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Analysis of Environmental

Economic Effects of Kiri Dam

Highlights

Rural Areas Offederal Capital

Spatial Analysis of Household

Discovering Thoughts, Inventing Future

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Analysis of Environmental and Economic Effects of Kiri Dam, Adamawa State, Nigeria

By A. A. Zemba, A. A. Adebayo & A. M. Ba
Modibbo Adama University of Technology, Nigeria

Abstract- This research was an attempt to study the consequences of dam construction in Nigeria. This was expedient because such projects are known to be characterised by array of disasters that ensued their construction. Satellite images captured before and after the dam in 1976 and 2014 respectively were subjected to image processing techniques so as to assess the likely changes in environmental variables of the area. This was supplemented by 250 questionnaires administered in settlements along the riverbank to elicit information on the socioeconomic characteristics of the people. Additionally, field observations and informal interviews were conducted to probe further into details of information required. Results show that natural vegetation has decreased by 63%. This has led to chains of environmental problems including soil erosion, loss of biodiversity and pollution. The other land use/cover types experienced increase, with water body accounting for the highest value of 54.7% owing to dam in the reservoir. The hitherto common crops of the area such as maize, guinea corn have been replaced with cash crops like cotton and potato etc., some of which are foreign to the area.

Keywords: kiri dam, environment, irrigation, fishing, quellabirds.

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A. A. Zemba [α], A. A. Adebayo [σ] & A. M. Ba [ρ]

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Keywords: kiri dam, environment, irrigation, fishing, quellabirds.

I. Introduction

Demands of the growing population for food, electricity power supply and economic growth have led to the initiation of large-scale river basin development in Nigeria. These river basins encompasses construction of man-made lakes and dams aimed at providing water for hydroelectric power, irrigation of floodplains, fishing, industrial and domestic needs. Some of the dams are multipurpose in nature, providing series of benefits like reservoir fisheries, transportation, domestic and industrial water supply, and recreational facilities needed by man.

It is in connection to some of the purposes stated above that River Gongola was dammed at Kiri under the auspices of the Upper Benue River Development Authority (UBRBDA). Kiri dam was originally initiated by Savannah Sugar Company but was completed by and it is now under the control of Upper Benue River Development Authority. Savannah Sugar Company is however, still the greatest user of the dam, where the dam water is used for irrigating its sugar plantations. The dam was constructed in 1982, at Kiri, some 25km upstream of its confluence with River Benue at Numan. The dam covers a land area of about 134km^2. Salau (1986) has reported earlier that the construction of Kiri dam displaced over 20,000 people, who were resettled in new areas.

It is also on records that very often ecological and socio-economic problems follow new dam construction. For instance, Adeniyi (1971) reported a decrease of about 70% in the acreage of cultivated farmlands; 75% decrease in income of fishermen; and an adverse effect on transport; and substantial decrease in the availability of fishes in the river after the construction of Kainji dam in Nigeria. This considerably reduced the quality and quantity of fish caught by fishermen and consequently caused them many untold hardships as they gradually and surely lost their means of livelihood after the creation of the dam.

Scudder (1980) cited in Salau (1986), pointed out that most dams and in fact other projects in Nigeria are embarked upon without an adequate knowledge of the location of the areas, hence, such consequences like indiscriminate levelling of land (with all trees uprooted, thus increasing the risk of erosion); diversion of natural water courses as well as alteration of ground slopes, which directly affect the existing ecosystem, ensued. Moreover, studies on environmental and economic impact of dams in different places have been carried out (e.g. Adeniyi 1970, Scudor 1980 in Salau 1986). Findings of these studies also revealed a lot of undesirable impacts, including reduction in water volume in the downstream, flood menaces, disappearance of aquatic lives etc. In extreme cases, floodplain fishing and floodplain pastures as well as recession culture and water availability become a problem and in the long term, soil fertility declines due to reduction of silt deposits. Reduced silt loads downstream deprive the floodplain from natural fertilization and sedimentation. These endanger the sustainability of traditional recession culture. Other impacts may include stream intrusions and surface run-

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off from the field, which cause much damage to agricultural lands; loss of aquatic lives; river bank erosion etc.

Observations of certain happenings around Kiri dam seems to suggest manifestations of dams related impacts. It is against this background that this research work was formulated to investigate whether the presence of the dam has any influence on the environment and economic well-being of the immediate communities.

II. Study Area

Kiri dam is located on floodplain of lower Gongola River basin, about 25km upstream of its confluence with River Benue at Numan. It was reported to have formed as a rift phase due to lithospheric peak thinning which caused long narrow depression that developed in some places filled with variety of sedimentary environment (Whiteman 1982, reported in Mubi 2001). Specifically, Kiri dam is located in Shelleng Local Government Area of Adamawa State and situated on latitude 9^0 42' North and longitude 12^0 01' East (Figure 1). The area has a sedimentary rock, which made up of shale and thin bands of limestone and lignite. It contains wide range of alluvial deposits, along wide channels of River Benue and Gongola which overlies the cretaceous deposit. It is generally a lowland area, between 500 – 700 meters above sea level. The landforms of the area are characterized by extensive floodplains and alluvial swamps. Most of the locations are liable to flooding, water logging or swamps along river catchments. The subsoil and shale formation allow underground flow of water, which raises water table during raining season and drops very low during dry season.

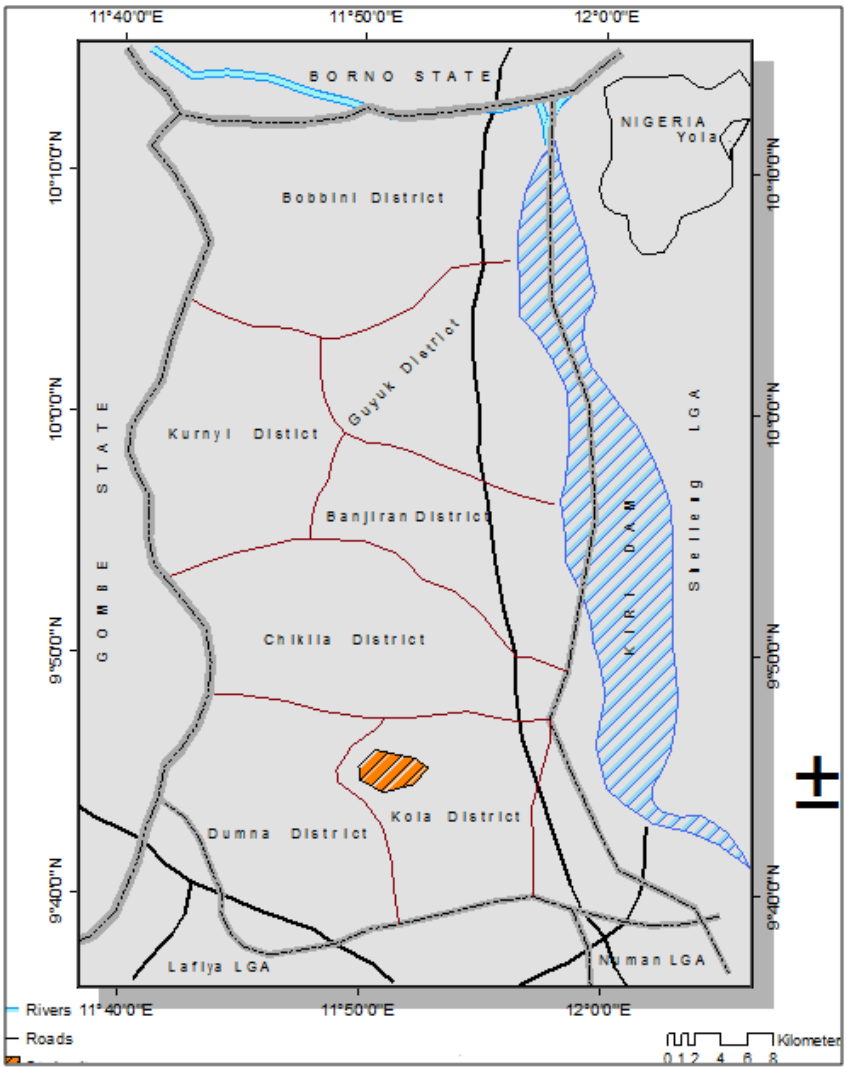

Fig. 1 : Map of the Study Area

The rainfall regime in the area is a tropical continental type of single peak toll usually in the month of August or September. The wet season ranges from April to October, with annual rainfall values of between

510 – 1040mm and dry season lasts for about 7 months. Kiri area of the Gongola valley has warm temperature with a mean annual minimum value of 18^{0}C in December and a mean annual maximum of 38^{0}C in March. The evapotranspiration is very high throughout the year. Relative humidity varies greatly during the year. It is high from May to October, which ranges from 60 – 78% but has lowest values during dry season that ranges from 27 – 35%. Table 1 shows mean monthly values of some climatic elements of the area.

Table 1 : Mean Monthly values of some Climatic Elements of Kiri

Month	Rainfall (mm)	Mean Temp (^{0}C)	Relative Humidity (%)	Evaporation	Wind speed (Km/day)
Jan	0.00	35	28	310.5	189.5
Feb	0.00	36	29	395.1	231.3
Mar	14.6	39	82	453.9	279.6
Apr	24.8	40	78	459.0	343.5
May	77.8	35	90	365.7	325.6
Jun	96.3	34	93	306.4	366.8
Jul	158.3	31	95	177.1	244.0
Aug	174.5	31	91	174.6	158.0
Sep	159.7	32	87	170.0	137.1
Oct	66.0	34	91	181.9	106.5
Nov	0.01	35	84	200.1	111.1
Dec	0.00	33	38	265.9	187.8

Source: Computed from the data obtained at UBRBDA.

III. Materials and Methods

The types of data required for this study included climatic data, hydrologic data, remote sensing images and information on the socioeconomic characteristics of the people in the study area. The climatic information was necessary so as to assist in assessing the amount of rainfall available in the area. It was also required so as to help in determining the intensity of annual flood, which is important for the development of farmlands along the river valley. Similarly, hydrologic data was important for the assessment of water discharge of the dam. Remote sensing images were required in order to assess the general changes in the water level of the dam over time and the presence of reservoirs along the river valley. It was also needed in order to assist in knowing the extent of the current land terrain as a result of changes in water level of the dam, as well as detecting changes (if any) in the physical characteristics of the dam site.

These data were obtained from two sources. These are through primary and secondary sources. Primary source involved the use of questionnaires, field observations and scheduled interviews. The data collected from secondary source included climatic and hydrologic records as well as remote sensing images. Climatic and hydrologic data were obtained from the archive of agro-meteorological data year book of the UBRBDA. Remote sensing images (landsat MSS and SPOT) of 1976 and 2014 respectively were obtained from National Centre for Remote Sensing (NCRS), Jos.

The study covered five settlements: Kiri, Tallum, Banjiram, Purokayo and Shelleng. These settlements are all located directly at the bank of River Gongola. For equal representations, each of the settlements was taken to form a cluster for the purpose of questionnaire administration. Fifty questionnaires were administered in each of the clusters. The questionnaires were issued out to the respondents in such a way that they took care of all the sub-clusters i.e. farmers, fishermen etc. The number of questionnaires allocated to each group was proportional to their total population.

The information from the questionnaires was analysed using different statistical techniques. These included both descriptive and inferential statistics. Descriptive statistics used included the use of simple percentages and measures of central tendencies in analysing the data. Student t-test was employed to test the difference in farm sizes as well as crop outputs before and after the construction of the dam. Remote sensing images were subjected to classification and change detection techniques using Integrated Land and Water Information System (ILWIS) GIS software. The remote sensing images were of two different dates, 1976 and 2014, and were analysed with the aim of assessing likely changes in the land cover around the river basin as well as floodplain delineation.

IV. Results and Discussion

This study was aimed at assessing the likely environmental and economic impacts of Kiri dam on its hosting communities. The study was deemed expedient considering the fact that such impacts have both short and long term consequences on the lives of the people living around such projects.

Findings of the study indicate that the establishment of the dam has impacted both negatively and positively on the inhabitants of the area. Negative effects seem to outweigh the advantages of the dam. This is because what are required to be put in place to

enable the local people take full advantage of the dam are lacking. For instance, fishing and irrigation equipment have not been made available and affordable to the local farmers and most of them cannot afford buying them on their own owing to high costs. This makes life difficult for them since these occupations are new to them. Meanwhile, the dam waters have overtaken most of the lands previously used for farming and grazing by the people. The dam has also brought in dangerous animals and birds particularly crocodiles, snakes and quella birds. These animals, which were not common in the area before the dam, are threats to both lives and crops.

Because some of their farmlands have been taken over by dam waters, farmers have been forced to go into cultivation of foreign and cash crops like cotton at the detriment of their former staple crops like guinea corn, maize etc. Moreover, fishes, which are supposed to be the available resources now, are reportedly scarce. Worse still, most of the farmers reported that they are not familiar with irrigation farming and fishing. The t-test result reveals that there are significant differences, at 1% level of probability, between the farm sizes and farm outputs of the peasant farmers before and after the dam in the area.

Considering the above catalogue of problems, it is not out of place to conclude that the social and economic well-being of the farmers has been inadvertently disrupted. At best, the dam can be said to be most advantageous only to Savannah Sugar Company, Numan, which draws its daily water from it for irrigating cane plantations. The commercial fishermen in the area are mostly immigrants from other parts of the country. Observations on remote sensing images also revealed a great difference in the environmental variables of the dam area before and after its establishment. For instance, the width of the Gongola River generally in Kiri area before the dam was about 2km. However, information from the Information Unit of the Dam project and analysis of images indicate that the dam presently has a catchment and dam area of 25, 000km^2 and 134m^2 respectively (Table 2). A 6.5 million cubic meters capacity of the water stored in the reservoir is an indication that large area has been engulfed by the dam structure. This is further confirms by the length (1,400 meters) of the embankment erected to contain the dam water to avoid spilling over to the other side.

Table 2 : Basic Information on Kiri Dam

Variable	Value
Catchment area	25, 000km^2
Area of the dam	134m^2
Height of the dam	20m
Length of the dam	1, 250m
Normal top water	170.5m
Lowest draw level	167.2m
Design flood (up flow)	4, 250m$^{2/s}$
Design flood (out flow)	4, 000m$^{2/s}$
Live storage	290 x 10^{6}m^2
Dead storage below	325 x 106/m^2
Dam type: Embankment	1, 400m long
Reservoir storage capacity	6.5 million cubic meters.

Source: Information Unit of Kiri Dam

Changes in variables around the dam were clearly confirmed by the remote sensing data. The 1976 landsat images, which was captured before the dam, depicts that the area was characterized with abundant vegetal cover, narrow river valley accompanied by intermix of cultivated farmlands. The second image, taken in 2014 (after the dam) shows clearly the increase in the area of dam water. A change detection results show that of the four major land cover types identified in the area, natural vegetation has suffered a decrease of over 63% in its area cover (Table 3). Settlements, farmlands and water bodies experienced some unprecedented increases in their total area due probably to population growth and of course presence of dam waters. This means that most of the land areas occupied by the dam water now used to be dry lands, most of which were farmlands. Incidentally, Salau (1986) has reported that about 20, 000 people had to be resettled as a result of dam construction. Unfortunately, most areas downstream of the dam, which used to be good floodplain areas for agricultural practices, have been disappeared and the upstream have been greatly inundated by water covering wide expanse of lands. Also, most of the trees, soils and other geomorphic features have been tempered with. The dam area has more of man-made features now than physical or natural features.

Table 3 : Changes in Land Use and Land Cover of Kiri Area (1976 – 2014)

Land Use/Cover 1976	(Hectares)	2014 (Hectares)	Difference (Hec)
Farmland	18, 221 (16.1)	35, 450 (31.3)	+17, 229 (15.2)
Natural vegetation	81, 035 (71.4)	9, 551 (8.4)	-71, 229 (63.0)
Settlement	1, 622 (1.4)	6, 382 (5.6)	+4, 760 (4.2)
Water body	12, 546 (11.1)	62, 041 (54.7)	+49, 495 (43.6)

Note: + means increase and – means decrease. Figures in parenthesis refer to percentages

V. Conclusion

This study focused on investigating the impact of Kiri dam on the immediate environment and economic lives of the inhabitants. It has been established that the dam has impacted mostly negatively on the environment and the economy. This is because farmers' farmlands have been taken over by the dam water. The inhabitants had to be resettled in the first place, thereby subjecting them to a lot of inconveniences and loss of properties. Foreign birds and animals are now common in the area imposing various sorts of threats and intimidation to lives and properties. The dam is mostly advantageous only to Savannah Sugar Company, Numan because it draws virtually all of its water for irrigation from it. Environmental components have also been tempered with in a great way. The aims for which the dam was constructed has not been fully achieved. This aim should be vigorously pursued so as to compensate for the lost environment and threatened human lives.

VI. Recommendations

Based on the findings of this research, the following recommendations have been presented:

- Government should conceive plans for the provision of projects and programmes in the areas of health, housing, rural development as well as other social services that will improve the living standard of the people in the area.
- Immediate communities should be provided with adequate and appropriate facilities and training in dam related vocations like irrigation and fishing to enable them take good advantage of dam reservoir.
- The area should be provided with enough agricultural extension workers so that they can train the farmers on the types of crops to be planted on different lands and how to embark of effective utilization of water for fishing.
- Regulation on minimal mesh size nets is essential of juvenile fish, which would seriously endanger the yields of future years. This is because it was observed that women and children use mosquito nets to catch young fishes that are at the edge of dam waters due to tidal waves.
- Priority must be given to coherent programmes that will deal with rational forest exploitation, energy saving methods and development of alternative energy sources for sustainable development. This is because large scale degradation of natural forest has occurred in the dam area.
- Government should provide enough incentives and encouragement for the farmers to participate in developing the over 400 hectares of land in the dam area and 12 large fish ponds at Tallum.
- There is need for the Department of Pests and Diseases Control to take care of controlling the menace of quella birds and other birds relating problems.
- Communities should be provided with water treatment plants so as to eradicate the problem of water borne diseases.

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African Myths on Climate Change and Environmental Degradation and Challenges of Development in Africa

By Nina Perpetua Waapela
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Abstract- African religion is a collection of the belief systems of Africans. It is one of the oldest religions of the world practiced in both rural and urban centres in Africa. The religion is known to possess many myths which play profound roles and strongly influence the understanding of the African environment, history, geography, religious ideas, medicine, and their social organisations. This paper unearths some African myths that have led to climate change and environmental degradation. The research employed extensive library study in collecting data on African myths, especially of West African peoples, which relate to climate. The paper relied on the anthropological and comparative methods of data analysis. The article is organised into segments. The first section is the introduction while the second locates the concepts of climate change and environmental degradation. The third segment identified African myths that promote climate change and environmental degradation along with their effects on the development of Africa. The research found that, African religion, besides its principal function of helping humans to live in harmony with God, the deities and with nature, possesses a certain measure of mythological dispositions leading to practices that result in bush burning/smoke emissions, earthquakes/landslides, desertification, drought, excessive rainfall and flooding, greenhouse effect, and locust invasion among other things.

GJHSS-B Classification : FOR Code: 040104

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Nina Perpetua Waapela

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I. Introduction

Colonialism has wiped out much of the African past and put on ground institutions and practices which are, to say the least, foreign to the African. However, many aspects of the African culture and tradition such as myths are still intact and provide an authentic way of understanding the African thought system, philosophy, religion, and world-view. A myth is a representation of reality. It is the moving history of transcendental entity, the sacred lore of the theological depositum of a people. Little wonder, Malinowski as cited in Metuh (1992 p.19) calls myth, "the pragmatic character of primitive faith and moral wisdom". Characteristically, myths are not usually dated, nor do they have specific authors. They are also narrated anonymously and defy any exact or logical thinking. Their message is forceful and their main aim is to produce immediate connection and acceptance.

Some African myths contain beliefs that are harmful to the environment but which are still tightly on to by Africans despite local and international efforts to preserve the environment. This is why UNESCO decided to deliberate on this issue and reached an agreement for member nations on protection of the cultural and natural heritage. Amokaye (2004) explained further:

> Although cultural and natural heritage is … regarded as an important impetus to conservation and biodiversity, the need for an international agreement for the protection of natural and cultural heritage is understood by the widespread destruction of many natural and scenic sites and historic sites of importance. (p.201)

To enable a better understanding of this discourse, the next segment throws light on the concepts of climate change and environmental degradation.

II. Climate Change and Environmental Degradation

Climate change has been found to have direct impact on agriculture, bio-diversity, coastal and forest areas as well as water resources among many other things. The term climate change could be defined as:

> A long-term change in the statistical distribution of weather patterns over periods of time that range from decades to millions of years. It may be a change in the average weather conditions or in the distribution of weather events … and may be limited to a specific region, or may occur across the earth. (*Wikipedia*, 2010)

The causes of climate change are attributed to natural processes such as variations in solar radiation which, both in the long and short terms, cause changes

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in atmospheric conditions and denation in the earth's orbit. Further, ocean waves redistributes heat by a slow and extremely deep movement of water which in turn results in the seasonal distribution of sunlight reaching the earth's surface and how it is distributed across the globe. Climate change is also caused by anthropogenic (man-made) factors which could be direct or indirect. At present, there is a consensus that human activities are the main cause of the reported rapid global warming over the past few decades. Such human activities include burning of fossil fuels like coal, gas, oil and wood and other contaminations. These collectively lead to environmental degradation. Environmental degradation thus is a product of several inter-related activities by humans upon nature. Some are either slow or fast and even encourage degradation of natural ecosystems. The effects of these activities of humans include desertification, bio-diversity loss and ozone layer depletion among others.

a) African Myths that Promote Climate Change and Environmental Degradation and their Effects on Development in Africa

Humans are the head of God's creation. And, the object of the African is to live in harmony with God and nature. Any attempt to threaten or weaken this communion, the harmony and integration of the whole is what Metuh (2004) calls, "the first evil … [which] would spell disaster both for humans and [their] immediate world" (p.71). However, when this unfortunate situation occurs, Africans carry out divinations, consult oracles and engage in rituals to ensure that they are at peace with the forces of the world and repair any damage which may have occurred in their relationship with nature or the environment. In spite of these efforts by Africans they still hold unto, they have continued to hold unto some cultural and religious beliefs that disrupt nature's balance. A few of these myths that have informed Africans' habits and have impacted negatively on the environment, causing climate change and environmental degradation and posing serious challenges to development on the African continent are reviewed here under.

b) Myths on Bio-diversity Depletion

There are African myths that threaten the survival of bio-diversity in Africa. These myths connect the origin of the death of biotic elements such as animals, plants and humans. The myths depict God as wearing away, demolishing, destroying, disrupting and causing disintegration. Some of these myths contend that, the catastrophes came as punishment for men's evil doings" (Mbiti, p.85). In Zambia, for example, the Ila myth presents God as, "He who takes till there is only one left" (p 84). In Nigeria, a Yoruba myth explains death as the creation of God, and the Edo have a "king of death" who takes away people when the time to die has come. The people thus make sacrifices to him in the hope that he will delay his mission. To some other Africans, there is a divinity of death to which people are believed to go and report themselves when their human life is over.

Owing to such mythical dispositions, Africans unknowingly engage in practices that lead to bio-diversity depletion such as bush burning and burning of animals for sacrifice which brings about climate change and the challenging weather conditions that affect man, animals and plants.

c) Myths on Earthquakes and Landslides

There are African myths that explain the origin of earthquakes across African sub-regions. A myth among the Watumbutu of Zanzibar-Tanzania holds that, "Earthquakes occur when the cow, which is believed to carry the world, gets exhausted and changes the globe from one horn to the other" (Mbiti, p.145). The Shona of Zimbabwe hold that God walks in earthquakes while the Bavenda of South Africa take earthquakes to be one of God's means of self-revelation. In Kenya, the Nandi myth holds that earthquakes occur when God is taking a walk or when departed kings are moving around. Similarly, in Uganda, the Basoga myth reveals, "There is a divinity of earthquakes supposed to cause the earth to quake when God is traveling" (Mbiti, p.145). This is similar to the Ankore and Kiga of Uganda who have earthquake divinities thought to be responsible for causing earthquakes. Supporting this belief many Africans hold that, "Earthquakes are caused by the spirits changing houses" (p.145). Consequently, the Basoga have a shrine beside the rock thought to represent the earthquake divinity, where they take offerings and pray to avert earthquakes. With such beliefs and other similar ones, many other Africans, do not see themselves as having a hand in causing earthquakes. They thus continue to engage in unsuitable land use and management that results to landsides and erosions. Indeed, of the many physiographic factors that have increased the severity of flood in recent times, poor land use and management are the most common.

Earthquakes constitute 15% of the natural disasters (Ologunorisa, 2006 p. 33). In Africa, earthquakes occur fairly frequently in and near the region of the Great Rift Valley which stretches across Africa from Ethiopia through Kenya, Tanzania, and Malawi to Mozambique, with branches into Zambia, Eastern Congo (Kinshasha), Burundi, Rwanda, Uganda and the Southern Sudan. In reality however, earthquakes have man-made causes. In Nigeria, for example, a land slide and near-earthquake experience occurred in year 2011 and 2012 in an Igbo community known as Umusaukpu. Umusaukpu community is located at the fringe of Umusaukpu/Omiri River, in Igbo-Etche Local Government Area of River State. Revealing the causes of the landsides, O'neil & Nwisi. stated:

> The … concrete drainage project initiated by Anglo Dutch oil giant, Shell Petroleum Development Company (SPDC), in the community in 2011. … rather than completing the job, the contractor stopped halfway after he had connected the rest of the community to the water channel,) … The flood continues to increase in strength, weight and speed as it makes its way into the river. Unfortunately, when it got to a point it lost sense of direction and since the direction it met at this point is a mere surface, which is helpless to the speed and weight of the flood current, instead of flowing smoothly, it eats deep and continues to expand with … time, creating the life-threatening gully around our residence. (p.21)

From the submission of these writers, the landside was a made-made disaster and not caused by gods or spirits as suggested in some myths. This erosion did not only wash away their homes and business premises, it also separated them from their kith and kin, posing a threat to their survival. For example, the erosion has cut off the main entrance to their community and stream. Also, fishing, which is their main source of livelihood, has bleak prospects because of lack of access to the river (O'neil and Nwisi p.20, 2012).

d) Myths on Desertification and Desolate Places

Desertification is experienced in every continent except the Antarctica. It is normally a very slow process and can only be assessed over decades of observation. Desertification has been generally agreed to refer to, "those formations and expansions of degraded soil, and not the advancing movement of the current deserts" (Amokaye, 2004 p.239). Desertification occurs in croplands (irrigated and non-irrigated), pasture and woodlands. The borders of the deserts expand and shrink cyclically with fluctuation in the climatic conditions and rainfall. Social processes such as loss of soil and loss of natural vegetation and natural processes such as long-term biological, geological and climatic evolution or fluctuations such as short rainfall all play important roles in causing desertification. In Africa, desertification is largely caused by human's destructive activities such as indiscriminate felling of trees. In Nigeria for example, Aimufia 2002, Umeh (1986), Ogigirigi (1986), their separate studies, all asserted that deforestation has wrecked untold havoc to the Nigerian ecosystem. Harris (1997), Udo (1990), Onumadu and Mbakwe (2001), Abu and Adebisi (2002), all are in agreement that the quality of many of the basic elements of the natural resource-base (air, water and soil) are deteriorating fast as a result of deforestation. According to Amokaye (2004):

> Nigeria is presently losing about 351, 000 square km of its landmass to the desert which is advancing southward at the rate of 0.6km per year. The outward and visible sign of desertification is the gradual shift in vegetation from grasses, bushes and occasional trees to grass and bush, and in the final states, extensive areas of desert-like sand. (p.240)

Some African myths and traditional beliefs encourage and promote desertification and/or desolate places. Many hold that God in His immanent aspect lives in desolate places and waste lands where people fear to go, build homes or make fields. Also, some hold deserted places as sacred and lonely abodes for the divinities. "Such places often become centers of African rituals, mythology and priesthood" (Mbiti, 1970 p.151). He further affirms:

> Before the Europeans came to this land, the Shona [Zimbabwe] had already made the Zimbabwe ruins a sacred place where they held solemn assemblies every two or three years. At these assemblies, which lasted for three days, the people approached God with offerings, sacrifices and prayers. (p.151)

Yet, among some Africans when one is about to become a diviner, he or she first retires into a desert for a period lasting from one day to several months. On returning home, he or she begins "the profession of receiving prophetic dreams, healing, combating witchcraft and curing barrenness" (Mbiti, p.151).

As a result of such myths, many Africans are blinded to the negative effect of desertification and/or celebrated deserted places. They do not consider activities like bush burning, careless land cultivation, deforestation, and over-grazing among others, which create such desolated places, as degrading the environment. The implication of such erroneous religious beliefs is that, it becomes increasingly difficult to deter the people from felling trees randomly- the major factor that is fast-tracking desertification with loss of farmland and water resources, leading to death of livestock in large numbers from hunger and thirst.

Another implication of such African myths on desertification is that, many Africans now are being displaced and population densities in certain geographical zones are rising, precipitated by mass exodus by inhabitants in search of greener pastures with the attendant problems of pressure on the inhabited zones. In the northern part of Nigeria, for example, especially in Borno, Cross River, Katsina, Sokoto, Yobe and Zamfara States, people are facing difficult times due to gradual encroachment of the desert on which. It has snatched their lands. In Borno State for example, desertification is ravaging Adadam, Kukawa, Gamboru-Ngala Kala-Balge and Mafa Local Government Areas among others. In Cross River State, Buanchor and Katbang Boki Local Government Areas are greatly affected while, in Katsina State, Batsari, Daura, Kaita, Jibia and Mai'adua communities and Zango and the communities sharing borders with Niger Republic are points of reference. The affected Local Government Areas, according to Muhammed, "are Isa, Sabon Birin,

Gada, Ilella, Tangaza and Gada" (p. 15). These places are indeed the worst hit because 85% of the people rely on firewood for cooking. Also, the River Yobe is threatened by siltation with the attendant effects on fishing and irrigation. Similarly, the borders of Nigeria like the famous Lake Chad which enjoyed a high profile as a fishing centre and served as a bed of roses for over 30 million people in Borno and Yobe states in Nigeria as well as other communities in Niger and Chad, Cameroon and Central African Republic is a near shadow of itself in the last few decades, as it has equally fallen victim of climate change precipated by desertification. Statistics from experts show that:

> The lake has shrunk from 25,000 to less than 2,000 square kilometres. … reduced to less than 10 percent of its original size in the last 50 years (14). Indeed, desertification is advancing southward at the rate of 0.6 kilometres per year, especially along the Niger Republic/Nigeria border. (Idris, H. Yahaya, I., Yushha' u A. I. & Rakiya, A. M. p.14)

The trend will continue unabated as long as Africans hold on tenaciously to myths that encourage desertification and glorify desolate places. However, the situation may be controlled if the myths are put in right perspective.

e) Myths on Drought, Famine and Locusts

According to Ibrahim (2002) and Barau (2004), cited in Muhammed, B. & Muhammed, K. (2009, p.138), drought is associated with periods of inadequate rainfall and prolonged dryness. It causes people and animals to starve while vegetation wilts and dries to the point of elimination within the environment. There are different types of droughts. These include hydrological (decrease in underground water), meteorological (delay in rainfall expectation), agricultural (insufficient moisture at stages of plant growth) and ecological (imbalance in an ecosystem due to abnormal decrease in rainfall) droughts. Locust on the other hand, is very dangerous species of grasshoppers-like insects. According to Muhammed, R.A, *etal* (2012).

> When environmental conditions produce many green plants and promote breeding, locusts can congregate into thick, mobile ravenous swarms. Locust swarms devastate crops and cause major agricultural damage and attendant human misery-famine and starvation. Its swarm can be 460 square miles (1,200 square kilometres) in size and pack between 40 and 80 million locusts into less than half a square mile (one square kilometre …. (p.26).

The desert locust inhabits about 60 countries and can cover one-fifth of the earth's land surface. Locust invasion can be life threatening for humans, plants and animals.

There are African myths which explain the causes of droughts and locust invasion which bring about climate change and environmental degradation away from modern agricultural experts. In such myths, Africans regard God as both creator and destroyer. According to an African myth, drought is one of God's methods of revelation by means of which He punishes men when He is angry with their chief and/or "punishes disobedience" (Mbiti, p.84). The Azande of Sudan too associate drought with God. In times of drought, the Nuer of Sudan, like the Male of Ethiopia, Nyanja of Malawi and Zambia, Ngoni and Suk of Kenya, accept calamities as God's will and "they do nothing, as they are beyond human control" (Mbiti, p. 84). In some cases, they pray and make offerings to God, pleading for His help. Consequently, in some African communities, when there is drought, human beings are killed for purposes of purifying and restoring the environment to normalcy. The Shona of Zimbabwe, for example, "kill a child when they are in desperate need of rain" (Mbiti, p.188).

Africans myths on locust invasion are varied. One such myth holds that locust invasion and other calamities are a manifestation of God's power. According to this belief, locusts are kept in a box by God and/or a spirit which, when God bids, lets loose these voracious pests to spread everywhere, causing destruction upon the earth. The Bavenda of South Africa have a myth which holds that, "the locusts live in an enormous cage in the sky which God opens, thereby letting loose these voracious pests" (Mbiti, p.84). Similarly, the Sukuma-Nyamwezi of Tanzani, it is believed that locusts are kept in a box and when the lid is opened, they spread everywhere, causing destruction upon the earth.

Such myths influence Africans to perpetrate climate wrecking habits. The implication of drought is that farming, the main occupation of the African people cannot take place at any meaningful level. Drought, is a major environmental problem affecting most parts of the Nigerian northern states. According to Idris, H., Yahaya, I., Yushha' u A. I. & Rakiya, A. M., "… drought is responsible for the loss of about 351, 100 square meters of the nation's (Nigeria) land mass" (p.14). Muhammed, B. & Muhammed, K. revealed that, "Borno State has suffered from fifteen years drought from 1966-1999 resulting in famine. … During the 1972-73 droughts, about 3000,000 animals and farm yields dropped by up to 60%" (p.138). Desert locusts threaten the economic livelihood of one-tenth of the world's humans. Although they occur in many parts of the world, at present, locusts are most destructive in subsistence farming regions of Africa. In Nigeria, swarms of locusts have invaded farms in some parts of Sokoto State, having been chased away from Bauchi State from where they headed towards Jigawa state and finally moved into Niger Republic. In Sokoto State, according to Muhammed *et al* (2012), "large numbers of locusts have sacked some farmers from their farms in Wamakko,

Silame, Gwadabawa, Wurno, Tangaza, Binji, Ilela, Goronyo, Bodinga, Gudu, Dange/Shuni and Gada Local Government Areas and taken over their farms" (p.26). In Kogi State, farmers are used to killing insects that destroy their farms even though they have never experienced locust invasion. They added that in case of any invasion by insects, they will still use the same chemicals to protect their farms. Apart from locust invasion, there are various other insect invasions such as tsetsefly which causes a disease in humans known as trypannosomiasis and Nagana in animals. The disease results in ill-health, shortage of farm labour, and rural poverty. In Nigeria, the situation is particularly alarming. According to Bello.

> Here tsetse fly population is so widespread. It is estimated to cover about 80 per cent of the country's total area. Much of this land is suitable for both crop and livestock production but rendered unusable by the deadly pests. This, in turn, has a negative impact on the country's ability to produce enough food, making hunger and malnutrition a sad but present reality. (p.49)

In Nigeria, it is worthy noteworthy that tsetse fly invasion had happened before 2003, but the areas were reclaimed. Unfortunately, the reclaimed areas reverted to infested areas. Also, in Nigeria, the Gambian sleeping sickness is a threat, mainly in Delta State. The net effect of drought and locust invasion is famine, hunger and malnutrition.

f) Myths on Fire and Smoke

There are a considerable number of concepts connected with fire in African religion. Many Africans believe that God gave fire to man as a gift when he said, "Let firewood be fetched that a fire may be kindled, and food be dressed" (Mbiti, p.152). To some other Africans, one of God's manifestations is that He eats fire. The Lugbara of Congo and Uganda believe that in God's immanence, He may be heard crying, "whee whee whee" in grass fires on hills or mountains" (p.152). The also hold that when God wants to communicate with their chief, He appears as a great fire near the Kraal and the fire always disappears before any person can reach it. With such a strong belief associating God with fire, and its negative implication is that it is not uncommon to hear Africans, particularly Nigerians, argue in favour of bush burning. Africans believe that burning of fields hastens the re-growth of grass for the grazing of animals.

Further, Africans have smoke generating practices which they use as signals for communication in the traditional settings. The thick clouds of smoke from the burning of fossils are used to convey cultural and political messages are uncommon. South African communities for example for example, a thick white smoke that goes straight into the air symbolises that, "A prominent son of the community had been either killed or kidnapped by an enemy" (Ayoo, 2007 p.125). Village council meetings are also summoned urgently through smoke. In Nigeria, among the Tiv of Benue State, a thick cloud of smoke on a hot afternoon symbolises a hunting expedition, while some African ethnics keep or use a "holy" fire for religious purposes. The Ganda of Uganda, for example, have a temple fire which burns both day and night and which is cared for by virgins. Among the Herero group of South Africa, there is a sacrificial place near the village centre which has a sacred fire burning on the altar. The people believe that, "the welfare of the village is connected intimately with that of the fire. It is never allowed to die, as this would symbolise the extinction of the nation" (Mbiti p.153). Mbiti further reveals a similar practice among Gikuyu of Kenya:

> When the crops begin to bear, the Gikuyu hold a ceremony to purify them. Part of the ceremony involves lightening the holy fire from all the sacrificial items like wood, bones, hoofs ... then four groups of the officiating elders carry this fire in the form of a torch to all the districts in the east, south, west, and north. The people look upon it as a 'purifying flame" and wait in their fields to catch it with grass and twigs, after which they carry it to their homesteads where the old fires have already been extinguished. The fire is not allowed to die out until the next season when a new based fire is lit and the ceremony repeated. (p.153)

Despite the arguments for such smoke and bush burning myths and practices, smoke and bush burning are serious causes of atmospheric contamination which reduce the quality of the air. These produce carbon dioxide which traps solar heat in the atmosphere, partly in the same way that glass traps solar heat in a survisom or a green house. Also, fire and smoke, though considered sacred and holy, emits carbon-dioxide and gases into the atmosphere increasing the earth's temperature which leads to global warming, the depletion of the ozone layer and depletion of phytoplankton--the earth's primary source of oxygen. Other effects of fire and smoke emitting practices on human health are that, they contribute to various respiratory and eye diseases, carcinogens and hasophargeal cancer common to women, especially those who have been exposed to fire and smoke from childhood.

g) Myths on Hail, Mist, Hurricanes and Wind

Some African myths portray hail, mist, hurricanes, storms and wind as manifestations of God. In some West African societies, the people interpret hail as God's punishment for innovations or departure from the established course of things. Yet, others hold that hail indicates that God is arming himself. The Tiv of Central Nigeria for example, holds that when hail falls, God is shooting darts. The Yao of Ghana and the neighbouring people have a myth on mist, which holds

that mist is sent by God to keep the sun from burning up the crops. Others take it to be the manifestation of the queen of heaven who is said to come and move many at spring time.

A number of African myths use the metaphor of the wind to speak about some aspects of God. Some describe His omnipresence by saying that He (God) is everywhere– in the wind and whirlwind. Yet, some African myths hold that, "god descends on the wings of the wind. Others consider the wind to be one of God's vehicles by which means He travels in great power through the sky" (Mbiti, p.121). In Nigeria, a Yoruba myth, for example, conveys the belief that there is a divinity of heavy wind which precedes rain.

African myths on hurricanes indicate God's anger expressed in storms, through which He comes to make His wishes known to their chiefs. In the case of potent storms, the belief is that "they are caused by the swinging to and fro of God's beard which He uses to punish people for their wicked tasks and actions" (Mbiti p.142). This explains why, when Africans see a thunderstorm, they become frightened and burn incense to God, praying that He would avert the storm or command it to take another course. As a consequence, "storm deities exist in many parts of West Africa with temples, priests and religious worship" (Parrinder, 1974 p.46). The Ashanti of Ghana, the Ewo of Dahomey, the Yoruba and Igbo of Nigeria have storm pantheons. Among the Ashanti, thunder is associated with the Supreme God who has "thunder stones". The Ewo of Dahomey too has a borrowed idea of a storm god. There are thunder stones, double headed axes, and symbolical rams in their cults. In Nigeria, the Yoruba, *Sango* (god of lightning and thunder), is worshipped by the Yoruba. Annual rites are performed here. Before the yam harvest, chickens are sacrificed to *Sango* and shared among worshippers and the village chief.

As a result of the belief in such myths, Africans ignore the fact that, their own activities, especially indiscriminate felling of trees, eradicate storms. They now face the devastating effects of wind, storm and mist. Research reveals that, one of the negative effects of windstorm is that it blows away fertile soils thus rendering the soil largely barren such that it cannot support crop production or it becomes difficult to have a good yield. This may be why many African lands have become grossly infertile and have to be supported by artificial fertilizers for better yields.

h) Myths on Rainfall and Flood

The most frequently occurring natural hazard that causes the greatest damage to the earth is excessive rainfall and flood. Excessive rainfall causes flood. A flood is any relatively high flow that over-tops the artificial or natural banks of any stream within reach. It is also regarded as, "an over flow of or inundation that comes from a river or other body of water and causes or threatens damage," or simply a "deluge or inundation" (Ologunorisa, 2006 p.32).

Africans, particularly West Africans believe that, "it is God who regulates this balance and they look to God as being behind the 'balance of nature" (Mbiti, p.67). Generally, Africans have many myths that "conceive God as the Rain Giver" (Mbiti, p.59). Some of these myths hold that, the overflowing of rivers, seas, and flood are generally linked to God. They also contend that, "When God speaks, it is reported that a nearby well overflows" (p.147). The Akan of Ghana for example, speak of God as the "Giver of Rain" who causes rain to fall piously and makes water to overflow without ceasing. The Ila of Zimbabwe have a myth which refers to God as, "The flooder", no doubt in connection with the annual flooding of the Zambezi River whose northern bank they inhabit. Other African myths that refer to God as the great deluge and the flooder or his agents are those of, "The Ashanti, Chagga, Dorobo, Herero, Nandi, Yoruba and other peoples, especially in the region of the Congo Basin and the Niger Delta" (Mbiti, p.146) of Ghana and Ivory Coast, Tanzania, Kenya, South Africa, and Nigeria. This myth is corroborated by the Christian and Islamic beliefs that the Creator sends such occurrences to check people's excesses. Both religious thoughts affirm that when Noah called His people to the path, and they remained obstinate, the flood was sent (Qur'an 71:25 and Genesis 7:13-17).

The African myths that revere flooding also hold that flood water leads to reduced stream pollution and provide opportunities for fishing, recreation and agricultural expansion since farming holds back the excess flood-water after the flood has receded. Others contend that floodplain soils are normally more fertile and easier to till than those of the flat land and the uplands and that floodplains are less costly to build on. The implications of such mythological dispositions, Africans have always had greater emotional affinity for riversides and floodplains suited for farming. Practical evidence of the Africans' attachment to flood plains is their early settlements along the valleys and floodplains of the Nile, Tigris, and Euphrates, Indus and Hwang Ho and other floodplains which gave rise to the emergence of Ghana, Mali and Songhai empires. At present, the Ganges Delta and the Hwang Ho floodplains are some of the most densely populated parts of the world. The Nok culture in Nigeria also developed on the floodplains of the Niger. Research have also revealed that some farmers along the lower zone of floodplains have adapted their crop patterns to annual overflows so much so that they would be disappointed if flooding were to fail. As though not enough, some traditional Nigerian peoples engage in ritual acts to God/divinities and the ancestors for rain making. These acts of rain making, when excessive, lead to environmental degradation by the occasioned floods, and the washing away of the earth's surface. With such myths and practices, "floods

are not only beneficial to the Africans but also desirably necessary for the sustenance of life" (Ologunorisa, 2006 p.36). These which have given rise to such popular sayings as, 'Egypt is the Nile and the Nile is Egypt' 'No Nile, No Egypt;' and "Nile gives life to the Egyptian desert'.

As a result of the belief in these African myths on flood and the settlement on African peoples on floodplains, valuable forest resources continue to be harvested on the Amazon floodplains by the inhabitants of such settlement areas. Little wonder, also that, nothing is done by traditional Africans to create good drainages to channel water so as to avoid erosions like the indiscriminate dumping of refuse. Another worrisome practice that exacerbates flooding is. Indeed, according to Bamidele, "It is on record that people are the habit of disposing refuse in the river channels while the shallowness of these channels coupled with the unplanned layout of streets and building are not helping matters" (p.4). Yet, Africans are never foresighted enough to know that, their activities encourage flooding which in turn causes untold hardship for them. For example, floods pollute the fresh waters of the rivers, giving a reddish colour to the water during the dry season. Some farmlands and sometimes even settlements along main banks suffer partial or total submergence and/or are washed away during floods in some cases. In Nigeria, for example, the Ogunpa floodings experienced in Ibadan as far back as August 30, 1980 and 1981 are pointers. For example, in 1981:

> August 31st, the Ogunpa River flowing through the city of Ibadan over flooded its banks and all features encroaching on its floodplains. Over 200 persons perished in that flood (*Oyo State Year Book* 2). The series of floods which hit the city of Kano between August 6 and 14, 1986 culminating in the collapse of the Baguda dam is estimated to have claimed a total of over 100 lives. (Ologunorisa, 2006, p.38)

In August, 2011, a flood disaster in Ibadan, the Oyo State capital, claimed over 100 lives and ruined property worth billions of naira. A similar scenario replayed itself in Bayelsa, Benue, Cross River, Edo, Lagos, Kebbi, Oyo and Ogun States and other parts of the country in year 2012, when the ravaging effect of flood was even worse and more pathetic. In Ibadan,Oyo state, for example, several locations and bridges were flooded including Apete, Odo-Ona, Oloni, Oluqule, Ayegun, Ode-ona Elewe, New Garage and other places. "It was a pitiable sight-seeing people of varied categories getting drowned" (Dele, p.4). In the Lagos State metropolis, areas of the city badly affected, according to Haruna, A. and Ezeobi, C. (2012), included:

> Murtala Muhaammed International Airport Road, Apapa-Oshodi Expressway, Yaba, Surulere, Gbagada, Oworonshoki, Mafoluku Oshodi, Iyana-Ejigbo, Isheri-Osun, Berger/Alagbole Road, Ajegunle Ikorodu Road, Ogijo, and Odogunyan. On the Lagos Island, many roads in Ikyoi, Victoria Island and Lekki were also flooded. (p. 8A)

Other worse hit areas were the mainland areas covering Ogba, Ikeja, Orile-Agege, Alagabado, Iyana-Ipaja, Ipaja, Ayobo, Moshalashi, AIT road, Killington, Oke -Ode and Ahamadiya where a portion of the expressway collapsed. Also affected were Arowojobe and Akinwunnmi estates in Maryland as well as parts of Ikeja GRA, Dophin Estate, Ikoyi, highbrow Victoria Island, VGC and Ibeju-Lekki, the Lagos-Abeokuta Expressway into Ijaiye bus stop near Abule-Egba particularly in Ajegunle covering the JMJ quarters, Apiri, Emodi, Ashafa, Alyenero, parts of Ogbewankwo and Olayinka streets located within Ajeromi Ifelodun Local Government Area of the metropolis and the Ijora Baida area.

i) Myths on the Sun

While the world is lamenting on the increased temperature which results in denation in the earth's orbit, and which has led to changes in the seasonal distribution of sunlight reaching the earth's surface, Africans continue to engage in activities such as tree felling which exacerbate the situation. Many Africans, particularly, West Africans believe that sunshine and the "moving" of the sun across the earth symbolises the presence of God. To them, the sun produces light, warmth, and a change of seasons, causing crops to grow and ripen. For this reason, they rarely reflect on the negative impact of the sun on the ecosystem. This orientation has informed the wanton felling of trees by Africans. Indeed, many Africans are yet to know that trees and/or thick forests are buffer zones for various atmospheric occurrences and balance of vital gases such as oxygen and carbon-dioxide, essential for the survival of living things. According to Umoren (2012):

> Apart from the life trees give, [they are] known to be very useful in sinking carbon dioxide which is a major contributor to greenhouse gases and replenishing the air with oxygen coupled with the aesthetic value [they] add to the environment ….. Trees also reduce the greenhouse effect by shading houses and office buildings. This reduces the need for air conditioning by up to 30 per cent, which in turn reduces the amount of fossil fuels burned to produce electricity. (p.39)

The combined roles of carbon-dioxide removal from the atmosphere, carbon storage in wood and the cooling effect make trees extremely efficient tools in fighting the greenhouse effect. Also, trees have been identified as a useful means to help curb respiratory diseases like asthma. These activities of Africans which enhance the negative effect of the sun on their

environment are gradually leading to global warming which is increase of the average temperature of the atmosphere, ocean, and land masses of the earth (*Microsoft Encarta*, 2007).

III. Recommendations

To mitigate the disastrous effects of climate change and environmental degradation occasioned by the mythical dispositions of Africans, the following are recommended:

- African Governments, Non-Governmental Organisations (NGOs) and Community Based Organisations (CBOs) should endeavour to sensitize people particularly those in rural areas, on the causes and effects of desertification and droughts. They should also teach the people land conservation techniques.
- African Governments should set up a task force against settlement on Flood plains and throwing refuse into drainages". This will go a long way to prevent blockages that lead to flooding and the destruction of lives and property.
- African Governments should build more drainages in the affected areas and dredge already existing ones to prevent cases of overflow. This will spur fishing, irrigation and other economic activities.
- Professional stakeholders should relentlessly harness weather prediction and analysis, embarking on state tours to educate the African rural and urban dwellers in the local dialects on the challenging weather conditions and the need to adhere to weather alerts and warnings.
- African Governments through their Ministries of Environment should embark on vigorous annual tree planting. To achieve this, Ministries of Environment and Natural Resources could raise 4-20 million seedlings of various tress and commence planting as soon as the rains set in. Two models of tree planting can be adopted; the community and private woodlots and school programmes, among others.
- African Governments, especially the government of Nigeria, should reconstruct the many bad roads in the country.
- Any measures taken to address desertification will be in futility unless the people of Africa, are provided with alternative sources of affordable cooking fuel.

IV. Conclusion

African myths play a significant role in the mysterious force that keeps the universe going. Whether these roles are positive or negative, especially as they relate to climate change, is of little or no concern to people. Thus, even when they see the negative effects of the myths on the environment, they continue to hold unto those religious beliefs that encourage harmful environmental practices. The people believe that these practices can ensure abundance of crops and long life. Unless such practices are discontinued, all efforts towards environmental preservation will be futile, in Africa and in the whole world.

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Modeling Retention Indices of a Series Components Food and Pollutants of the Environment: Methods; OLS, LAD

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Abstract- The gas chromatographic retention indices for (89 pyrazines of test and 25 of validation) on O V-101 and Carbowax -20M are successfuty modeled with the ald of a computer and the Software system. Structural descriptors are calculated and multiple linear regression analysis are used to generate model equations relating structural features to observed retention characteristics then was treated with two methods. The detection of influential observations for the standard least squares regression model is a problem which has been extensively studied. LAD regression diagnostics offers alternative dicapproaches whose main feature is the robustness. Here a nonparametric method for detecting influential observations is presented and compared with other classical diagnostics methods. Comparisons are between models generated for the two stationary was carried out with two methods, and descriptors that may encode differences in solute interactions with stationary phases of differing polarity are discussed and validated results in the state approached by the tests statistics: Test of Anderson-Darling, shapiro-wilk, Agostino, Jarque-Bera and the confidence interval thanks to the concept of robustness to check if the distribution of the errors is really approximate.

Keywords: *LAD Regression, Robustness, Outliers, Leverage points, tests statistics.*

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I. Introduction

Some compose food are volatile heterocyclic which are found in a natural way in our environment and the attraction which the men test for the flavours is ever contradicted during centuries and which have an interest in multiple fields, in particular in the food like flavour. Their presence in food results mainly, of process requiring a stage of cooking (partial or supplements), Egyptian civilization already used them for the kitchen.

In the evaluation of the environmental risks, information on the fate in the environment, the properties, the behavior and the toxicity of a chemical substance is fundamental need.

The volatile heterocyclic also constitutes a significant family of odorous molecules, particularly interesting in the field of the chemistry of the flavours. They represent more than one quarter of the 5000 volatile compounds insulated and characterized to date in our food.

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Pyrazines are heterocyclic very present in our food. More than 80 derived from pyrazines were identified in a great number of cooked food, like the bread, the meat, the torrefied coffee, the cocoa or the hazel nuts; they are very powerful aromatizing compounds.

Mihara and Enomoto (1985), described a relation structure/retention for a unit of substituted pyrazines for which the increments of indices relating to various substituents on the cycle were given for a small series of substituents present. The method was then extended to integrate others substituents, by adding a term which takes account of the position on the cycle of a substituent compared to the others (Mihara & Masuda, 1987). In a similar approach, Masuda and Mihara (1986) describe the use of indices of connectivity modified to calculate in advance the indices of retention of a series of substituted pyrazines. The methods lead to good results, in so far as the increments of indices determined in experiments available for the unknown compounds are implied, which constitutes their principal defect.

Stanton and Jurs (1989), used methodology QSRR to develop models connecting the structural characteristics of 107 variously substituted pyrazines, with their indices of retention obtained on two columns of very different polarities (OV-101 and Carbowax-20M). The equations were calculated using the multilinear regression, the choice of the explanatory variables (topological, electronic and physical properties) being realized by progressive elimination (Swall & Jurs, 1983), among the 85 individual molecular descriptors obtained for each whole molecule. The indices of retention (IR) obtained on each column were treated separately, while drawing from the same sets of descriptors. The models calculated with 6 explanatory variables provide high standards errors (S = 23 units of index - u.i. - on OV-101 and S = 36.33 u.i. out of Carbowax -20 M) which do not predict good predictive capacities for these models, and which let suppose nonlinear relations between descriptors and property (IR) studied.

The objective of this work aims at using methodology QSRR, the approach Method LAD /Least square (LAD/OLS), to model the indices of retention of (114) pyrazines reported from Davit T. Stanton and Peter C.Jurs (1989) and reported from Mihara and Enomoto

(1985), the molecular descriptors being only calculated starting from the chemical structure of the compounds.

The linear statistical model for fixed purposes will be examined by two robust methods for the evaluation of the parameters of regression starting from estimates of the robust coefficients of regression most popular by the appendices. We based ourselves on the comparison between the two methods, the applicability (DA) will be discussed using the diagram of Williams who represents the residues of prediction standardized according to the values of the levers (hi) (Eriksson *et al.*.2003; Tropsha *et al.*2003). We present the tests statistics and graph of compatibility at the normal law for validated the results of the state approached between the two methods for a risk $\alpha = 5\%$.

II. Methodology

i. *Descriptor Generation*

One used the molecular software of modeling Hyperchem 6.03, for to represent the molecules, then using semi-empirical method AM1 (Dewar *et al.*,. 1985;. Holder 1998) to obtain the final geometries. It is established (Levine, 2000) that this Method gives good results when one treats small molecules (of less than one hundred atoms), like those considered in this work.

The optimized geometries were transferred in the software dragon from data-processing software version 5.4[19], for the calculation of 1320 descriptors while operating on 89 pyrazines of test; subsets of descriptors were chosen by genetic algorithm, these descriptors can be separate in four categories: topological descriptors of The topological, geometrical, physical, and electronic accounts of way and molecular indices of connectivity included. The geometrical descriptors included sectors of shade, the length with the reports/ratios of width, volumes of van der Waals, the surface, and principal moments of inertia. The calculated descriptors of physical property included the molecular refringency of polarizability and molar. The electronic descriptors included most positive and most negative described by Kaliszan.

By employing the software Mobydigs (Todeschini et al., 2009) [21] and by maximizing the coefficient of prédiction Q^2 and minimal R^2 of S (the error).

ii. *Regression Analysis*

The analysis of the multiple linear regressions was carried out with two methods by software Matlab (R2009a) for (LAD) and Minitab 16 for (OLS).

One considers the multiple model of regression given by [9]:

$$y_i = \beta_0 + \sum_{j=1}^{p-1} \beta_j \, x_{ij} + \varepsilon_i \qquad (1)$$

The detection of meaningless statements and `with action leverage according to the method of least squares is a problem which' was largely studied. The diagnosis by the regression LAD offers alternative approaches whose principal characteristic is the robustness. In our study a non-parametric method to detect the meaningless statements and the point's lever was applied and compared with the traditional method of diagnosis (least squares) [9].

iii. *Method of least squares OLS*

This one was carried out with the software Minitab 16 [33], method MLR applied to the multiple regression consists in defining the β estimate which minimizes ([9, 17, 18]:

$$\sum ei^2 = \sum (\text{yi- } \beta 0\text{-} \sum \beta xij)^2 \qquad (2)$$

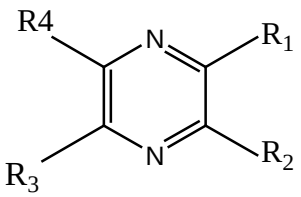
iv. *Least Absolute Deviations (LAD)*

The analysis of linear regression multiple was carried out with the software Matlab (R2009a) [31], by using the method of the least variations in absolute value, said method LAD (Least Absolute Deviations), is one of the principal alternatives to the method of least squares when it is a question of estimating the parameters of a model of regression, which minimizes the absolute values and not the values with the square of the term of erreur. La method stable-lad applied to the multiple regression consists in defining the β estimates which minimize [9, 17, the 18]:

$$\sum |ei| = \sum |\text{yi- } \beta 0\text{-} \sum \beta xij \qquad (3)$$

III. The Data Set

One uses the molecular software Hyperchem 6.03 [20], to represent the molecules, by employing semi-empirical method AM1 (Dewar mud et al., 1985; Holder 1998) to obtain the final geometries. The compounds implied in this study have the general structure 1:



R1: H, alkyl, alkoxy, alkylthio, aryloxy, arylthio, acetyl, chloro.
R2: H, alkyl, chloro, vinyl.
R3: H, alkyl.
R4: H, alkyl.

The retention data for the114 compounds chromatographed on the OV-101 and CRW-20M stationary phases were taken from (113 taken from Davit T. Stanton and Peter C. Jurs (1) and 1 compound (2-VinylPyrazine) taken from Mihara and Enomoto [29]) and are listed in table 1.

IV. Results and Discussion

An ideal model is one that has a high R value, allow standard error, and the fewest independent variables [1, 9]. The best models found has 3 descriptors for each stationary phase by using the software Moby Digs [21] are given below.

The criterion for identifying a compound as an outlier was that compound being flagged by three or

more of six standard statistical tests used to detect outliers in regression analysis. These tests were (1) residual, (2) standardized residual, (3) Studentized residual, (4) leverage, (5) DFFITS, (6) Cook's distance. The residual is the difference between the actual value and the value predicted by the regression equation. The standardized residual is the residual divided by the standard deviation of the regression equation. The Studentized residual is the residual of a prediction divided by its own standard deviation.

Leverage allows for the determination of the influence of a point in determining the regression equation. DFFITS describes the difference in the fit of the equation caused by removal of a given observation, and Cook's distance describes the change in a model coefficient by the removal of a given point.

Table 1 : Experimentally determined Retention Indices for pyrazines on OV-101 and Carbowax-20 M

n°	Compounds	ov-101	Compounds	IR(cw)
1	Pyrazine	710	Pyrazine	1179
2	Methylpyrazine	801	Methylpyrazine	1235
3	2,3-dimethylpyrazine	897	2,3-dimethylpyrazine	1309
4	2,5-dimethylpyrazine	889	2,5-dimethylpyrazine	1290
5	2,6-dimethylpyrazine	889	2,6-dimethylpyrazine	1300
6	Trimethylpyrazine	981	Trimethylpyrazine	1365
7	Trimethylpyrazine	1067	Trimethylpyrazine	1439
8	Ethylpyrazine	894	Ethylpyrazine	1300
9	2-ethyl-5-methylpyrazine	980	2-ethyl-5-methylpyrazine	1357
10	2-ethyl-6-methylpyrazine	977	2-ethyl-6-methylpyrazine	1353
11	2,5-dimethyl-3-ethylpyrazine	1059	2,5-dimethyl-3-ethylpyrazine	1400
n°	Compounds	ov-101	Compounds	IR(cw)
12	2,6-dimethyl-6-ethylpyrazine	1064	2,6-dimethyl-6-ethylpyrazine	1415
13	2,3-dimethyl-5-ethylpyrazine	1066	2,3-dimethyl-5-ethylpyrazine	1421
14	2,3-diethylpyrazine	1065	2,3-diethylpyrazine	1417
15	2,3-diethyl-5-methylpyrazine	1137	2,3-diethyl-5-methylpyrazine	1459
16	Propylpyrazine	986	Propylpyrazine	1374
17	2-methyl-3-propylpyrazine	1072	2-methyl-3-propylpyrazine	1438
18	2,3-dimethyl-5-propylpyrazine	1154	2,3-dimethyl-5-propylpyrazine	1500
19	2,5-dimethyl-3-propylpyrazine	1142	2,5-dimethyl-3-propylpyrazine	1474
20	2,6-methyl-3-propylpyrazine	1151	2,6-methyl-3-propylpyrazine	1493
21	Isopropylpyrazine	949	Isopropylpyrazine	1316
22	2,3-dimethyl-5-isopropylpyrazine	1112	2,3-dimethyl-5-isopropylpyrazine	1431
23	Butylpyrazine	1088	Butylpyrazine	1474
24	2-butyl-3-methylpyrazine	1121	2-butyl-3-methylpyrazine	1459
25	3-butyl-3,5-dimethylpyrazine	1184	3-butyl-3,5-dimethylpyrazine	1487
26	3-butyl-3,6-dimethylpyrazine	1196	3-butyl-3,6-dimethylpyrazine	1514
27	5-butyl-2,3-dimethylpyrazine	1254	5-butyl-2,3-dimethylpyrazine	1600
28	Isobutylpyrazine	1043	Isobutylpyrazine	1406
29	2,3-dimethyl-5-isobutylpyrazine	1200	2,3-dimethyl-5-isobutylpyrazine	1525
30	2-isobutyl-3,5,6-trimethylpyrazine	1263	2-isobutyl-3,5,6-trimethylpyrazine	1556
31	sec-butylpyrazine	1040	sec-butylpyrazine	1394
32	5-sec-butyl-2,3-dimethylpyrazine	1194	5-sec-butyl-2,3-dimethylpyrazine	1500
33	Pentylpyrazine	1192	Pentylpyrazine	1575
34	2,3-dimetyl-5-pentylpyrazine	1352	2,3-dimetyl-5-pentylpyrazine	1700
35	Isopentylpyrazine	1157	Isopentylpyrazine	1530
36	2,3-dimetyl-5-isopentylpyrazine	1317	2,3-dimetyl-5-isopentylpyrazine	1655
37	(2-methylbutyl)pyrazine	1151	(2-methylbutyl)pyrazine	1527
38	2,3-dimethyl-5-(2-methylbutyl)pyrazine	1306	2,3-dimethyl-5-(2-methylbutyl)pyrazine	1636
39	2-(2-methylbutyl)-2,5,6-trimethylpyrazine	1363	2-(2-methylbutyl)-2,5,6-trimethylpyrazine	1661

40	(2-methyl-3-pentyl)pyrazine	1240	(2-methyl-3-pentyl)pyrazine	1606
41	(2-ethylpropyl)pyrazine	1121	(2-ethylpropyl)pyrazine	1449
42	(1-methylbutyl)pyrazine	1133	(1-methylbutyl)pyrazine	1471
43	2,3-demethyl-5-(2-methylpentyl)pyrazine	1377	2,3-demethyl-5-(2-methylpentyl)pyrazine	1710
44	Hexylpyrazine	1293	Hexylpyrazine	1668
45	Octylpyrazine	1495	Octylpyrazine	1845
46	2-methyl-3-octylpyrazine	1546	2-methyl-3-octylpyrazine	1956
47	2-methyl-5-(2-methylbutyl)-3-octylpyrazine	1923	2-methyl-5-(2-methylbutyl)-3-octylpyrazine	2200
n°	Compounds	ov-101	Compounds	IR(cw)
48	2-methyl-6-(2-methylbutyl)-3-octylpyrazine	1962	2-methyl-6-(2-methylbutyl)-3-octylpyrazine	2264
49	Methoxypyrazine	877	Methoxypyrazine	1306
50	2-methoxy-3-methylpyrazine	954	2-methoxy-3-methylpyrazine	1339
51	2-methoxy-5-methylpyrazine	969	2-methoxy-5-methylpyrazine	1358
52	3-ethyl-2-methoxypyrazine	1037	3-ethyl-2-methoxypyrazine	1400
53	3-isopropyl-2-methoxypyrazine	1078	3-isopropyl-2-methoxypyrazine	1400
54	5-isopropyl-3-methyl-2-methoxypyrazine	1170	5-isopropyl-3-methyl-2-methoxypyrazine	1467
55	5-sec-butyl-3-methyl-2-methoxypyrazine	1250	5-sec-butyl-3-methyl-2-methoxypyrazine	1536
56	5-isobutyl-3-methyl-2-methoxypyrazine	1257	5-isobutyl-3-methyl-2-methoxypyrazine	1556
57	3-methyl-2-methoxy-5-(2-methylbutyl)pyrazine	1362	3-methyl-2-methoxy-5-(2-methylbutyl)pyrazine	1664
58	3-methyl-2-methoxy-5-(2-methylpentyl)pyrazine	1444	3-methyl-2-methoxy-5-(2-methylpentyl)pyrazine	1737
59	Ethoxypyrazine	959	Ethoxypyrazine	1348
60	2-ethoxy-3-methylpyrazine	1029	2-ethoxy-3-methylpyrazine	1385
61	2-ethoxy-5-methylpyrazine	1047	2-ethoxy-5-methylpyrazine	1418
62	2-ethoxy-3-ethylpyrazine	1101	2-ethoxy-3-ethylpyrazine	1439
63	2-ethoxy-3-isopropylpyrazine	1143	2-ethoxy-3-isopropylpyrazine	1431
64	2-ethoxy-5-isopropyl-3-methylpyrazine	1230	2-ethoxy-5-isopropyl-3-methylpyrazine	1500
65	2-ethoxy-5-isobutyl-3-methylpyrazine	1314	2-ethoxy-5-isobutyl-3-methylpyrazine	1584
66	5-sec-butyl-2-ethoxy-3-methylpyrazine	1306	5-sec-butyl-2-ethoxy-3-methylpyrazine	1566
67	2-ethoxy-3-methy-5-(2-methylbutyl)pyrazine	1415	2-ethoxy-3-methy-5-(2-methylbutyl)pyrazine	1693
68	(methylthio)pyrazine	1076	2-ethoxy-3-methy-5-(2-methypentyl)pyrazine	1771
69	3-methyl-2-(methylthio)pyrazine	1151	(methylthio)pyrazine	1600
70	5-methyl-2-(methylthio)pyrazine	1163	3-methyl-2-(methylthio)pyrazine	1616
71	3-ethyl-2-(methylthio)pyrazine	1237	3-ethyl-2-(methylthio)pyrazine	1695
72	3-isopropyl-2-(methylthio)pyrazine	1273	3-isopropyl-2-(methylthio)pyrazine	1692
73	3-isopropyl-3-(methylthio)pyrazine	1362	3-isopropyl-3-(methylthio)pyrazine	1737
74	5-sec-butyl-3-methyl-2-(methylthio)pyrazine	1441	5-sec-butyl-3-methyl-2-(methylthio)pyrazine	1800
75	5-isobutyl-3-methyl-2-(methylthio)pyrazine	1446	5-isobutyl-3-methyl-2-(methylthio)pyrazine	1816
76	3-methyl-5-(2-methylbutyl)-2-(methylthio)pyrazine	1552	3-methyl-5-(2-methylbutyl)-2-(methylthio)pyrazine	1941
n°	Compounds	ov-101	Compounds	IR(cw)
77	3-methyl-5-(2-methylpentyl)-2-(methylthio)pyrazine	1638	3-methyl-5-(2-methylpentyl)-2-(methylthio)pyrazine	2008

78	(ethylthio)pyrazine	1148	(ethylthio)pyrazine	1635
79	2-ethylthio-3-methylpyrazine	1215	2-ethylthio-3-methylpyrazine	1655
80	2-ethylthio-5-isopropyl-3-methylpyrazine	1418	2-ethylthio-5-isopropyl-3-methylpyrazine	1769
81	5-sec-butyl-2-ethylthio-3-methylpyrazine	1494	5-sec-butyl-2-ethylthio-3-methylpyrazine	1832
82	2-ethylthio-5-isobutyl-3-methylpyrazine	1496	2-ethylthio-5-isobutyl-3-methylpyrazine	1843
83	2-ethylthio-3-methyl-5-(2-methylbutyl)pyrazine	1602	2-ethylthio-3-methyl-5-(2-methylbutyl)pyrazine	1951
84	2-ethylthio-3-methylyl-5-(2-methylpentyl)pyrazine	1686	2-ethylthio-3-methylyl-5-(2-methylpentyl)pyrazine	2026
85	Phenoxypyrazine	1415	Phenoxypyrazine	2104
86	2-methyl-3-phenoxypyrazine	1465	2-methyl-3-phenoxypyrazine	2103
87	5-isopropyl-3-methyl-2-phenoxypyrazine	1620	5-isopropyl-3-methyl-2-phenoxypyrazine	2114
88	5-sec-butyl-3-methyl-2-phenoxypyrazine	1694	5-sec-butyl-3-methyl-2-phenoxypyrazine	2173
89	5-isobutyl-3-methyl-2-phenoxypyrazine	1706	5-isobutyl-3-methyl-2-phenoxypyrazine	2209
90	3-methyl-5-(2-methylpentyl)-2-phenoxypyrazine	1807	3-methyl-5-(2-methylpentyl)-2-phenoxypyrazine	2301
91	(phenylthio)pyrazine	1606	(phenylthio)pyrazine	2400
92	3-methyl-2-(phenylthio)pyrazine	1658	3-methyl-2-(phenylthio)pyrazine	2399
93	5-isopropyl-3-methyl-2-(phenylthio)pyrazine	1806	5-isopropyl-3-methyl-2-(phenylthio)pyrazine	2375
94	5-sec-butyl-3-methyl-2-(phenylthio)pyrazine	1874	5-sec-butyl-3-methyl-2-(phenylthio)pyrazine	2430
95	5-isobutyl-3-methyl-2-(phenylthio)pyrazine	1882	5-isobutyl-3-methyl-2-(phenylthio)pyrazine	2452
96	3-methyl-5-(2-methylbutyl)-2-(phenylthio)pyrazine	1985	3-methyl-5-(2-methylbutyl)-2-(phenylthio)pyrazine	2569
97	3-methyl-5-(2-methylpentyl)-2-(phenylthio)pyrazine	2064	3-methyl-5-(2-methylpentyl)-2-phenylthio)pyrazine	2669
98	Acetylpyrazine	993	Acetylpyrazine	1571
99	2-acetyl-3-methylpyrazine	1061	2-acetyl-3-methylpyrazine	1567
100	2-acetyl-5-methylpyrazine	1093	2-acetyl-5-methylpyrazine	1625
101	2-acetyl-6-methylpyrazine	1089	2-acetyl-6-methylpyrazine	1618
102	2-acetyl-3-ethylpyrazine	1138	2-acetyl-3-ethylpyrazine	1617
103	2-acetyl-3,5-dimethylpyrazine	1153	2-acetyl-3,5-dimethylpyrazine	1629
104	Chloropyrazine	861	Chloropyrazine	1351
105	2,3-dichloropyrazine	1032	2,3-dichloropyrazine	1581
n°	Compounds	ov-101	Compounds	IR(cw)
106	2-chloro-3-methylpyrazine	951	2-chloro-3-methylpyrazine	1399
107	2-chloro-3-ethylpyrazine	1044	2-chloro-3-ethylpyrazine	1467
108	2-chloro-3-isobutylpyrazine	1187	2-chloro-3-isobutylpyrazine	1575
109	2-chloro-5-isipropyl-3-methylpyrazine	1173	2-chloro-5-isipropyl-3-methylpyrazine	1505
110	5-sec-butyl-2-chloro-3-methylpyrazine	1256	5-sec-butyl-2-chloro-3-methylpyrazine	1577
111	2-chloro-5-isobutyl-3-methylpyrazine	1264	2-chloro-5-isobutyl-3-methylpyrazine	1600
112	2-chloro-3-methyl-5-(2-methylbutyl)pyrazine	1371	2-chloro-3-methyl-5-(2-methylbutyl)pyrazine	1710
113	2-chloro-3-methyl-5-(2-methylpentyl)pyrazine	1456	2-chloro-3-methyl-5-(2-methylpentyl)pyrazine	1789
114	2-VinylPyrazine	907	2-VinylPyrazine	1392

The definition of each descriptor is given table 2:

Table 2 : Definitions of Descriptors used in the Retention index Prediction Models [19]

Name	Definition
MPC03	Molecular path count of order 03
GATS5e	Geary autocorrelation-lag 5/weighted by atomic Sanderson electronegativityies
AEigp	Eigen value distance matrix sum from Polson arizability weight (Barysz matrix)
Qpos	total positive charge
Se	sum of atomic Sanderson electronegativityies
Mp	mean atomic polarizability (scaledon Carbon atom)
X1sol	salvation connectivity index chi-1
DP01	molecular profile no.01
Mor06v	(3D-MORSE-signal 06/weighted by atomic Vander Waals volumes
Tm	T (Total size index/weight atomic masses

The coefficient of multiple determinations (R^2) indicates the amount of variance in the data set accounted for by the model. The standard error of the regression coefficient is given in each case, and n indicates the number of molecules involved in the regression analysis procedure [1, 9].

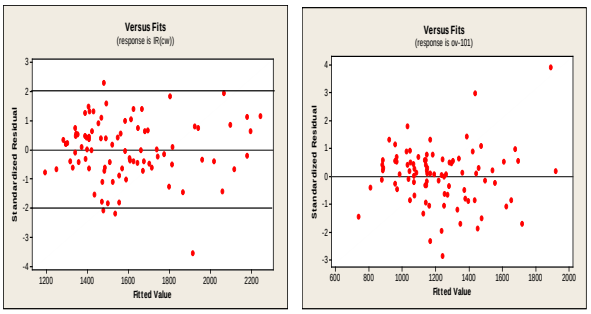
a) The best models

IR(OV-101): (MPC03, X1sol, GATS5e, AEigp, L3e,Qpos); -S=20.892, R^2=99.30, n=89 compounds.

IR(RWC): Se, Mp, X1sol, DP01, Mor06v, Tm; S=22.64, R^2=99.22, n=89 compounds.

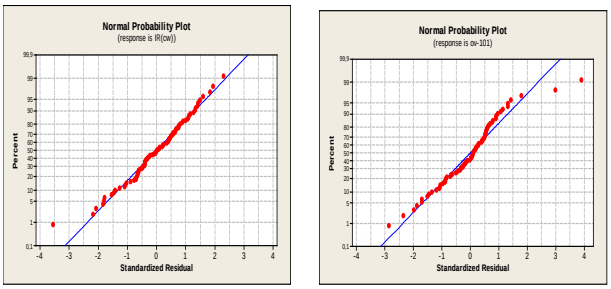
Indeed Figure 1 reproduced the distributions of the standard residues di (ordinary residue report /root of the average square of the variations) according to the adjusted values, which seem random (without particular tendencies).That shows the constancy of variances σ^2, it be-with saying their independence of the regresses and the adjusted dependent variable.

The quasi-linearity (R = 0, 9951; OV-101 - R = 0, 9835; Carbowax-20M - critic = 0, 96048) of the diagram of the normal scores (Figure 2) is an index of normality. Values of the statistics of Durbin-Watson (Durbin, & Watson, 1951), [d= 1,33535; OV-101/D = 1,66161; Carbowax-20M] are the greater than higher values given by the tables, respectively for 3 regresses, and any reasonable risk σ, which establishes each time the independence of the residues.



Colonne RCW -20 M Colonne OV -101

Fig. 1 : Plot of the standard residues according to the estimated retention indices



Colonne RCW -20 M Colonne OV -101

Fig. 2 : Diagram of the normal scores

The diagnostic statistics joined together in Table 3 make it possible to make comparisons and to draw several conclusions [21].

Tableau 3 : Diagnostiques Statistiques pour les Modèles Sélectionnés

ID	Size	Models	R2	Q2	Q2boot	Q2ext	R2adj
OV-101	6	MPC03 X1sol GATS5e AEigp L3e Qpos	99.30	99.12	98.99	96.94	99.24
			SDEP	SDEC	F	s	
			22.448	20.05	1927.2	20.89	

IDx<	Size	Models	R2	Q2	Q2boot	Q2ext	R2adj
CRW-20M	6	Se Mp X1sol DP04 Mor06v Tm	99,2	99	98,92	75,9	99,2
			SDEP	SDEC	F	s	
			24,1	21,7	1740	22,6	

Values of R^2 and of $R^2_{(adj)}$ show, each time, quality of adjustment, whereas the very weak differences between $R^2$and Q^2inform about the robustness of the models which are, moreover, very highly significant (high values of the statistics F of Fisher).

Moreover, the similarity of *SDEP* and *SDEC* mean that the internal capacities of prediction models are not too dissimilar their capacities of adjustment.

The validation by bootstrap (Q_{BOOT}) confirms all at the same time the capacity of internal prediction and the stability of the models.

b) Robust Regression

Any robust method must be reasonably effective once compared to the estimators of least squares; if the fundamental distribution of the errors is normal and primarily more effective independent than the estimators of least squares, when there are peripheral observations. There are various robust methods for the evaluation the parameters of regression. The principal goal of this section is the method LAD (nap of the absolute values of the errors) whose coefficient of regression qualifies the robustness among the additional data [16].

i. *Comparison Robust Regression of OLS and LAD*

More particularly we will test 2 methods of estimate for the vector of the Parameters ($(\beta_0^*, \beta_1^*, \ldots, \beta_k^*)$):

- Method of least squares ordinary, more known and the most used.
- The method LAD (Sum of the absolute values of the errors.)

The large advantage of the method LAD is his robustness, i.e. that the estimators are not impact by the extreme values, (they are known as "robust"). It is thus particularly interesting to use the method LAD if one is in the presence of aberrant values in comparison with method OLS [8].

ii. *Comparison of hyperplanes of regression*

Column OV-101:

1/LAD:

$$Y=-48.05-10.14\ MPC03+337.87\ X1sol\ -35.78\ GATS5e\ -2.54\ AEigp\ -38.51\ L3e\ -156.88\ Qpos \quad (4)$$

2/OLS:

$$Y = -31{,}2 - 7{,}77\ MPC03 + 300\ X1sol - 24{,}9\ GATS5e - 2{,}31\ AEigp - 53{,}1\ L3e - 62{,}6\ Qpos \quad (5)$$

Column CRW -20M:

1/LAD:

$$Y= -242,89\ -42,45\ Se+ 687,45\ Mp+ 298{,}16X1sol+ 205,42*DP01+ 200{,}62Mor06v+ 8{,}04Tm \quad (6)$$

2/OLS:

$$Y = -167 - 42{,}8\ Se + 755\ Mp + 320\ X1sol + 130\ DP01 + 163\ Mor06v + 10{,}7\ Tm \quad (7)$$

Each equation on each column check the assumptions on the same linear statistical model for Fixes purposes for each method in comparison with the hyperplane calculated by LAD compared to the hyperplane calculated by the method of least squares.

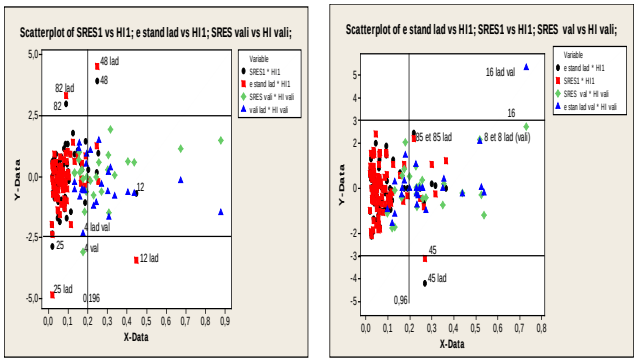
It is noticed that $\beta$the calculated OLS are not very different for the regression with β the LAD on the two columns, except, $\beta 1$ the calculated OLS is almost the same ones as for the regression with $\beta 1$ the LAD on column CRW and $\beta 4$ the calculated OLS is almost the same ones as for the regression with $\beta 4$ the LAD on column OV-101.

It is thus relevant to remake a checking of the presences of aberrant values by using the following stage (figure 3):

The hyperplane of regression can radically change, with the change of the coefficients of the hyperplane.

iii. *Graphical Comparisons of Alternative Regression Models*

The field of application was discussed using the diagram of Williams.



Column OV -101 Columns RW -20M

Method LAD and OLS (test, validation)

Fig. 4 : Diagram of Williams of the residues of prediction standardized according to the lever

The analysis of the residues shows that the observations (82,25) residues raised but it (48) point influence in the two estimates and the observation (12) point influence with the LAD estimate and lever by least square also observation 4 residue raised with OLS and not lever with LAD in the whole of validation on column OV -101 and on column CRW -20M the observations (45) not influence in the two estimates and observation

16 point influence in the two estimates in the whole of validation.

After elimination of the aberrant points collective between the two methods and after the secondary treatment one has the observation (12) point influence and the observations (1, 24) residues raised in the two estimates but it (25) observation 4 residue raised with OLS and not lever with LAD also the observation 4 residue raised in the whole of validation in the two estimates on column OV -101 and on column CRW -20M the observations (45) not influence in the two estimates and observation 16 point influence in the two estimates in the whole of validation and on column CRW -20M the observations (24 25 35) residues raised but it (84)point influence in the two estimates and observation 8 point influence in the two estimates in the whole of validation.

Thus finally the models in which the meaningless statements were removed become after elimination of the aberrant points collective [OV-101: test - (1, 12, 24), validation (4), CRW-20M: test - (24, 25, 35 84), validation (8)] between the two methods:

Column OV-101:

1/LAD:

$$y=-48.05-10.14\ MPC03+337.87\ X1sol -35.78\ GATS5e -2.54\ AEigp -38.51\ L3e -156.88\ Qps \quad (8)$$

2/OLS:

$$y = - 61,1 - 9,80\ MPC03 + 343\ X1sol - 35,7\ GATS5e - 2,80\ AEigp - 40,7\ L3e- 160\ Qpos \quad (9)$$

Column CW -20M:

1/LAD:

$$Y= -242, 89 -42, 45\ Se+ 687, 45\ Mp+ 298, 16\ X1sol + 205,42DP01+ 200,62Mor06v+8,04Tm \quad (10)$$

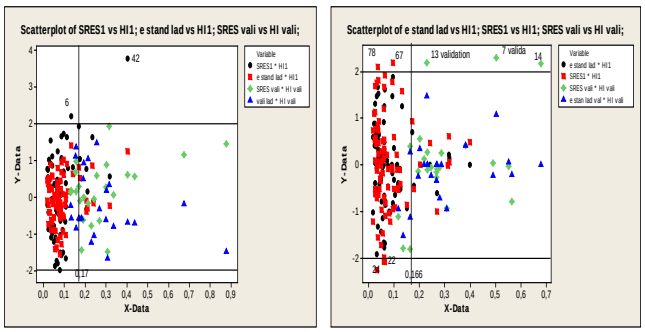
2/OLS:

$$IR\ (RCW) = - 192 - 42, 4\ Se + 752\ Mp + 305\ X1sol + 155\ DP01 + 156\ Mor06v + 13, 0\ Tm \quad (11)$$

It is noticed besides that β the OLS calculate more to approach which for the regression with β the LAD on the two columns into precise $(\beta 1, \beta 3\ and\ \beta 4)$ the OLS calculate are almost the same ones as for the regression with $(\beta 1, \beta 3\ and\ \beta 4)$ the LAD and on the same order with $(\beta 0, \beta 5\ and\ \beta 6)$ on OV 101 and $\beta 1$the OLS calculate are almost the same ones as for the regression with $\beta 1$ the LAD on CRW -20M.

The analysis of the residues shows that in this case All the point of lad method between (-2, 2), but it the analysis of the residues of OLS method shows that the observations [OV-101: test - (6,42), CRW-20M: test - (22, 24, 67 ,78), validation (7 ,13,14)] the LAD estimate given good result On the other hand estimate OLS figure (4):

iv. *Graphical Comparisons of Alternative Regression Models*



Column OV -101 Columns RW -20M

Method LAD and OLS (test, validation)

Fig. 4 : Diagram of Williams of the residues of prediction standardized according to the lever

Lastly, it is noted that LAD is a robust estimator but loses stability in the presence of points aberrant.

We note however the observation that the estimate the least square is near to the LAD estimate to which removed the aberrant values.

To conform the approach between the two methods and to deduce the robust method between them, There is a package of tests of normality (of the standard errors or residues…) indeed, thanks to the concept of robustness, we can used simple techniques (descriptive e.g. statistics, technical graphs) to check if the distribution of the data is really approximate.

Any test is associated *a* σ *risk* known as of first species years works us, we will adopt it risk σ = 5%.

c) *Comparisons of the Tests of normality of the errors between the method LAD and OLS in the approached state*

The software Minitab 16 carries out automatically the estimate of the two principal parameters of the normal law (μ the Mean (OV-101:0, CRW-20M:0), σ the variation-type(OV-101:13.26, CRW-20M:18.53) for OLS one applying the same principle with the method LAD but one used (it median (OV-101:-0.96, CRW-20M:0.01) σ variation-type (OV-101:13.84, CRW-20M:18.66) and with the number principal in the state approached to the two columns n=32.

i. *Test statistical*

a. Test of Anderson-Darling

In our work, one finds us that AD [OV -101: (lad) = 0.250 with value of p>0.250, (OLS) = p=0.938 with value of p = 0.747, n=82]-RCW-20M: (lad) = 0.547 with value of p > 0.250, (OLS) = 0.165 with value of

p=0.572, n=84] <AD critique=0.752 with p> 0.1. To 5%, the assumption of normality is compatible with the method LAD and OLS [33, 34, 35].

b. test of Shapiro-Wilk

It is particularly powerful for small manpower (n<50) for this that one using for valid the results of the validation.

For a risk σ = 0. 05, the critical points read in the table of *Shapiro*-Wilk for n = 23 is W_{crit}= 0. 914 and for n=24 and W_{crit}= 0. 916. In our works, on *(OV) [W_{LAD} =0.9969, W_{MLR}* = 0.9877, n=24*] and on CRW [W_{LAD}* = 0, 0.997, W_{MLR} = 0,9227, n=23 *] W> W_{crit}*, with the risk of 5%, the assumption of normality compatible with us is given (normal law) [34,35].

c. Test of D'Agostino

For σ = 0.05, the threshold critic is χ2 0:95(2) = 5.99.In our works, *on (OV) [:(W_{LAD}* = 0,0072 with value of p = 0,99, W_{OLS}= 0.042 with value of p = 0.97, n=82),: *] and on CRW [(W_{LAD}* = 0,1202 *with value of p = 0.94, W_{OLS}*= 0,00116 with value of p = 0.99, n=84), *] W <Wcrit*, with p > 0.1 with the risk of 5%, the assumption of normality compatible with us is given (normal law)[33,34,35].

d. Test of Jarque-Bera

As the Test of Agostino It becomes particularly effective starting from *N*>20 for this that one using for valid the results.

For σ = 0.05, the critical point is χ2 0:95(2) = 5.99. In our works, *on (OV)[(W_{LAD}* = 0,0971with value of p = 0.95*, W_{OLS}* = 0.0949 with value of p = 0.95, n=82), *] and on CRW [(W_{LAD} = 0.1059 with value of p = 0.94, W_{OLS}* = 0,0979 with value of p = 0.95, n=84), *] W <W_{crit} (*is largely lower than 5.99) with p > 0.1 than the risk of 5%, the assumption of normality compatible with us is given (normal law).[33, 34, 35]

Completely all the statistical tests is accepted the data of the state approached between the two methods especially the test of Shapiro-Wilk the value of the method LAD closer to method OLS and the other tests the values of the method LAD is higher has the method MLR which explains than give them method LAD is effective and robust para for give method OLS.

Completely all the statistical tests is accepted the data of the state approached between the two methods especially the test of Shapiro-Wilk the value of the method LAD closer to method MLR and the other tests the values of the method LAD is higher has the method OLS which explains than give them method LAD is effective and robust para for give method OLS.

e. *Interval of confidence*

The confidence interval and the risk $\alpha = 0.05$ constitute a complementary approach thus (an approach of estimate) the most used confidence interval is the confidence interval has 100 (1 –∝) = 95 %.

The Column OV-101: LAD :(-28.11, 26.17), OLS (-25.9, 25.99).

The Column CRW-20M: LAD (-36.56, 36.58), OLS (-36.34, 36.34).

These result is formed L approximate of two method.

You can be 95% confident that the 50th percentile for the population is between OV-101 (LAD:-3.96 and 2.027,-OLS:-2.87 and 2.87, CRW-20M (LAD:-3.98 and 4.00, OLS:-3.96 and 3.96) [33, 34, 35].

V. Conclusion

The modeling of the indices of retention of 114 pyrazines (89 tests and 25 validations) eluted out of two columns various OV -101 and CRW-20M by two methods LAD and OLS are based on the following comparisons:

a) The comparison of the equations of the hyperplanes

L equations of OLS is closer to LAD after elimination of the aberrant points for the β2 (LAD) ≅β2(OLS) and the other coefficient remaining with the same order for column OV-101 Pour the column Crw-20m the β1 (LAD) ≅β1(OLS) and the other coefficient remaining with the same order after the secondary treatments for the checking of the presence of aberrant values (82, 48, 26, 25, 24,12, 1) on column OV -101 and item (45, 82,35, 24, 25) for the column CRW-20M, and to be able to compare them By employing the following stage.

b) Graphic comparison: The applicability was discussed using the diagram of Williams in dependence

Lastly, it is noted that LAD is a robust estimator but loses his stability in the presence of aberrant points.

Used test of normality's of the errors by statistical test. One applied compatibility with the normal law, but to differing degrees using p-been worth. One notes that the touts test to accept the assumption of normality is that of Anderson-Darling, the test of Shapiro-Wilk His power is recognized in the literature.

Lastly, the tests of Agostino and Jarque-Bera, based on the coefficients of asymmetry and flatness accepts readily the assumption of normality with one p-been worth sup 0.1 on the columns, Too one confirmed approached graphically by histogram of frequency in finished by the confidence interval.

It general this study is shown that results by the two estimates theoretical (equation) and graph give good results expressed by the models.

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Spatial Analysis of Household Size as a Determinant of Health Status of Rural Areas of Federal Capital Territory, Nigeria

By Akanbi, OluwatoyinAdewuyi
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Abstract- This research was an attempt to study the consequences of dam construction in Nigeria. This was expedient because such projects are known to be characterised by array of disasters that ensued their construction. Satellite images captured before and after the dam in 1976 and 2014 respectively were subjected to image processing techniques so as to assess the likely changes in environmental variables of the area. This was supplemented by 250 questionnaires administered in settlements along the riverbank to elicit information on the socioeconomic characteristics of the people. Additionally, field observations and informal interviews were conducted to probe further into details of information required. Results show that natural vegetation has decreased by 63%. This has led to chains of environmental problems including soil erosion, loss of biodiversity and pollution. The other land use/cover types experienced increase, with water body accounting for the highest value of 54.7% owing to dam in the reservoir. The hitherto common crops of the area such as maize, guinea corn have been replaced with cash crops like cotton and potato etc., some of which are foreign to the area.

Keywords: *household size; healthstatus, rural areas.*

GJHSS-B Classification : *FOR Code: 050299*

Strictly as per the compliance and regulations of:

Spatial Analysis of Household Size as a Determinant of Health Status of Rural Areas of Federal Capital Territory, Nigeria

Akanbi, OluwatoyinAdewuyi.

Abstract- Household size is one of the determinants of socio-economic development of any country. It is the total number of people living in a house, sharing certain things in common and may contain more than a family: it includes the fathers, mothers, children and other dependents that live under the same roof and having certain things in common. Household size varies in size in space as a result of diverse reasons. In the light of this, the present study is conceived, in order to establish the relationship between household size and health status of rural areas of Federal Capital Territory, Nigeria. The study involved 172 household heads across the six area councils of the study area. Random sampling technique was adopted to obtain all the relevant data. In all, in-depth-interviews (IDI), Focus Group Discussions (FGDs) were conducted and questionnaires were also administered in the randomly selected settlements of the wards on the subject matter. Data from all these sources were subjected to correlation analysis. The study concludes that, there is high proportion of household size in the study area with its attendance effects on the health status of the rural populace. In the face of this finding, the study recommends manageable household size as one of the conditions for healthy living upon which economic growth can evolve. This can be achieved through adequate family education.

Keywords: household size; healthstatus, rural areas.

I. Introduction

Household size is a central to planning of socio-economic sector of any country. Policies relating to housing, health, education and other aspect of governance are planned with data from households. Household is not same thing as family and according to America Heritage Idioms Dictionary (2005), family is a basic social unit, consisting of parents and their children considered as a group whether dwelling together or not. However, NPC (2013) described household as a person or group of persons, related or unrelated who usually live together in the same dwelling unit, have common cooking and eating arrangement. Similarly, Havilland (2003) also defined household as a situation where one or more people live in same dwelling and also share at meals or living accommodation, and may consist of a single family or some other grouping people.

Household is relevant for many purposes and this according to United Nations (1973) includes: it's in housing analysis, because household is made up of single houses. Additionally, household is the unit of census and survey enumeration, thus it is statistically relevant. Household assists in having understanding of family size, household headship, needed in formulating population based policies (NPC, 2014).

According to Hurtubia, Gallay and Bierlaie (2010) a household size is determined by age, ethnic group (culture), sex, education, marital status among others. This explains its geographical variation in space: in some places, there is marked high proportion in the number of households, while reverse is the case in others (Mohammed, Andreal, Barrere, Ekalevi and Otto, 2010).

Household heads are in most cases males in many African traditional societies, but in a few other cases, females may head: female headship is not common in many African cultures (Varga, 2001). In Nigeria, National Bureau of Statistics (2012) in a survey carried out in the period 2006-2010, submitted that, male-headed household constituted 84.8%, while female headed was 15.2%. All these have their effects on economic status of the people and on health status. World Bank, (2014) affirmed that, in Nigeria, poverty level remains at 33.1% and majority of people live on less than 2 dollars per day. However the incidence of poverty is high in the rural than urban area, however the fact remains that, slum dwellers that are also part of urban setting are not free (Akanbi, 2014). This among other reasons may have explained why poverty level is high among Nigerians.

On the other hand, WHO (1946) definedhealth as a state of complete physical, mental and social well-being and not merely the absence of health according disease or infirmity. It follows therefore that, a healthy person must be of sound health. This definition has been criticized, because it is considered to be flexible and unreasonable. For instance according to the critics, it is not possible for a human being to be in complete state of health. Aboriginal and Health and Medical Research Council (2015) also referred to health as the social, emotional, and cultural well-being of the whole common in which each individual is able to achieve their full potentials as a human being, through the total well-being is extended to their communities. Central to all

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these definitions is that, health is a resource of life, upon which socio-economic activities lies.

Studies have confirmed the links between household size and poverty level (Lajouw and Ravallion, 1994 and Anyanwu, 2013).

Large household size has impoverished the rural areas, because of the poor economic base that has manifested in diseases and poor economic growth, which has further aggravated the poverty level of the rural people (Ki-moon, 2011; WHO, 2014 and Olawuyi and Adetunji, 2015). WHO (2014) identified income (which also determine the poverty level) as one of the determinants to health, which is peculiar to many developing countries.

According to MDG's report (2015), the most common diseases in FCT are malaria, typhoid, cholera, abdominal pain, dysentery, chicken pox, diarrhea and diabetes. Thus, Adesina (2015) in an online post estimated that about 75% of Nigerians particularly those living in the rural area prefer to solve their health problems consulting traditional healers. This may not be unconnected with low disposable income among other reasons (Srvastava, 2011).

It is in the light of this that this work is conceived and therefore, the aim of this study is to look at the relationship between household size and health status, using the rural areas of Federal Capital Territory as a case study. This aim is achieved through the following objectives: evaluate the household size and examine the relationship between household size and health status of rural areas of Federal Capital Territory, Nigeria.

II. The Study Area

a) Location and Size

The Federal Capital of Nigeria is located in the northern part of confluence of Rivers Niger and Benue. It is bordered in the West and North by Niger State; bordered in North-East by Kaduna State; Nasarawa State in the East and Kogi State in the South-West. Federal Capital Territory occupies a land area of about 7,315 SqKms. It is located between latitude 8^0 30' and $9^0$00' north of the equator and longitudes $7^0$00' and $7^0$30' east of Greenwich Meriden. According to United Nation Fund for Population Activities-UNFPA (2015), FCT is estimated to have a population of 3,324,000people.

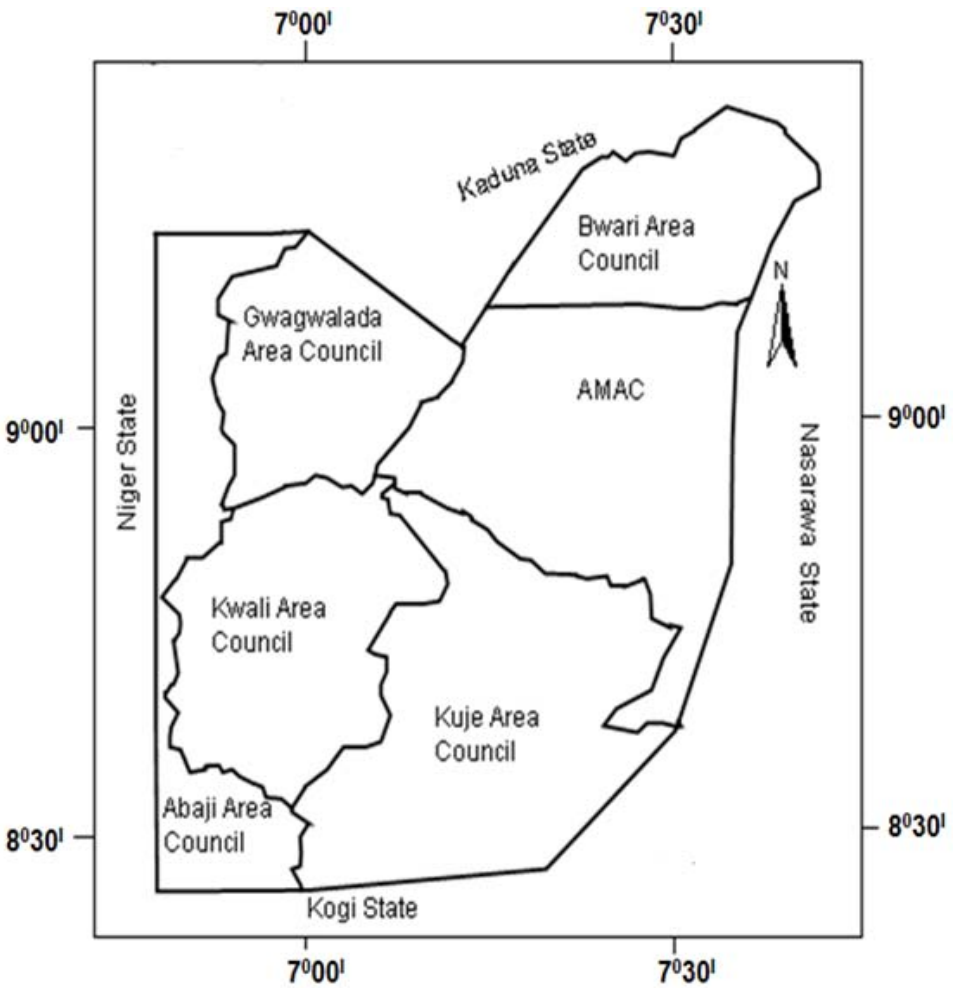

Figure 1 : Map of Federal Capital Territory

II. Material and Method

The data used in this study were obtained from primary and secondary sources. The secondary source included National Population Commission (NPC) publications and maps while the primary sources involved were Focus Group Discussions (FGDs), questionnaire and in-depth-interview (IDI). In obtaining relevant data for the study, multi-stage sampling technique was adopted. Three stage sampling method was adopted in the selection of household. The first stage in sampling process is the identification of wards from each local area councils (Table 1).

Table 1 : Local Area Councils and Wards in Federal Capital Territory

Local Area Council	Wards	Local Area Council	Wards	Local Area Council	Wards
Kuje	i.Kuje Central ii.Chibiri iii.Gaube iv.Kabivi. v.Kwaku vi.Rubochi vii.Gwargwada viii.GudunKarya ixKujekwe x.Yenche	Kwali.	i.Pai ii.Kilankwa iii.Kundu iv.Kwali Central v.Wako vi.Yabu vii.Dafpa viii.Yangoji ix.Ashara x.Gunbwo	Gwagwalada	i.Paiko-Kore ii.Ibwa iii.Dobi iv.Ikwa v.Tunga-Maje vi.Gwako vii.Quarters(Phasei,ii&iii) viii.Kutunku ix.Zuba x.Dagiri
Abaji	i.Agyana/Padangi ii.Gawu iii Rimba/Ebagi iv.Nukun/sabongari v.Alu/Mawopi vi.Yaba vii.Gurdi viii.Abaji Central ix.Abaji North-East x.Abaji South-East	Bwari	i.Shere ii.Igu iii.Kawu iv.Ushafa v.Usuma vi.Kubwa vii.Byazhi viii.Bwari Central ix.Kuduru x.Dutse	AMAC	i.CityCenter ii.Garki iii.Wuse iv.Kabusa v.Kuyi vi.Gwarinpa vii.Karu viii.Orozo ix.Nyanya x.Gwagwa xi.Jiwa xii.Karsi

Source: Field Survey, February, 2015.

The second stage in involved, picking of 10.0% of all the settlements in each area council, constituting the sampled settlements.

The uniformity in the choice of 10.0% is as a result of variation in the number of settlements per ward so as to ensure total coverage of the study area (Table 2).

Table 2 : Sampled households and Distribution of Questionnaire in the Study Area

Local Area Council	No. of Settlements	Sampled Settlements (SS)	Estimated Household= (SS × Mean HH (4.2*)	Number of Questionnaire
Kuje	60	6	25	58
Kwali	60	6	25	58
Gwagwalada	54	6	25	58
Bwari	108	11	46	107
AMAC	40	4	17	40
Abaji	82	8	34	79
TOTAL	404	41	172	400

Source: Field Survey, February, 2015.

The third stage is the selection of households purposively in the settlements that make up the study area. Household (HH) is a group of people living together and maintaining unique eating arrangement (NBS, 2010). The respondents (Households) were estimated using National Population Commission (1991) estimated mean household for each settlement in Federal Capital Territory (as at 1991) put at 4.2. The use

of 1991 census data is informed by the fact that, there is no current population data that disaggregate into localities.

In carrying out the analysis of data collected, regression analysis test was used and is of form:

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon$$

Where Y=Dependent Variable

X_1 =Independent Variables

β_0 and β_1 = Coefficients

ε =Error

III. Results

a) Socio-Economic Characteristics of Respondents

This part of the study explains the socio-economic characteristics of the respondents in relation to sex, marital status, occupation, educational attainment, religion and income.

Table 3 : Distribution of Respondents by Socio-Economic Characteristics

	Frequency	Percentage
Sex	Male(146)	Male (85)
	Female(26)	Female(15)
Marital Status	Married(163)	Married (95)
	Spinster(9)	Spinster (5)
Occupation	Farming(90)	Farming (52.5)
	Artisan (26)	Artisan (15)
	Professionals(23)	Professionals(13.5)
	Trading(20)	Trading(11.5)
	Civil Service (13)	Civil Service(7.5)
Education	Non-formal (30)	Non-formal (17.5)
	Primary(52)	Primary(30)
	Secondary(34)	Secondary(20)
	Tertiary(17)	Tertiary(10)
	None (39)	None (22.5)
Religion	Christianity(52)	Christianity(30)
	Muslim (47)	Muslim (27.5)
	ATR (73)	ATR (42.5)
Income	Less ₦5,000 (90)	Less ₦5,000 (52.5)
	₦5,000-₦10,000(39)	₦5,000-₦10,000(22.5)
	₦11,000-₦16,000(22)	₦11,000-₦16,000(12.5)
	₦17,000-₦22,000(13)	₦17,000-₦22,000(7.5)
	₦23,000-₦28,000(6)	₦23,000-₦28,000(3.7)
	More than ₦29,000(2)	More than ₦29,000(1.3)

Source: Field Survey, 2015.

The profile of respondents in Table 3 shows that, 85.0% are male, while the remaining 15.0% are female. In Africa society, discussions that has to with family lies with heads, who are mostly men. Furthermore, 95.0% of the respondents are married, while 5.0% are spinsters. The married are able to give detail knowledge of what they understand as traditional medicine, and whether it should be encouraged or not. In the same vein, majority of the respondents are farmers. Farmers and artisans constitute 52.5% and 15% of the respondents respectively, while professionals and traders are 13.5% and 11.5% in that order whiles the unemployed is 7.5%. About 17.50 % of the respondents have non-formal education, and 30.0% have primary education. Similarly, 20% and 10% of respondents have secondary and tertiary education respectively. Respondents without formal education constitute 22.5%.

Christians and Muslims constitute 30% and 27.5% respectively, while African Traditional Religion is 42.5%. Similarly, Table 3 reveals that, 52.5% of respondents earn less than ₦5, 000 per month, while 22.5% earns between ₦5, 000 and 10,000. In the same vein 12.5% of respondents earn between ₦11, 000 and ₦16, 000 and 7.5% earns between #17,000 and ₦22, 000 monthly. Suffice to add that 3.7% and 1.3% earn between ₦23, 000 and ₦28, 000 and above respectivelyN29, 000

b) Household Size in Study Area

The number of children born into human society is a social activity, which can be used to measure the socio-economic status of a people. In any society where more children are born in addition to the existing population without corresponding increase in economic activities, would always create a worse scenario. Although, the number of wives doesn't determine the number of children, but it adds to household size.

Among the rural populace in Africa, the study area inclusive marrying a wife is seen as a sign of

laziness, in fact, people with a wife are not considered to be relevant in decision making. This assertion is without considering the socio-economic consequences, which are manifested in high poverty level.

Table 4 : Distribution of Respondents by Household Size

Number of Children	Frequency	Percentage (%)
1-2	25	6.3
3-4	30	7.5
5-6	90	22.5
7-8	110	27.5
9 and Above	133	33.2
Never had a child	12	3.0
Total	400	100.0

Source: Field Survey, 2015.

Table 4 reveals that, 6.3% of respondents have had between 1-2children. Additionally, 7.5% have between 3-4 children, while 22.5% have between 5-6children. Similarly, 27.5% and 33.2% of respondents have between 7-8 and 9 and above children. Lastly, 3.0% have never had children. In an FGD discussion, a discussant who has many children averred that:

> *"As a Muslim, Islam encourages Islamic adherents to bear many children, so that horizon of Islam can be broadened. So if we bear few children, how do we achieve this tenet''* (FGD, Paikok-ore, Gwagwalada LAC, 2015).

There is controversy as to what is an ideal household size: NPC (2013) in a survey of Nigeria estimated that 49.5% of the respondents agreed that more than six (6) children are ideal for a household. However, National Bureau of Statistics (2012) submitted that the mean household size of Federal Capital Territory was 4.5.

Without to the prejudice to volume of household in the study area, the pattern of size of household is determined by occupational and cultural factors. All of which are considered relevant in explanations on education, food and health status.

In an interview, a retired nurse is of the opinion that:

> "*Too many children can further aggravate the already existing poverty with its negative effects on the system. From experience, uncontrolled child bearing has led to inability to meet the necessities of life".* (IDI, Kwakwu village, Kuje LAC, 2015).

The bulk of people of respondents who believes in large household size are confined in the rural areas: this is informed by the nature of occupation and cultural reasons.

A discussant during one of FGDs, who has traversed nooks and crannies of the study area averred that:

> *"My experience in the study area reveals that, high proportion of household in FCT rural is determined by nature of our occupation. We need hands to work on the farm since we can't afford modern farming technique'. (FGD, Karshi AMAC, 2015).*

Central to all these submissions is that, household size in the study area is a major social issue that has effects on health of the rural areas.

c) Null Hypothesis

H_0: There is no significant relationship between household size and health status of rural areas of Federal Capital Territory, Nigeria.

Table 5 : Result of Correlation Analysis

	Health Status
Pearson Correlation	.530**
Sig. (2-tailed)	.008
Df	22

***. Correlation is significant at the 0.05 level (2-tailed).*

The correlation co-efficient on Table 5 revealed that there is an average relationship between household size and economic status of people of Federal Capital Territory. This is because the p-value of .008 < 0.05 level of significance at a correlation level of 0.530 at 22 df. The null hypothesis which states that, ''there is no significant relationship between household size and health status of people area council is being rejected.

IV. Discussion

From the foregoing, the rural areas of study area have high proportion of household size. This trend has been associated to a number of factors including social, cultural and economic. The study area is known for peasant farming, as they constituted 52.5% of the respondents and with majority earning less than N5, 000 per month.

Additionally, an ideal household should be based on income, occupation and state of health. An ideal household should be a type that income cannot sustain.

In the study area, 1.3% of the respondents earn more than N29, 000 per month, which is not adequate for a household size of 12 (highest in the area).

No matter, how available essentials of life are (including health facilities), they may not be accessible because poor disposable income. The overall effects is that socio-economic sector will continue to be retarded.

V. Conclusion and Recommendation

Household is the smallest unit of the social unit, upon which development evolve. It varies from one area to another as a result of social, cultural and economic differences. This study reveals that there are links between household size and poverty with its attendance effects on the study area: the higher the household size, the higher the poverty

Bearing in mind the above relationship between the duos, the study recommends that, affordable household size is ideal, for sustainable development which cannot be achieved in the absence of healthy living. This can be achieved with the aid of adequate family planning education.

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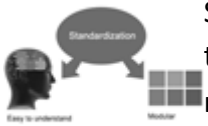

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3. Submission of Manuscripts,

4. Manuscript's Category,

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The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.

- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

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- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
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- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

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- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
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- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
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Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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