rooms, and with the belief that no assailant can come from the (Azoforo) back yard. (See figure 54 and 55.)

Rain fall

The Cross-River Igbo area has the prevailing monsoon type of climate (see table 4). The rainy and dry seasons, share equal number of months in the year. The rainy season starts in June peaks in July-August and subsides in September, while the dry season starts in October, peak in December, when harmathan sets in and subsides in May (Table 3). The high Velocity harmathan winds are not only dry but dust-laden and can be very dangerous both to the buildings and their occupants. These two seasons are influenced by both the tropical maritime air mass (South west winds) from the Atlantic Ocean and the tropical continental air mass (North-east winds), from the Sahara Desert. Being in the tropical rainforest zone, the maritime air mass is warm and moist while the continental air mass is cold and dry and necessitates the harmathan in the area. (Macmillan, 2008). The rainy season of this area influence their residential architecture in an adverse manner. The quantity of rain that flow along the compound streets, cause the eroding of the Foundations of the mud-houses. During the rains, the compound streets became so flooded that wading through them becomes difficult Health wise, the dirty water flowing in front of the residential compound streets could be very dangerous to the health of the people as germs can easily get to those wading through the rain waters. Secondly, the raffia palm mats used as roof cover easily decay under moisture in the torrential rains. To avert the decay, the people construct their houses with very high king posts which give their houses very high pitch.

Table 3: Climatic Record of Rainfall And Sunshine In South Eastern Nigeria Abia and Imo States (2004 – 2009)

Months	Rainfall Amount (mm)	Rainy days (no)	Sunshine Bright sunshine duration (hr)	Maximum daylight duration (hr)	Radiation intensity (W/m ²)	Ratio of sunlight to rainfall
Rainy season						
March	106.2	7	4.4	12.0	193	1.28
April	195.1	13	5.3	12.2	207	0.8
May	294.4	15	5.7	12.3	206	0.6
June	303.6	18	5.6	12.4	198	0.5
July	298.3	22	2.9	12.3	156	0.3
August	326	21	2.4	12.3	151	0.22
September	395.3	21	2.7	12.1	158	0.20
October	298.3	18	3.6	12.0	173	0.37
Seasonal total	277.2	15.1	4.1	12.2	180.3	
Mean	2772.					
Dry season						
November	54.9	8	5.6	11.9	200	3.0
December	5.1	1	5.8	11.8	197	35.3

January	20	1	5.4	11.8	193	8
February	31.1	2	5.5	11.9	205	5.0
Seasonal total	111.1	12				
Mean	27.8	3	5.6	11.9	198.8	
Annual total	2329.8	147				
Mean	194.2	12.3	4.6	12.08	186	

Source: Nigeria Meteorological Agency Abuja Nigeria, Directorate of Weather Forecast Service

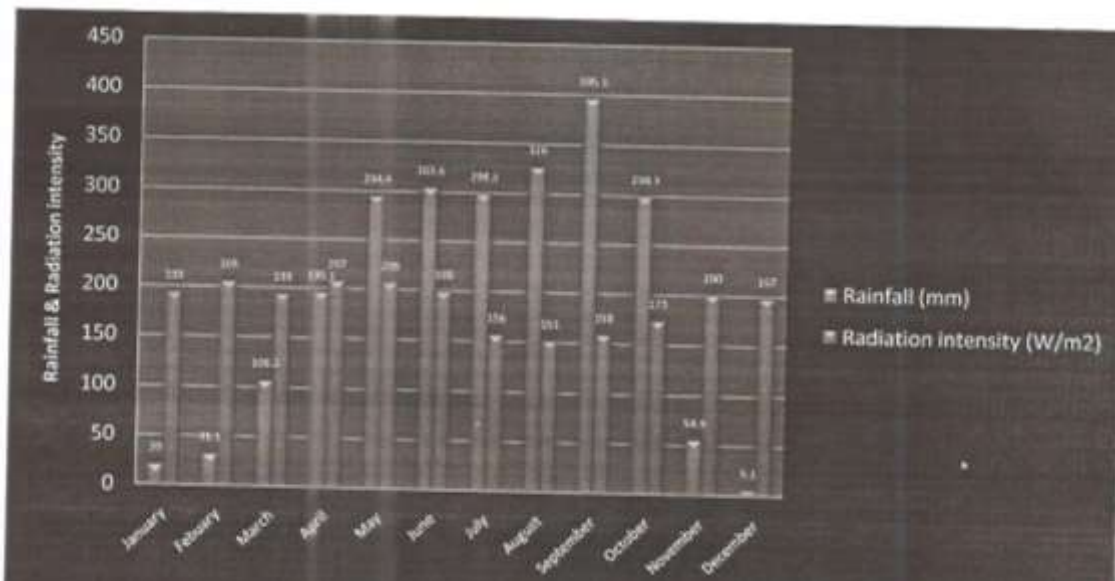


Figure 6: Bar Chart Showing Record of Rainfall and Radiation Intensity in South East Nigeria Abia & Imo State (2004 – 2009)

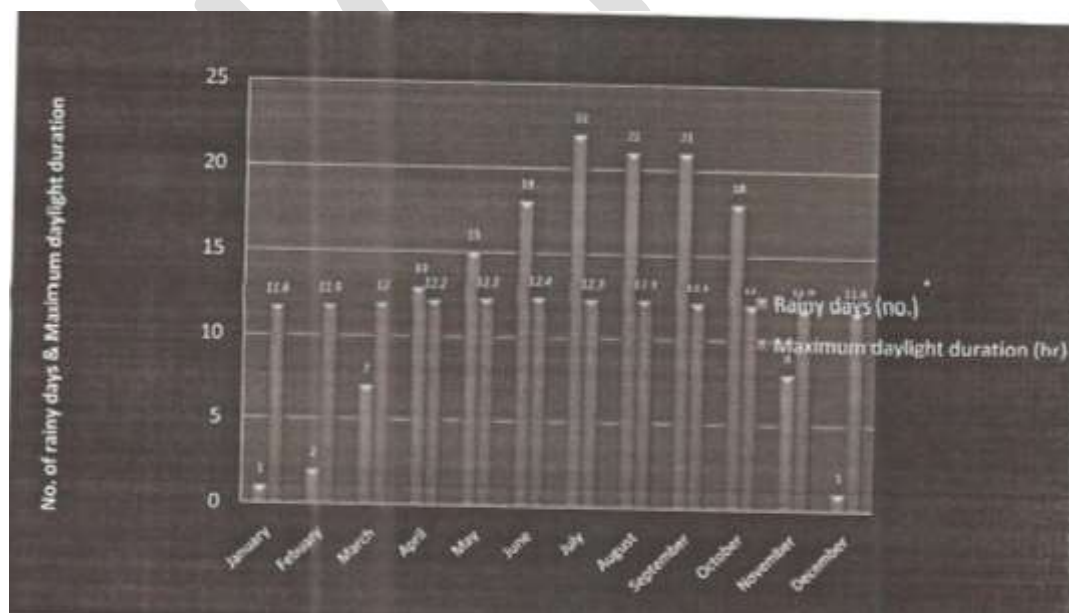
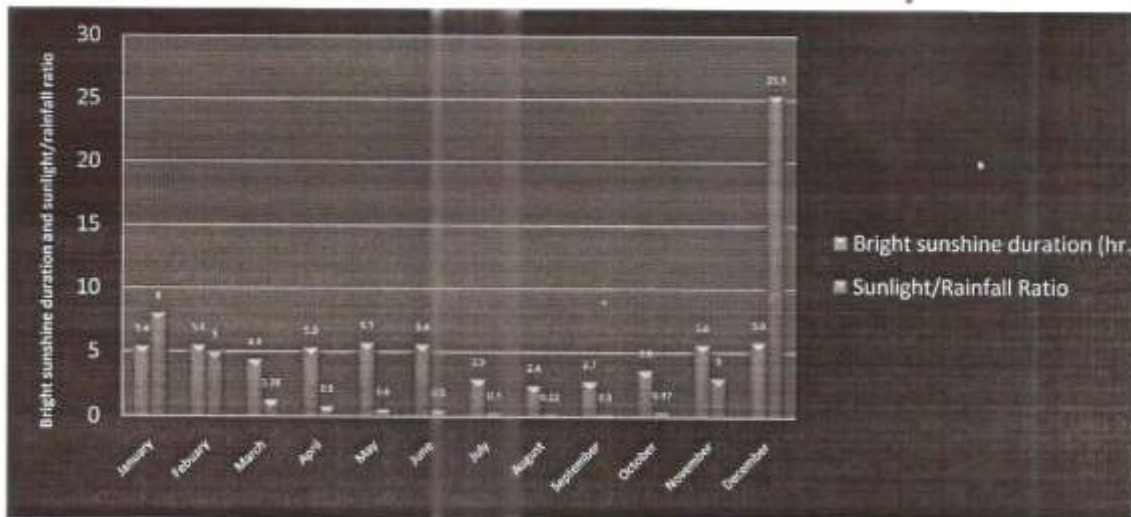


Figure 7: Bar Chart Showing Record of Number of Rainy Days and Maximum Daylight Duration in South East Nigeria Abia & Imo States (2004 – 2009)



Duration and Sunlight/Rainfall Ration in South East Nigeria Abia & Imo States (2004 - 2009)



Plate 9: A Patrilineal Obu (Meeting Hall) Being Eroded By Rain

roofs. High pitch roofs aids water to run-off faster and cannot percolate to cause decay of the raffia mat roof covers, (Plate 9). Apart from being a security measure, the low eave of the residential houses of the people of the area, is to protect the mud walls from having, any contact with the rain water that can reduce their strength, causing their collapse (plate 9). The torrential rains of this area, shortens the lifespan of the building materials, especially the raffia mats used as ridge cover. The ridge cover (Abuo otu) which is made up of some grasses and raffia leaves, are easily rotted by contact with moisture (plate 10). To have a longer lifespan the materials will have to be constantly changed. The lifespan of a mat is normally six months. A wealthy man's house will normally have its roof mats changed twice a year. But the common people will only have the point of the leaking roof changed by replacing the rotten mat with a new one.

Solar Radiation

Solar radiation intensity in South Eastern Nigeria varied from 151W/m² in August to 207W/m² in April with an annual average of 186W /m². The dry season average value is 199W/m² while rainy season average is 156W /m². These values indicate that light intensity might be limiting crop photosynthesis in the study area given that daily photosynthetically active radiation is roughly one-half of the total solar radiation (Sinclair and Muchow, 1999). Earlier in this work, Sa' ad (2009) had posited the effect of climate on the buildings of three types of climates in the world. He deposed that, buildings in the cold climate invariably have high thermal mass or significant amounts of insulation - (that is materials that prevent or reduces the passage of heat, electricity or sound). They are usually sealed in order to prevent heat and openings, such as windows tend to be small or non-existent. Buildings in warm climates by contrast, tend to be constructed of higher materials and allow significant cross ventilation through the openings in the fabrics of the building. But buildings of the continental climate must be able to cope with significant variations in temperature, and may be altered by their occupants according to the seasons, contrary to this assertion is what happens in the Cross River Igbo area. The area is in the Rain forest zone of Nigeria but cannot be described as cold climate, yet the buildings have high thermal mass and significant amount of insulation. The windows and other openings are small and in some buildings, in the Cross River Igbo area should have been constructed with materials that allow significant amount of cross ventilation but it is not so. No traditional residential building in the area has any kind of cross ventilation. In all residential building, male or female houses, there non-existent windows openings at the approach elevations; only at the back (Azoforo) that little window openings can be found. Although there are no provisions for cross ventilations, yet the interior of the residential houses are cool and cozy. The reason for this is not farfetched. The materials used in the construction of these houses have great insulation qualities. The walls are made of wattle and daub (mud) which has very high heat resistivity, so does the raffia mats used as roof cover. These materials absorb the solar radiation that hit the raffia mats and the quantity of the heat flux that will reach the interior of the house will be minimal. Secondly, the high pitch roof, creates a space at the ceiling level (alcove) where there is constant interplay of hot and cool air (Plate 11). The incoming air from the door of the house is normally Cool and moisture laden, so moves on the lower part of the room, the hot air being lighter moves into the voluminous space at the ceiling level where the raffia mat had absorbed the hot air outside and releases a cool air into the space. . By the time the hot air moves down, it had cooled, making the interior micro-climate very cool and comfortable. This is the reason for the cool and comfortable. This is the reason for the cool interior of the residential houses despite the lack of openings at buildings fabric to allow cross ventilation. All the materials. traditional architecture of the Cross River Igbo are sustainable complaint. what they practiced was based on the principles of green or sustainable architecture.

Sunshine Characteristics And Duration

Day length or length of light period (hours) in South eastern Nigeria varies from 11.8 hours in January to 12.4 hours in June with an annual average of 12.08 hours. The average day lengths during the rainy season and dry season are 12.2 hours and 11.9 hours respectively. The region has a prevalence of short dry condition with a difference of only 36 minutes between the longest and shortest day in the year. An examination of data reveals that actual mean daily sunshine vary from 2.4 hours in August to 5.8 hours in December with an annual mean value of 4.6 hours. The mean daily value for sunshine duration is 27% greater in the

dry season than in rainy season. Greater solar radiation during the dry season implies more photosynthetic energy according to atmosphere (Reading, 1994). It is also due to water vapor in the air that reflects and absorbs solar radiation at low latitude (AVRDC, 1990). Knowing exactly how the sun will strike a building means that it is possible to precisely calculate.

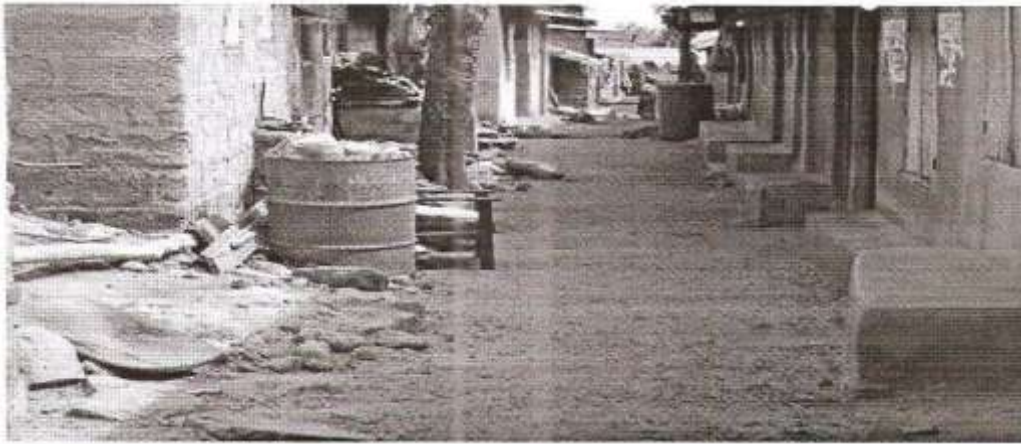


Plate 10: Compound Street In Front Of The Line Of Male Houses On The Left And Female Houses On The Right



PLATE 11: COMPOUND STREET IN FRONT OF LINE OF FEMALE HOUSES IN EDDA



Plate 11; The Space At The Ceiling Level (Attic) Where The Interplay Of Hot And Cool Air Create Cool Interior Of A Residential House. Source: Dmochowski, 1990

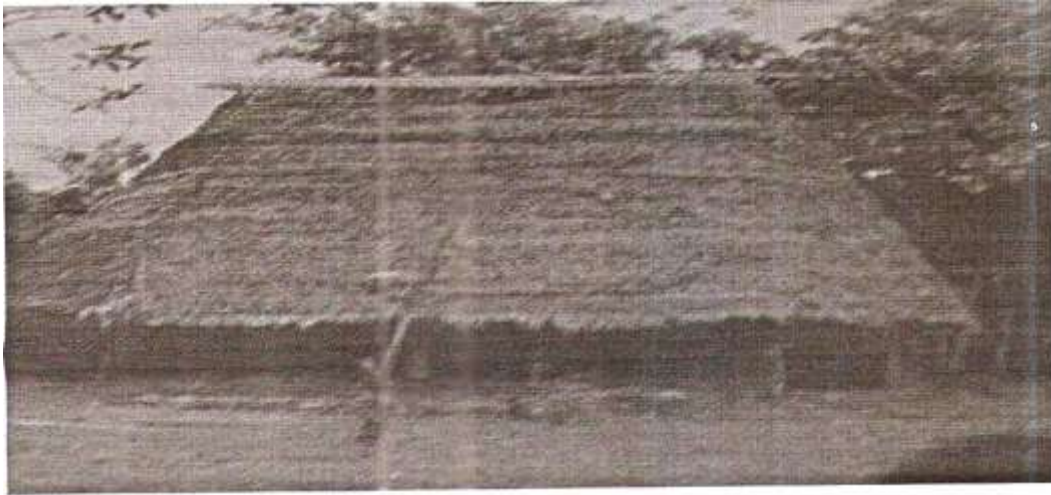


Plate 12; The High Pitch Roof And Low Eave Verrandah Of An Obu House Source: Dmoschowski, (1990)



PLATE 13: THE RIDGE COVER (ABUO OTURU) USED TO SECURE THE LONGIVITY OF THE ROOF. SOURCE: DMOCHOSWKI, 1990

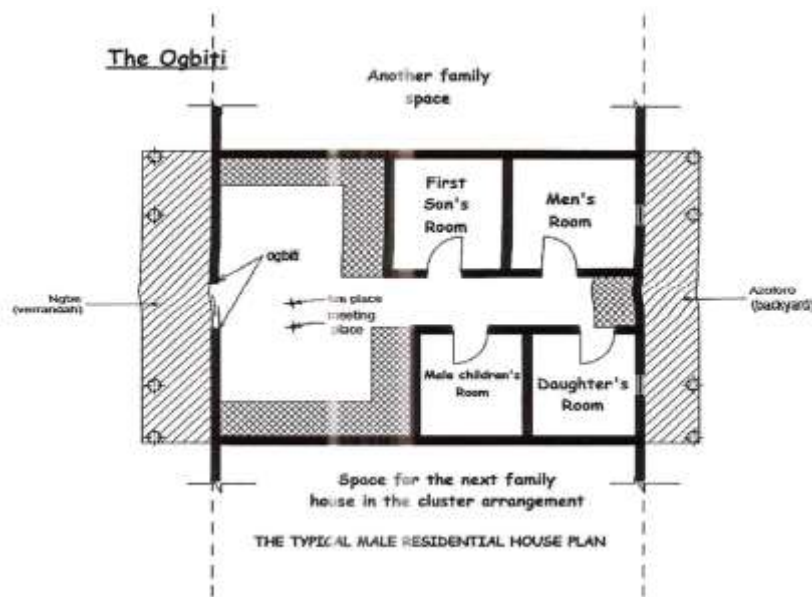


FIGURE 10: NO EXISTENCE OF ANY WINDOW AT THE FRONT ELEVATION OF ALL RESIDENTIAL BUILDINGS (MALE OR FEMALE)

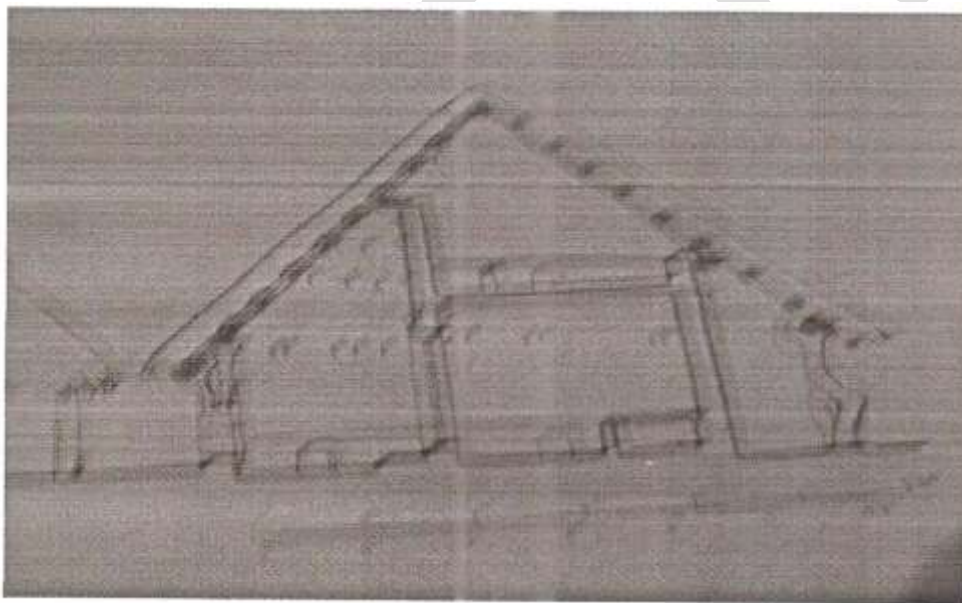


Figure 11: A Section Of The Attic In The Male Traditional Houses

Source: Dmoschowski, 1990

the length of the overhang of a sun shade, depth of a fin, the angle of a solar collector, the placement of a courtyard, the length of the shadows cast by nearby buildings, or even the way sunset will be affected by distant hills or other objects that rise above the local horizon

Relative Humidity

Relative humidity is the actual water vapor pressure to the saturated vapor pressure expressed in percentage. This Could be termed the ratio of amount of water vapor actually present in the

air to the amount the air could hold. Water vapor enters the air by evaporation, primarily from the surface of the oceans, but also from moist surfaces, vegetation, and small water bodies. In South-East Nigeria, the vapor is carried and distributed over the earth surfaces by the prevailing south west and north east trade winds. The air's capacity to hold water vapor increases progressively with its temperature, which is the principal factor (Thomas, 2008). In the study area (South-East Nigeria), the following deductions were made:

- (a) Vapor pressure increaseS with increase in relative humidity and Vapor pressure and relative humidity rise sharply between January and April.
- (b) Vapor pressure and relative humidity are fairly constant between July and September and Low relative humidity results in low pressure. Design solutins usually employed in the study area to counter problems associated with relative humidity include provision of proper ventilation in the buildings to enhance air flow. thid will help to maintain the comfort zone in heavy humid periods.

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