DOI: http://dx.doi.org/10.4314/gjpas.v22i1.9

GLOBAL JOURNAL OF PURE AND APPLIED SCIENCES VOL. 22, 2016: 73-80
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CONTEMPORARY URBAN DEVELOPMENT IN CALABAR – PROMOTING SUSTAINABILITY BY CURTAILING ECOLOGICAL FOOTPRINTS OF (HOUSING) DEVELOPMENT

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(Received 15 December 2015; Revision Accepted 21 March 2016)

ABSTRACT

The need to regulate land use and the exploitation of natural resources has led to the concept of sustainability, and by extension, ecological footprint (the total amount of land required by an individual to grow his/her needs). This paper examines ecological footprint savings in urban growth and housing development in Calabar (middle-sized Nigerian city) by comparing compact house development with single detached units per lot size. The method involved first, exploratory studies, mainly in the form of physical observations, conducted across the city towards the determination of the principal land use activities that are responsible for rapid urban growth in Calabar. Second, concepts of housing were analyzed by the use of experimental projects in order to demonstrate housing development paradigms that would be ecologically more beneficial for the city, with a view to minimizing the ecological footprints of the city in the future. The result showed that the existing urban development spread could be reduced by more than 150% if the current trend of individual one-unit housing practice is replaced by aggregation of units in a single block. The study also shows that ribbons of farmland could be saved between developments for urban agriculture.

KEYWORDS: Ecological footprint, sustainability, housing, urban development.

INTRODUCTION

The world has become an urban planet; the phenomenon being driven by in-migration and population growth. Urban settlements in Africa, for instance, now grow at the rates of more than 2% (UN, 2011); this growth is both demographic and spatial as the demand for housing, circulation and leisure heightens. The challenges facing urban designers are indeed great as land use patterns are altered disproportionately in disfavour of such critical area as agriculture. Urban habitation (housing) has become increasingly unsustainable as it not only draws on materials from the natural environment but also make incursion into ecologically fragile lands such as wetlands, forests and water bodies. These areas had acted as climate stabilizers for centuries and their alteration had invariably been exacerbating the climate change effect. Urban housing yields high ecological footprint through the materials of construction drawn from the environment as well as direct land occupation. These anomalies are already manifesting in Calabar, a rapidly growing urban centre of Nigeria.

Two concepts that emerged, towards the end of the 20th century, have very significant interpretations in the spheres of urban development in the developing world - sustainability and ecological footprints. The emphasis on the developing countries is legitimate. The greatest impacts of the phenomenal rise in the world's population that occurred in the 2nd half of the 20th century (from 2.8 billion in 1950 to nearly 6 billion at the end of the century) took place in the developing world (Brown, 1999). It has been noted that population increase "in developing-country cities will continue to be the distinguishing demographic trend" of the 21st century, "accounting for nearly 90 percent of the 2.7 billion people projected by U.N. demographers (in their medium-growth scenario) to be added to world population between 1995 and 2030" (O'Meara, 1999).

Following these unfolding scenarios Africa began to emerge as one of the world's most critical zones of intense population growth and rapid urbanization. In 1996 the continent surpassed Europe; becoming the second most populous region of the world, after Asia. Although Africa holds 15 percent of the world's population (in comparison with Asia that holds 50 percent); there is the hidden challenge that resides in Africa's population high growth rate. For Africa the population growth rate stands at 2.3, compared with that of Asia, which is 1.0 (UN, 2011). By 2009, African population was put at 1 billion and was projected to 2 billion and 3.6 billion by 2044 and 2100 respectively, and with that Africa's share of the world's population is expected to stand at 24 percent by 2050 and furthermore at 35 percent by 2100 (UN, 2011). As greater numbers of people continue to relocate daily from Africa's rural regions to the cities, the population challenge of Africa will be located in the realms of urbanization and urban growth. The worrisome fact is that the machineries for orderly management of

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urbanization and urban growth are very weak in Africa. With specific reference to Nigeria, it is alleged that one of the principal reasons for this worrisome situation is the obsolescence and weakness of the existing planning tools for providing a sustainable basis for urban development in Nigeria (Okosun et al, 2010).

In order to cope with the increasing urban populations in Africa, with the often attendant high density at the core, people tend to seek for building lands at the urban fringes, leading to the emergence of sprawl However, research has shown that viewed ecologically and economically; urban sprawl actually does not provide the desired solution; it actually compounds urban development problems of the developing world. Several problems are associated with urban sprawl: excessive costs induced by over-stretched infrastructural networks, car-dependent lifestyle, high energy consumption (as a result of car-dependency), automobile-related urban pollution etc (Okosun et al, 2010) and Shechan, 2001).

Another problem that is rapidly unfolding in Nigerian cities is the rapid destruction of peri-urban agricultural lands due to rapid urban growth. Uncontrolled urban growth that results in uncontrolled destruction of peri-urban agricultural lands incorporates within itself a serious ecological dilemma - expanding the capacity of the city to accommodate more people while, at the same time, curtailing the capacity of the same city to meet up with the daily demands for food by the increasing numbers of city dwellers. This is the principal context of this work.

2. Theoretical Framework

The theoretical foundations for this research work are located in the study of urban development within the contexts of sustainability and ecological footprints. It is evident that, under the pressures of the population challenge, not much attention is being paid to these issues in urban development in Nigeria. Much attention has often been directed to the issues of urban planning within the contexts of addressing the "obsolescence and weakness of the existing planning tools", as for example in the work of Okosun et al (2010). This tendency to place emphasis exclusively on urban planning leaves one important question unanswered in the case of Nigeria: Why do the problems occur in cities where master plans were established at the outset of rapid urbanization? We suggest that the problem is located more critically in the realms of urban development management; and this is the posture of this paper. This thus leads in the direction of urban development management that ought to be anchored on the concepts of sustainability and ecological footprints.

2.1. Ecological foot print

Rees and Wackernagel (1994) developed the ecological concept in the early 1990s which they popularized in their 1996 publication, Our Ecological Footprint: Reducing Human Impact on the Earth. The authors define ecological footprint as “the area of ecologically productive land (crops, pastures, forests and aquatic ecosystems) required to produce the resources consumed and to assimilate the wastes produced by a given population with specific life level and indefinitely”. (Rees and Wackernagel, 1994). In essence, ecological footprint is a measure of human demand on the earth’s ecosystems and their services. The ecological footprint has been well documented (Rees and Wackernagel, 1994 and Rees, 1999), and simply attempts to weigh human demands on the natural environment against the biophysical carrying capacity of the Earth. Every human needs resources like water, food, transportation, homes, electricity, etcetera, and each of these needs an amount of land to take place. But our planet can support only a limited number of these activities because of its limited size. Should humans consume and generate more resources than the Earth can carry, we will need more than just one planet. Today, humanity uses the equivalent of 1.5 planets to provide the resources we use and its estimated that by 2030, we might need the equivalent of two Earths (UN, 2010 and Piquero, 2012). Already this scenario is playing out in different dimensions across the world’s developmental divides. The Canadian city of Vancouver needs land mass of about 207 times the geographical area of the home territory to sustain her lavish lifestyle (Rees, 1999) Similarly, the nations of Scotland and Netherlands require about six and fifteen times their sizes respectively to sustain their population (Moffat, 1996)

In calculating, ecological footprint, certain categories are assumed; cropland, pasture, forests, productive oceans and built area- urbanized surface and infrastructure. The urban built area, apart from the direct impact of its development on ecosystem depletion, contains buildings and civic infrastructure that consumes natural resources sometimes procured from far distant places. Thus, the ecological footprint of the built environment, particularly that of housing (often referred to as residential ecological footprint), extends beyond the bounds of the city.

2.2. The concept of urban residential ecological footprint

Rees (1992), while examining the issue of urban sustainable development, came up with the concept of urban ecological footprint. The concept emphasizes that, in order to maintain a certain number of persons in the built environment, a certain amount of productive land and water area is needed (Rein xifeng, 2010 and Yun, 2011).

Urban landform exhibits different characteristics and functions with the different matrixes accounting for different percentages of land use. In the study of the city of Wuhan, China, Yun (2011), showed that the residential ecological footprint was 28% as against 49% for industrial land use. However, from a general view point it was discovered that the square of residential area exceeded 20% of total urban built area. But that was the core of urban ecological footprint. Yun therefore opined that the possibility of adjusting the scale of residential land use could assist in controlling the ecological footprint, easing the pressure on urban ecological carrying capability.

The average overall footprint of humanity in 2007 was put at 2.8Ha/inhabitant, 2/3 above the carrying capacity of the Earth, given a total of 11,300 million hectares of productive land and sea space; of this number, the built area was 0.1 Ha/inhabitant (Piquero, 2012 In a study of the Victorian city of Australia, it was

found that housing accounted for about 5% of the city's ecological footprint, noting that each building required 27 global hectares. The figure was actually the land required to produce all the construction materials, provide the energy and deliver services needed to build a new house. (EPA Victoria, 2008).

2.3 Ecological footprint, sustainability in urban development

As state previously, in order to reduce ecological impact of urban development, significant changes must be made to the urban form and the development practices inherent thereof (Hurley et al, 2007). In that regard, several frameworks, such as LEED, for sustainability assessment of urban development are developed and applied in several advanced countries, (Hurley and Home, 2006 and Hurley et al, 2007). The concept of sustainability has often been given varied interpretations by different scholars depending on their view points; however, they all anchor their theses on the simple notion that the Earth's resources are limited and should be used in such a way as to guarantee future generation of their share.

Following the publication, in 1987, of the Brutland Report of the United Nations - Our Common Future, the worldview on development began to be dominated by the consciousness for sustainability. The fundamental philosophy of sustainable development is considered to be that the development of the present generation should not eliminate the access of future generations to the resources they would need, thereby foreclosing the access of those future generations to meaningful development (WCED, 1987). Within the context of urban development in Africa (the continent that is living under the unique combination of the highest population growth rate and one of the highest urbanization rates) the future city will be a place that will hold much higher orders of magnitudes of people than can easily be imagined in the present time. Viewed from this standpoint, it is desirable that in the management of the resources of the city (especially land) one must always keep a mental picture of the demands of future generations.

The experience of man (since the first cities began to emerge in the fertile crescent of Mesopotamia) has been that one natural resource that man has found to be very difficult to regenerate is prime agricultural land. According to Rees (1992).

> Some economists have accepted the ecological argument that sustainability depends on the conservation of certain biophysical entities and processes. These "resources" maintain the life-support functions of the ecosphere, the risks associated with their depletion are unacceptable, and there are no technological substitutes.

In the work of Wackernagel (1994), the rapidly diminishing access to "ecologically productive land", following the phenomenal explosion of the world's population throughout the course of the second half of the 20th century, has been articulated in the following manner:

> While in 1950 there was still 3.6 hectares of ecologically productive land remaining per capita, less than 1.6ha is left in 1994. A global population of 10 billion – expected by 2030 – would leave humanity with only 0.9 hectares per capita, with some of it degraded.

The position of this paper is that the prime agricultural lands that are located in the peri-urban regions of the rapidly growing African cities are among such "biophysical entities" that ought not to be drastically depleted, being that they are needed for maintenance of "the life-support functions" of the city in the present; and much more so in the future.

2.4. Urban Development and Urban (Housing) Ecological Footprints.

The subject of urban ecological footprints has become very topical since the last decade of the 20th century. Cities now depend on resources located far beyond the discrete geographical territories towards the performance of life-supporting functions that are essential for the city dwellers. Among these are critical demands such as energy, food and materials for housing development (Rees, 1992).

While cities of the industrialized world can afford the costs of maintaining the in-flows of such critical in-puts for the sustenance of urban life, the same is not the case with the cities of the developing world. In the cities of the developing world, the importation of food and building materials from distant locations result in high costs that compound the problems of urban inequities. The costs of food and building materials fall outside the reach of many urban dwellers, leading to the escalation of urban poverty and slums.

Following the logic of urban ecological footprints, this paper has focused on the study of urban (housing) development trends in and around the city of Calabar in Nigeria. A peculiar trend has been observed, which is conversion of peri-urban prime agricultural lands into urban housing sectors, a phenomenon that has been happening since the 1970s. The trend has transformed a city that once had the capacity for meeting the daily demands for vegetables and other such perishable food items into a net importer of the agricultural produce needed for daily consumption by the city dwellers.

3. Ecological Footprints and Urban (Housing) Development in Calabar

Calabar in Nigeria is located on latitude 04.58 degrees north of the Equator and longitude 08.21 degrees east of the Greenwich Meridian (see Fig. 1). Similar scenarios of rapid population growth that swept across many Africa nations, following national independence in the second half of the 20thy century, (Brown et al, 1999, O'Meara, 1999 and Shechan, 2001) also occurred in the cities of Nigeria. In the case of Calabar, the major impetus for rapid population growth is traced to the establishment of the city as the capital of South Eastern State (later named Cross River State) of Nigeria in 1967.

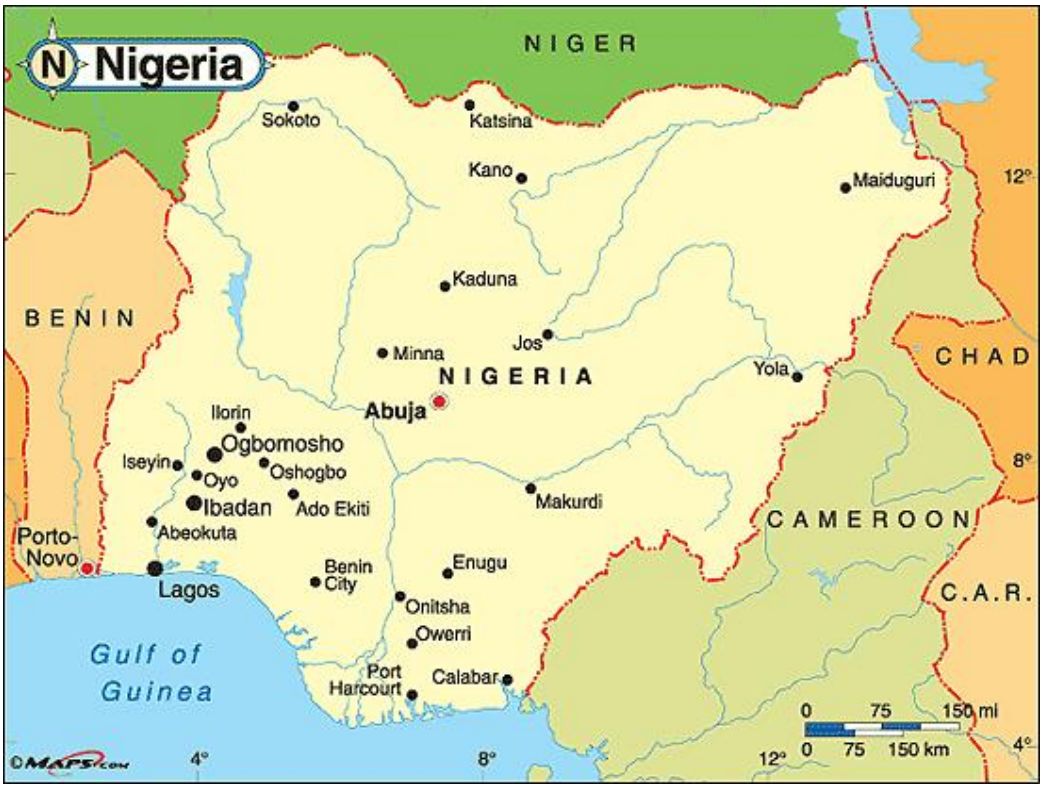


Fig 1: Location of Calabar in Nigeria
(Source: Commons http://searchnigeria.net/websearch/index.php?page=search/images&search=nigeria+map&type=images&startpage=4)

3.1 Compact Development versus Urban Sprawl.

In consideration of the subject of the relationships that connect urban sustainability with ecological footprints it has become necessary to place focus on the ecological argument proposed in Rees (1992) "that sustainability depends on the conservation of certain biophysical entities and processes". The argument is that the "certain biophysical entities and processes" constitute the foundations upon which "the life-support functions of the ecosphere" are anchored. Sprawling cities tend to deplete the biophysical entities and processes that support life in the ecosphere; thus compounding the problems of food insecurity and urban poverty. According to O'Meara (1999),

> Much wasted energy and air pollution stem from a city's failure to link transportation and land use decisions in a sensible way. Sprawling cities require not only more fuel for transportation, but also more land, building materials, water lines, roads, and other infrastructure than compact ones do.

Calabar is a city in which urban sprawl has been embraced as the paradigm of urbanization. In 1967, when Calabar became the capital of South Eastern State (now Cross River State) of Nigeria, Diamond Hill (with the associated facilities such as Simpson's Spring, the pioneer Electrical Works of Calabar together with the Calabar Cement Company Limited - CALCEMCO) constituted the northern peri-urban fringes of metropolitan Calabar. The evidence of this assertion is established in the fact that No 1 Calabar Road is located in the vicinity of the twin overhead water tanks situated at Diamond Town. The New Secretariat (which did not exist at the time) is located to the east of the territory. Today, the momentum of sprawl has expanded northwards in the city to the extent that a housing estate (meant for the residents of metropolitan Calabar) is located at Odukpani Junction - more than 20 kilometres north of the central business district of Calabar.

The principal driver of urban sprawl has been the city's official housing paradigm. This housing paradigm is based on the concept of housing on individual plots of land. Based on this paradigm, housing is already being developed at a distance of more than 20 kilometres in a city in which the population is in the region of 0.5 million. According to O'Meara (1999), the forces that propel destructive impulses of chaotic urbanization in the city are both economic and political:

> Powerful economic and political forces drive environmental degradation, chaotic urbanization, and the fragmentation of cities into disparate political entities that are hard put to collaborate for the benefit of the overall urban area, and each city faces its own combination of destructive forces. (O'Meara 1999: 9)

In the case of Calabar, powerful economic and political forces have adopted a housing paradigm that

will turn out to be destructive in the long run. Development of housing on individual plots of land is both resource-extravagant and ecologically unfriendly. Long transportation distances (for commuters, car owners, waste disposal and sundry services) increase consumption of urban energy resources and also increase in the risk of pollution emanating from automobiles (O'Meara 1999, Hurley et al, 2007 and Moffatt, 2000),

3.2. Architecture, Housing and Urban Sustainability.

In Calabar, housing development (private as well as public) is based on the paradigm of individual plots for individual house owners. This housing paradigm consumes much and is therefore land extravagant (O'Meara 1999, Hurley et al, 2007 and Moffatt, 2000), It would appear that this housing paradigm is founded upon the myth that prospective home buyers would not be attracted by property located in apartment blocks of two or more storeys. A survey of the Nigerian situation has shown that this is untrue. In Victoria Island in Lagos, members of the public have been buying apartments located in apartment blocks as high as 7 to 10 storey. The legislative quarters of Nigeria's second republic, popularly known as 1004 in Victoria Island in Lagos, consist of several apartment located in apartment blocks. The apartments were not stranded (for want of buyers) in the real estate market, when the apartments were put up for sale in the first decade of the 21st century

4.0. Methodology of the Study

The methodology of the study consists of the exploratory studies, data analyses and comparative analyses of land use concepts.

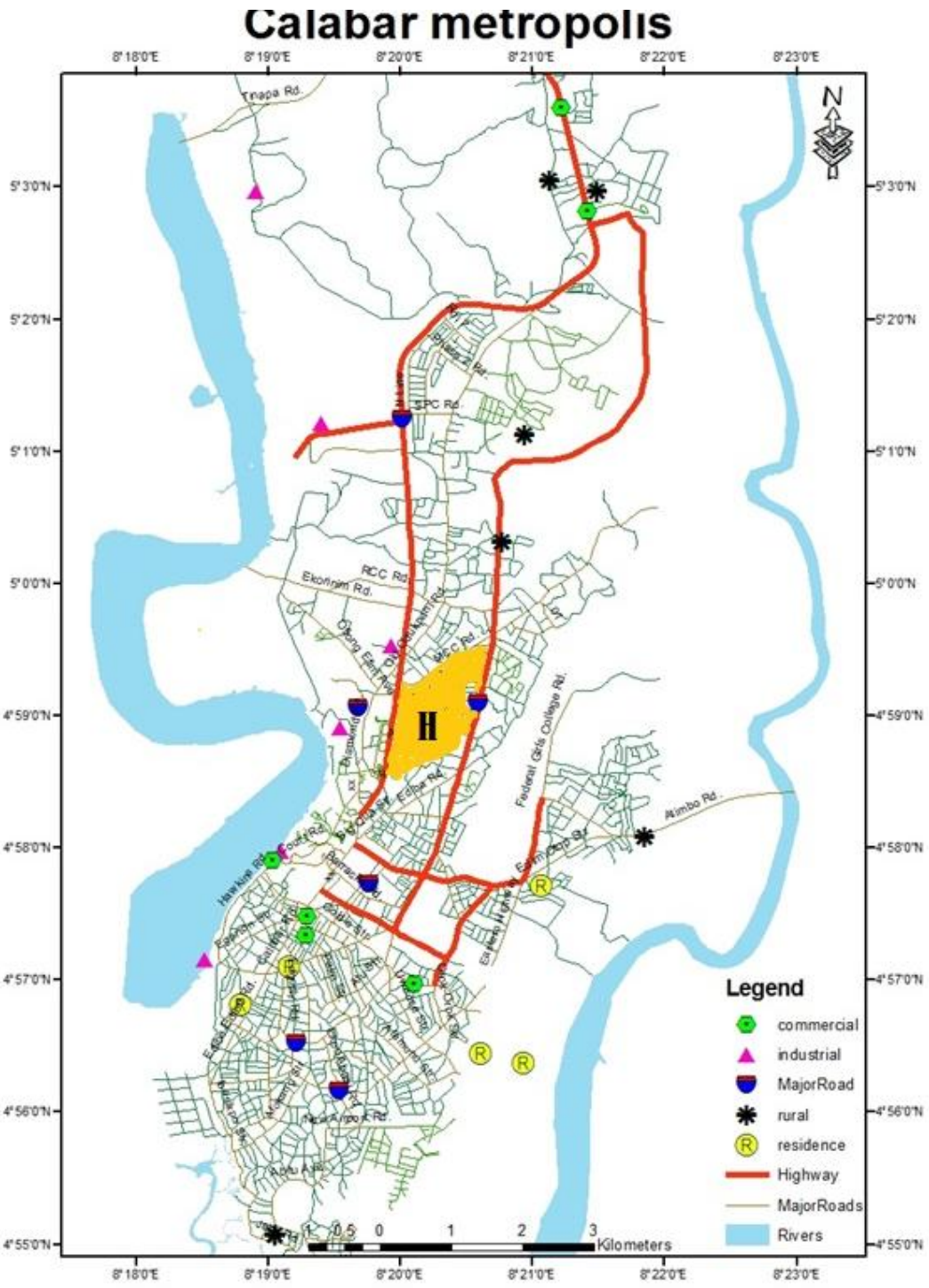
- Exploratory studies were mainly in the form of physical observations, conducted across the city towards the determination of the principal land use activities that are responsible for rapid urban growth in Calabar.
- Data were collected from the various government agencies responsible for registration and processing of land-use conversions with a view to determining the principal directions of such conversions.
- Concepts of housing were analyzed by the use of experimental projects in order to demonstrate housing development paradigms that would be ecologically more beneficial for the city, with a view to minimizing the ecological footprints of the city in the future.

This study was conducted at the State housing Estate in Calabar. The section marked '**H'** in the map (Figure 2) shows the location of the estate in Calabar Municipality). The estate was one of the medium income housing developments of the South Eastern State (now Cross River state) of Nigeria for urban areas of the state. That was in line with the policy of the then unitary Federal Military Government of Nigeria to provide adequate shelters for all (Waziri & Roosli, 2013). The Federal Government on its part built proto-type estates with provisions for three categories of residencies; the high, medium and low income dwellers, across the states of the Federation in the early 1980s.

As indicated previously, houses in the State Housing Estate in Calabar were single units of structures in plots of sizes of about 30mx30m. The built up area of a plot was usually not more than 40% of the lot size. Urban population then was low and the demand for land was equally low. That informed the adoption of single bungalow housing type, usually with a small backhouse (often called 'boys' quarters') for the gardener and/or house helps. That house type was introduced by the colonial government for her staff and later adopted by African top civil servants when their European counterparts left. Moreover, American system of sprawl development was gaining general acceptability, especially amongst the elites.

Subsequently, it became a common practice for individual house owners and estate developers to adopt this mode of building as the city expanded. The end result had been an uncontrolled sprawl development that threatens the city of Calabar today. Land thus has become a scarce commodity, leading to incursion of developments into wetlands and other ecosystems and historical hotspots that had hitherto been preserved. This problem has led to the need for developers and urban environmental researchers to seek for alternative ways of housing delivery in the city as well as other cities in the country. An architectural solution is a major way out of this quagmire. In this study, apartment form of buildings on multi-floor levels is contemplated to aid in efficient land management. This would check senseless waste of land and prevent incursion into wetlands and other eco-hotspots thereby reducing the city's aggregate ecological footprint.

A study of the situation, conducted for the purpose of this research, has shown that development of housing in the form of apartment blocks does not necessarily amount to curtailment of levels of comfort. An experimental project was developed based on each of the two paradigms – housing on individual plots and housing on 3-storey or 4-storey apartment blocks; using an estate of 1 hectare in land area. In the case of the paradigm of housing development by apartment blocks, four 2-bedroom flats were arranged per floor on an apartment block designed for a nominal plot area of 30 metres x 30 metres (see Fig. 3). The apartments were arranged on the upper floors of the block, with parking and services located on street level in each block. Placement of five of the blocks on the estate demanded 60-70 percent of the territory; leaving 30-40 percent of the total land area for social services such as playgrounds as well as other ecological services like urban agriculture. Under this arrangement, it would be possible to accommodate 40 families on 3-storey apartment blocks or 60 families on 3-storey apartment blocks.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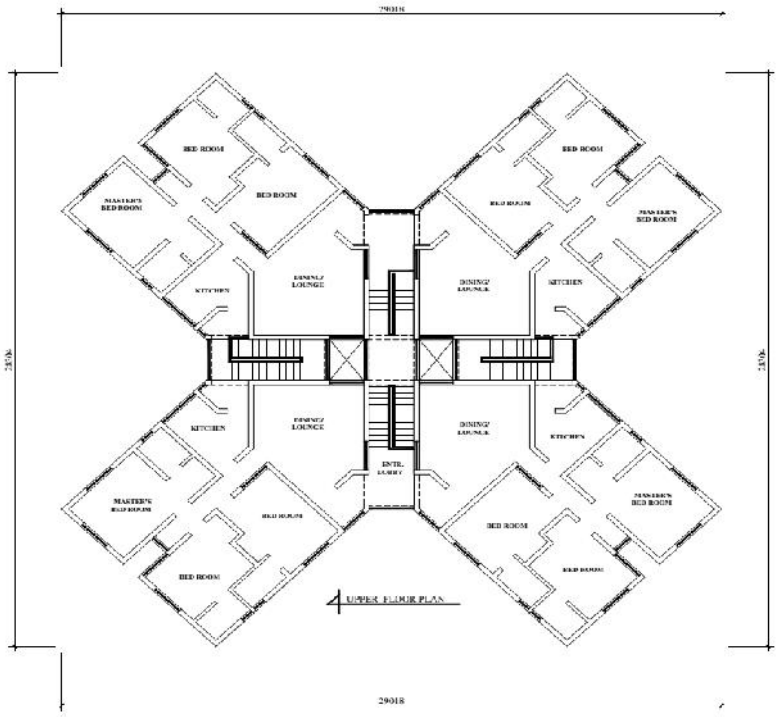

Fig. 3: Typical model of housing on apartment blocks (based on experimental projects)

In the case of housing on individual plots, an estate of 1 hectare in size would only be able to accommodate about 18 families on 18 individual plots of land. In comparison with the situation of housing on 3-storey apartment blocks (with occupancy rate of 40 families, located only on the upper floors), the comparative occupancy rate of the housing model by individual plots is only 45 percent. Furthermore, when the comparison is made with the situation of housing on 4-storey apartment blocks (with occupancy rate of 60 families), the comparative occupancy rate of the housing model by individual plots becomes only 27 percent.

When the concept of compact housing is extrapolated on the urban scale, then placing a tight control on urban sprawl becomes a possibility in Calabar. Placing a tight control in this manner on urban sprawl in Calabar could actually mean curtailing the city size by as much as 30 percent. The benefits derivable from this would include concomitant reductions in demands for urban infrastructures (which could turn out to be very heavy burdens on government if permitted to be excessive) and liberation of land for urban agriculture (a very significant consideration in urbanization in the present era).

DISCUSSIONS AND CONCLUSION

Urban sustainability has to contend with two primary demands of humans which are housing (shelter) and agriculture (food). Rising earth's population means more mouths to feed and thus more land for agriculture. The demand for housing will also mean a demand for materials of construction, all extracted from the stock of nature found on the earth's only land and water reserves. Each inhabitant of the earth's surface thus has his own share of these demands; often encapsulated in the concept of ecological footprint, the individual land acreage needed to sustain his/her needs The demands exert pressure that has now exceeded the bearing capacity of the planet.

Unfortunately, the rising urban population is witnessed more in the developing countries of the world, particularly Africa where institutional infrastructure poorly developed to cope with the challenges. In Calabar, one of the leading centres of urban growth in Nigeria, the development of single-storey detached housing had been the norm, with the attendant consequences of fast developing sprawls at the city's fringes. This is a big impediment to agriculture that answers one of the primary demands of humans, food.

In this study, it has been shown that there could be more than 200% savings on land if medium rise structures are developed to replace the current single unit detach structures. That would ensure more land for agriculture and a reduction in ecological overall footprint as well as sustainable development for the future city of Calabar.

There are challenges to be overcome in the development of high rise structures; ranging from satisfactory architectural design of common spaces to structural stability of form, and from funding to post construction maintenance of such structures. These challenges are not addressed in this paper which central focus is how to reduce ecological footprint through savings in land and natural resources by the adoption of compact design approach. However, it needs to be mentioned that professionals in these fields have gone a long way to prescribing workable and tested solutions to these challenges. It is the observance of these prescriptions that is often the problem. The rising cases

of collapse of buildings in Nigeria for instance, are not largely due to inadequate/wrong designs but corrupt contract execution practices. In this situation, contractors and clients are culpable. In the case of Government contracts, the supervising government agencies/ministries connive with contractors to abuse design prescriptions in order to divert money into private pockets. Private developers (companies, religious houses, estate developers and private home developers) on the other hand, most times pay passive attentions to the prescriptions of the architect and his team in order to safe cost! These attitudinal problems can best be addressed through a holistic social re-engineering.

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