WOOD FUEL CONSUMPTION AND ECOLOGICAL FOOTPRINT OF AFRICAN CITIES

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Abstract
Africa has high rate of urbanisation which are due to several factors such as natural phenomenon and self-induced activities of concentration of infrastructure in cities. There is a significant relationship between the rates of urbanisation in Africa and destruction of ecosystem which make it relevant in sustainability discourse. The Ecological Footprint (EF) is a system to show relationship between urban environment and natural eco-system though in a parasitic manner. It has been proved that Africa has the lowest EF in the world because of her lifestyle and consumption of resources. Little research has been conducted on EF at city level in Africa as there is dearth of data for it. The major source of energy in both urban and rural Africa is though wood fuel and this has

devastating effect on the forest and ecosystem. The forest has been depleted and a lot of CO_2 emitted to atmosphere. This is the major problem of deforestation in Africa than lumbering process. Many households in urban area depend solely on wood fuel throughout the year. Consideration on other sources of energy for domestic use need to be looked into so as to reduce the level of degradation of the environment.

Keywords: Charcoal; Ecological Footprint; Energy; Fossil Fuel; Population Growth; Urbanisation.

1.0   Introduction
The rapid economic growth, social polarisation and poverty with increasing environmental and health condition are the major problem of urbanisation in African cities. High urbanisation is due to economic prosperity, increase in industrial and commercial activities and transportation. There has been high degree of environmental degradation due to high industrial production, transportation and inadequate housing in the cities. The major factor in urbanisation has been material put and flow (i.e. high consumption of water, fossil fuel, oil, food, building materials and energy etc.). The city consumes high percentage of this product and at end produces waste (solid, liquid, heat etc.). These processes take place at both local and global scale. This has brought to the fore, the problem of environmental risks which require sustainable development.

The ecological interest of African cities really emanated from the analysis of population movement released by United Nation Fund for Population Agency's (UNFPA) document "State of World Population" for 2008/2009. The report indicated that by 1900 5% of African lives in urban area but 2007, it has risen to 38%. African urban growth rate of about 4% is the highest in the world (UNPFA, 2007). The population of Africa over time is thus put in the table 1.

This implies that the population of Africa rose from 228 million in 1950 to about 1.016billion in 2010, and will rise to about 1.51 billion in 2030. The increase in urban population implies reduction in rural population. It has effect because ecologists consider people as agent of disturbance (McCintyre et al, 2000). It has also been said that development of peri-urban area will displace rural dwellers and bring problem of encroachment to farmland by built environment in this fringe area of the city due to sprawl. One of the problems of African urban development is urban sprawl due to poor planning and lack of infrastructure. The ratio of urban population to rural population in Africa is shown in figure 1

There have been environmental impacts of built environment on the habitat of man, the rural area and worldwide effect. The utilisation of natural resources is the bane of problem of the society. These resources are used to provide goods and services and consumption of such produces waste and CO_2 emission. The ecosystem has been changed in the process of using land, water and energy by man. It has become artificial not as natural as several century ago as it used to be. Many effects include depletion of ground water, thereby reducing the water table and land degradation just to mention a few. Rivers have now been considered as source of water for urban populace as many of it has been dammed (Shower, 2002). It has effect on both upstream and downstream populace. It has changed the hydrological cycle of the area where the dam is constructed, water

channels and flows are affected which also in turn affect flora and fauna and biodiversity especially the aquatic lives.

The sustainability process originated from general attribute to shift in the way environmental degradation are viewed and international development agenda such as poverty (Suderlin, 1995). The more awareness created by international, regional and national government and organisation about the problem been faced by people on environmental issues such as degradation of biodiversity, climate change, overconsumption and overburden of ecosystem. Differences in the rate of development have also contributed to the problem of poverty and health. Weiland (2006) argued that environmental, economic and social stress in the urban society today are related and caused by uneven development and over use of resources especially in urban area compared to rural Africa. The rate of consumption of resources (both natural and artificial) are in such that Sustainable Development will become problem except in attempt are put in place to stem the rate of consumption and lifestyle of the western world. Therefore, there is need for a holistic shift in the way development is viewed. Put in a simple form, sustainability is a process of paradigm shift that allow for economic development, qualitative growth, bioregionalism, symbiosis of man and natural environment.

The dam has its attendant problem in the area of untreated water coupled with industrial chemical channelled to the rivers have destroyed aquatic life and affect human as well. Many cities have developed along coastal area thereby destroying coastal habitat, the dredging of rivers, shipping of vessels and habour have totally changed the coastal lifestyle (McGranahan et al, 2004).

Arable land are been lost on daily basis, it is been built on to provide shelter and mine for industrial and resources exploration. This has caused soil pollution and erosion to be on increase due to dumping of untreated waste (both solid and liquid) on it. In fact it has been proved that waste has also affected ground water as many chemicals percolate down to water table to pollute ground water. The pollution has also occurs at point source because waste are dump along the river channels.

Though urbanisation has its own benefits, the development of peri-urban area also has its own biodiversity of green area that can be higher than the rural area (Anon, 2006). The development of peri-urban area creates a bridge between urban and rural setting. It is lower in the level of development to urban area but higher than the rural area, thereby creating a different identity for such development. It has developed are for urban agriculture and provide source of revenue to the dwellers. Though provide a paradigm shift in the urban studies, much research has not been done carried out on the aspect of peri-urban development in Africa (Robert et al, 2003).

The paramount aspect of urban ecology is the scale and location of urban area; this is due to the fact that the numbers of urban centres are growing rather than rate of urbanisation. It has been predicted that there will be growth of mega cities in Africa (UN-Habitat, 2003), but the findings indicated that rather is the proliferation of smaller cities that is obtainable (Tannerfeldt and Ljung, 2006) which lack basic developmental plans, investment on infrastructure thereby aggravating poverty. Poverty is seen as rural phenomenon but poverty have been urbanised as poor people are more in urban Africa than rural setting nowadays (Abd'razack and Ludin, 2012). The UN in 2006 defines smaller cities as cities with population less than 500 thousand. It is difficult at this juncture

to determine what constitute a smaller city in Africa. There is no universal definition of smaller cities and several factors account for this, for example, different countries have different criteria for definition of cities, thereby making generalisation difficult. In Nigeria a location of 20,000 people are considered urban area and this is far cry from the UN definition of smaller city. Research also found out that smaller cities account for nearly half of the population of urban people in Africa and it is expected to habour more than 50% of the population by the year 2015 (McCintyre et al, 2000).

There are attendant problems associated with residing in smaller cities in Africa; it does not command investment from government and industrialist compared to mega-cities and thereby lacking in basic infrastructure for basic lifestyle. The services are poor, even in a situation where it is available, planning and regulations are lacking or rudimentary if available (Clancy, 2008) and unplanned neighbourhood emerged every nook and crannies of the cities in Africa. There is no comparison of smaller cities and mega-cities in Africa as they lack the strength to match the larger cities. The land-use, transportation services provision, water and energy supply are poor and erratic, poor sewage and drainage etc. are common features of the smaller cities in Africa.

There are three main reasons for urbanisation in Africa; natural increase, because of improvement in healthcare services and high fertility rate in Africa. Natural increase has been a major factor in urbanisation in Africa. The World Health Organisation (WHO, 2006) report indicated that on average, there are about 6 children per woman in Africa; another factor of concern to urbanisation is the government policies that favour the urban area at the expense of rural area in terms of investment on provision of infrastructure. There is provision of infrastructure in urban area than rural area which have the pull factor for population from rural area to urban area; the third and important factor of urbanisation in Africa is rural-urban migration which was earlier think to be caused by drought, famine, ethnic tension, civil strives and wars, epidemics etc. This has changed perception as impression now is that urban area provides window of opportunities than rural area. This encourages migration as government neglect rural area in the process of providing basic necessities of life. This has led to urbanisation of poverty as many of the migrants find it difficult to fit in into urban setting. This has led to problem of managing the city. Mabogunje (2002) summed the problem facing urbanisation in Africa thus: manageability, liveability, congestion and crime of all kinds.

The issue at hand is not stopping urbanisation but rather, to make urban area sustainable and habitable to the people. Wherever people live, basic needs such as water, electricity, food, transportation, proper planning etc. have to be provided and proper waste management to reduce epidemic and pollution of the urban environment. The production of basic amenities is just a prerequisite as natural ecosystem must also support these facilities to make cities sustainable, therefore, natural limit should not be exceeded so that it will be able to assimilate CO_2 and regenerate for the benefit of present and future generations. This study examines the environmental impact of wood fuel consumption in Africa, as it relates to Ecological Footprint in urban area and effect of urbanisation on human environment.

2.0   Methodology

The method employed in this study was basically secondary; it requires the collection of secondary data from relevant books, journal, working reports and internet search. The analysis was done on these collected secondary data to establish the relationship of Ecological Footprint in

African cities. Ecological Footprint is one of the assessment tools to measure sustainability which indicates the lifestyle and consumption habit of the people in urban area. It also shows the way poverty was urbanised. The major focus of this research is on consumption and energy derived from biomass (wood fuel charcoal etc.) used in all parts of Africa for domestic cooking. Though there are other energy sources, but are uniform in Africa except water and bio-fuel. Other issues of environmental problems are also considered such as poor sanitation and hygiene.

3.0   Result and Discussion

Increasing human population (Urbanization) had proved to be the driving force in natural resources consumption. Ecosystem has continually playing the role of provider of resources and assimilator of the waste produced. Cities globally depend on their hinterland to provide input and also export the output to them (the implication of the phenomenon is that nature is been consumed at a rate that is not sustainable). Economic growth has been the major factor that is causing the unsustainability of the world as economic development implies the production and consumption of resources that are produced from nature. This has brought a lot of damage to the ecosystem both globally and nationally (Wackernagel and Rees, 1999; Yue et al, 2006; GFN, 2008; WWF, 2009; Wackernagel et al, 2010).

The ecological impact of our development has been a subject of discussion in the field of sustainability. The expansion of our cities has reduced or consumes arable land for agriculture, deplete ecosystem and local biodiversity. The growth of population implies higher demand on resources and other ecological services. Hurley et al (2007) opined that urban form is a function of energy consumption for transportation; most of the household consumption is centered on its size. Also, for sustainability to be achieved, there is need to consider the form and function of the city, this will reduce the ecological impact the city have on the environment.

Norbert and Peter (2010) argued that large number of the world's population lives in urban area, which continue to expand rapidly. This assertion was corroborated by the UN-Habitat report of 2008/2009 that 50% of the world's population now lives in cities by 2007. Although cities all over the world cover only 2% of the earth surface, it has enormous impact on biodiversity due to the fact that it account for the consumption of 75% of global natural resources and 80% of Green House Gas (GHG) emission. This indicated that urbanization has been a grave threat to the ecosystem and global biodiversity. It leads to environmental degradation, replacement of natural environment with artificial one. Therefore, the cities should act as essential actor in the protection of the environment and biodiversity.

Ecological Footprint has emerged as one of the leading measures of human's demand on nature. This is done by measuring how much land and water area a human population required to produce the resources he consumed and to absorb its waste using prevailing technology (GFN, 2010). Ecological Footprint measure humanity demand on the biosphere by accounting for the area of biologically productive land and sea require to provide the resources used and to absorb the waste. This area of land include the cropland, grazing land, forest land, fishing ground (all land require to produce food, fibre and timber consumed by humanity), built up land (for provision of houses and infrastructure) and energy land use for transportation and the embodied conversion land

for the absorption of waste and store humanity CO_2 emission which comes from burning fossil fuel and natural gas (Wackernagel and Rees, 1996; Wackernagel et al, 1999; Wackernagel et al, 2002; 2005; 2008; 2010, Rees, 1998; 2000; 2001; 2002; GFN, 2010).

Ecological Footprint has shown to be the most successful indicator of sustainability for providing necessary information about the concept of environmental sustainability and the limit of the earth physically. The past event over a decade has shown that Ecological Footprint has been the main measure for resource utilization and consumption at national and international level, because it shows the impact of man on the environment; though it is not the overall indicator of sustainability, it has proved to be one of the criteria for environmental sustainability. It has proved how much bio-capacity is available and used by man and how much is available on sustainable basis. Then, Rees (2001; 2002) put it forward that Ecological Footprint analysis therefore estimate the size of modern patch and it also serve as a measure of economic scale.

3.1   The Ecological Footprint of Cities in Africa

O'meara (1999) opened that over 60% of the natural resources are consumed in the cities and generation of waste. He further stressed that over 80% of the CO_2 emission take place in cities; 75% of wood fuel are burn in the cities and 60% of fresh water on earth for human use. EF has been an important index for measuring human impact on the natural resources. The use of this indicator makes it easy for comparison of EF of individual city or a country. The WWWF have used this indicator to measure the rate of consumption of resources and its bio-capacity of a country over a period of time. It is measured in global hectare (gha) calculated from world average biological productivity. There are two sides to the calculation of EF which are the productive land and consumption. The productive land include cropland, fishing ground, forest land (land needed to produce food, fibre, fuel wood and timber that is consumed in such area), energy land for transportation, Built up land and land to absorb CO_2 generated while using the energy and space for infrastructure (WWF, 2006).

It was estimated in 2008 by WWF (GFN, 2010) that the African EF African cities is about 1.1gha per capita and the bio-capacity of Africa is about 1.4gha. It is lower than the global average of 2.70gha. It may looked that the Africans are producing EF lower than the global average but this statistics has not shown the particular city's EF as average may inhibit the reality (Clancy, 2008). There may exist local problem where EF may be higher than the average and it bio-capacity lower than 1.3gha. The African contribution to EF and bio-capacity is shown in table 2 thus:

The analysis indicated that Africa produces lower EF (6%) annually over a period of 50 years and produces higher bio-capacity of between 9 and 12% within this period. This implies that that Africa have contributed fair share of the world bio-capacity and if the world population lives like Africans, it will requires 0.90 earth (11 months) to produce what is consumed in a year globally.

3.2   Ecological Footprint of Wood Fuel Consumption

One of the measure of EF is energy used as it is most important contributor to EF, and it is a requirement that make use of biosphere and pour waste (heat and CO_2) to biosphere as well due to use of it. The EF is the amount of energy land needed to produce and sustain energy consumption of such country. The EF of energy consists of four different energies: fossil fuel (coal, oil, and gas);

biomass (wood fuel and charcoal); nuclear and hydropower. The land needed is sequestering the excess CO_2 produced during the use of energy is known as energy land.

The main source of energy to households in African cities is through biomass as the harvesting is used to make fuel logs and charcoal for cooking. 59% of energy consumed in Africa in 2001 was from biomass (UN-DESA, 2004). FAO (2006) indicated that 88% of the 546 million m^3 of round wood produced in 2005 in Africa was used as charcoal. The ecological effects of this charcoal used in African cities are enormous. The clearing of forest has always led to loss of indigenous biodiversity, depletion of ecosystem and desertification of Africa. FAO (2000) indicated that the rate of deforestation in Africa differ indifferent regions; it ranges between 0.75% and 2.2%. The climax of wood fuel was reached in the 1970s when the demand for charcoal exceeds supply (FAO, 2000). This led to assertion by Nash and Luttrell (2006) that by the turn of the century, most of the African countries would have been deforested. The problem of deforestation cannot be blamed on wood fuel alone; there are other factors such as lumbering, and export of wood product to other nations (there has been increase in the market for hard wood in developed countries and illegal lumbering). Leach and Mears (1998) suggested that deforestation cannot be stopped even if the use of charcoal is stopped. The production of charcoal has greater ecological effect on the environment and ban on the use in African cities will be alright but counterproductive as many households depend solely on it for their livelihood (Girad, 2002).

There are several avenues for urban households to obtain charcoal, apart from wood in the forest. Other avenues include: waste from saw-mill-saw dust, useless branches of logs, discarded packaging, peri-urban wood etc. (Hosier and Kipondya, 1993). More research about urban wood for cooking still need to be done to ascertain volume of wood consume annually in domestic household cooking in Africa.

The major source of deforestation in Africa is through lumbering and farming; the timber companies cut down trees in the forest for profit purpose while farmers cut down trees to give way for farming practices. Both the saw-millers and farmers produces product for urban populace and as the population increases, the demand for these products also increases. The urbanisation and development of peri-urban fringe allow for the woodland to be cleared for building purposes, thereby reducing the forest and make available woods for making charcoal for urban fuel (Abd'razack and Ludin, 2012). The extent of poverty in the cities has also led to growing use of charcoal in the cities in Africa.

Another energy use in the African cities is city-energy-water nexus. Rivers are been dammed to provide water for hydro-electricity in the cities. Theuri (2006) said that Africa has 10% of the world hydro-station of the world and have potential to produce 1,100tWh of electricity, but at the present actualise only 4% of its potentials (Bartle, 2002). Small percentage of African have access to electricity which make them to depend on charcoal , but the growing clamour to reduce CO_2 emission and mitigating global warming might compel African leaders to tap this potentials. Though dams have their own consequential effect such as distortion of ecosystem, flooding, disruption of water flow and aquatic life, it also has effect on downstream population as it distorts their means of livelihood (Acreman, 1996). Construction of small and large scale dams have been reported to have some health and environmental problems. The ecological problems of downstream

is increased and displacement of people from their natural habitat as witness in Akosombo (Ghana) and Bussa (Nigeria). The disruption of ecosystem by the construction of these dams has put natural resources at risk (Shower, 2002).

3.3   Urban Ecology and Human Activities in African Cities

Two main contaminations exist in urban area: air pollution and waste management especially solid and liquid. The major pollutant of air in urban area is transportation and industrial pollution. Everybody in the urban area exposed to air pollution and the level of exposure depend on income level and the function of that city. Some cities have higher air pollution than the other. High exposure is common among the poor than the rich. The ways urban dwellers are exposed are in varieties of ways such as: *Indoor Air Pollution (IAP), Work place, indirect exposure due to poor planning*. Almost in all the African cities, urban dwellers uses wood fuel and charcoal for their households' energy need especially the poor who constituted higher percentage. This id usually done in the open fire and stove with poor ventilation, usually leading to IAP that affects women and children most because they are saddled with responsibility of cooking on daily basis. But some families use electricity and Liquefied Natural Gas (LNG). The pollutant from the charcoal has many side effects such as irritation and lung cancer. Child health problem is also been connected to exposure to IAP in developing countries like Africa. Ailment such as low birth weight, pre-natal mortality, asthma and middle ear infections are common is a locality where constant use of biomass is favoured (Bruce et al, 2000).

The level of poverty has also led to the reduction in the type of windows been used by households because standard are not followed in the construction of dwellings, especially in the low-income neighbourhoods. The effect of this is poor ventilation which further exposes women and children to IAP. World Health Organization estimated that Africa accounts for 24% of the world IAP death in the world as related by Warwick and Doig (2004). IAP as a *"killer in the kitchen"* accounts for 1.6 million death globally (WHO, 1996). This call for change in household energy consumption pattern due to the effect it has on users and the environment. The consumption of biomass is fast becoming the order of the day as the cost of the alternative energy is on the increase.

Exposure to pollution in work place have had little attention in Africa, but that does not indicate that African are exposed to limited hazard like that of industrialised nation, rather, they are exposed more harmful pollution than them, because of high level of technology the industrialised nations have been able to reduce the exposure to industrial pollution than Africans. For example, the workers in South Africa are exposed to more harmful pollution than the industrialised world. APINA (2003) indicated that workers in copper belt in Zambia are exposed to higher pollution than the WHO recommended level of pollution. The SO_2 exposure is about $2000\mu gm^{-3}$ per week while WHO indicated that 500 μgm^{-3} in 10 minutes and about 350 μgm^{-3} per hour is recommended. This is four times higher than the recommended level of exposure. This has environmental and health effect on the workers.

Large percentage of the urban population work in an unregulated informal sector in Africa (Clancy, 2008). These industries use unprocessed biofuel and residual oil that are harmful to human health. Majority of bakeries in Africa uses wood fuel and charcoal for firing up their locally made ovens for bread production. There is dearth of research on this aspect of exposure to pollution by

these unregulated informal sector activities. Maduka (2006) opined that women that smoke fish in Lagos and which is common practice in all urban African cities, uses drum from chemical industries for the combustion of wood fuel. This exposed them to danger of not only the biofuel CO_2, but also toxics from this device used. There has been report about different ailment for people in Addis-Ababa using wood fuel for cooking (Haile, 1991).

Traffic and transportation in the cities of Africa is another major contributor to air pollution. UNEP indicated that over 90% of the air pollution comes from combustion of fossil fuel by vehicles, and have been promoting using of non-lead fuel in Africa. About 90% of the vehicles used in Africa are older vehicles which have been used in Europe or America and transported to Africa as used vehicle, thereby have higher emission tendency (Anon, 2003).

The estimated number of used imported vehicles to Nigeria between 1988 and 2005 is shown in table 3 and the attendant pollutants poured into the atmosphere to cause air pollution (compound of Nitrogen Oxide NOx, Carbon Monoxide CO and Hydrocarbon HC) is shown thus in table 3:

The analysis of the above data indicated that the number of used imported vehicles rose from 432 in 1988 to about 43, 678 in 2005 (an increase of over 10,000%) within 17 years. This has led to increase in the volume of pollutant from this vehicle from 4.80 Kg per average mile of air pollution to about 48.1 Kg per average mile per air pollution. Considering the rate of emission of all the air pollutant from new vehicle and imported used vehicle shows that, the used vehicle produces pollutant 5 times higher than the rate of new vehicles. The combustion of coal, oil and gasoline accounts for the most of the airborne pollutants. For instance, more than 80% of the sulphur dioxide, 50% of the nitrogen oxides and 30-40% of the particulate matter emitted to the atmosphere in the US, are produced by fossil-fuel fired electric power plants, industrial boilers, and residential furnaces (Dosunmu, 1998). In addition 80% of Carbon Monoxide (CO) and 40% of the Nitrogen Oxides (NOx) and Hydrocarbons (HC) come from burning gasoline and diesel fuels in cars and trucks (Dosumnu, 1998).

Another problem of urbanisation in Africa is the disposal of both domestic and industrial liquid waste; sewage treatment is lacking and industrial liquid were channelled to streams and rivers to pollute them, and thereby causing the dearth of aquatic lives (Showers, 2002). Furthermore, the domestic sewage is not channelled as the effluence is allowed to spread round the community to cause unpleasant scenery and poor environment.

Solid waste is a problem in African cities as waste are not well managed and treated, this has caused widespread of vectors and diseases in African cities. The once know garden city in Nigeria (Port-Harcourt) is now known as garbage city as there is heaps of solid waste in every nooks and crannies of the city and many other cities in Africa. Though the average rate of solid waste produced differs in different regions, but the common feature is poor management and heaps of garbage visible in every part of African cities. Average solid waste production in African cities is between 0.5kg and 0.8kg per person per day while it is between 1kg and 2kg per person per day in OECD countries (UNEP, 2008; OECD, 2010). Despite the higher production of solid waste in

OECD countries there is better management of their waste. The problem of ecology in urban solid waste management is the problem of management of open dump and sorting of waste; this has posed to be a greater problem to waste, management in African cities. Open dump is usually employed and dumping of waste indiscriminately in every part of the cities, and the ecological consequences on health, water, soil, and air pollution is not considered. Governments at all levels in Africa have not fared well, and the problem continues to assume many dimensions.

3.4   Reducing Ecological Footprint of Wood Fuel Consumption in African cities

The major source of energy used by the households in African cities is the use of wood fuel and charcoal for their daily need. This has greater consequence on both ecosystem and environment. There supposed to be alternative use of fossil fuel such as Kerosene, Liquefied Natural Gas (LNG), and electricity, which is less dangerous to human health and environment. But the process of subsidy removal on these product brought about the world market on these products have also made it to be beyond the reach of the urban poor. For example, the cost of Kerosene and LNG increased astronomically in Nigeria between 1991 and 2012. The problem with alternative energy sources is a complex one, one of the problem of alternative is the price of the alternatives. Research have proved that many households in African cities where poverty is common spend up to 25% of their income on these alternatives for their energy consumption which is can aggravate poverty and thus reduce their affinity to the use of these alternatives (Barnes, 1995). There exists a gulf between the price of wood fuel and the alternatives which makes wood fuel more accessible and its consumption continues unabated.

Another problem with alternative energy use is the availability of the products at the recommended price round the year. The resent research indicated that Kerosene availability in Nigeria has become problematic as households are not having access to the product at the pump price. The LNG is beyond the poor who constituted higher percentage of Africans. So LNG is not seen as an alternative. Other dimension to encouragement to use of wood fuel in African cities is due to the perceived advantage of the use of wood fuel and charcoal is that it provides energy for longer hours than the alternatives especially Kerosene. The cooking utensil used in Africa are round bottom that is not useful on Kerosene stove also constituted apathy for the use of alternative (Leach and Mears, 1998).

Furthermore, the human behaviour and perception about food cooked by wood fuel and charcoal that it is more tasteful than the Kerosene stove is a problem, this has led to objection to these alternatives by some Africans especially the poor. There is telepathy between the food and taste produced by wood fuel and Kerosene stove that support the use of wood fuel (Clancy, 2006). There is need to change human perception which is often difficult.

The supply chain of wood fuel in the urban centres is wide and the people involved are many. This has led to clearing of the peri-urban forest for wood fuel. This has to change over time because government policies have to encourage the use of alternative energy for domestic use. Another dimension is the clearing of peri-urban land for agriculture and built-up in the expansion process of the cities to accommodate people. The product of the cleared peri-urban land in African cities end up been wood fuel and charcoal for use in African cities and transported for international trade where it is been needed for heating up in Europe and America. Majority of the urban poor still depend on this non-conventional energy for their use. Urban planning and forest management have

to play a prominent role in the conservation of the natural habitat so that sustainable development will be achieved.

Though to say that the use of wood fuel will stop in African cities is not real, because the supply chain is fast becoming sustainable but the government have to make policies that will guide the use and sales of this product to protect the forest and make the environment sustainable. There supposed to be public sector policy on forest that will integrate the environmental services into consideration. This will make sure that charcoal is produced and protection of the environment is also paramount so as to protect the forest and other natural habitats.

Though shifting from wood fuel to fossil fuel increases the EF, it is a short term or medium term strategy for energy use in cities. The problem associated with fossil fuel consumption is the fact that the price of these products keeps on soaring on annual basis. There has been such an increase in the price of Kerosene and LNG, and the trend will continue as government clamour for the removal of subsidy on these products, therefore, the expected shift from wood fuel to fossil fuel is a mirage especially among the poor. Therefore, it is important to address the issue of sustainable use of wood fuel and charcoal in the cities.

4.0   Conclusion and Recommendations

The EF of African cities indicated that Africa is better managed in the process of consumption and production of natural resources. But that does not mean that we should be complacent, and not to think of how the process of sustained in the use of these resources. Depletion can occur if the resources are not used in a sustainable manner. The figure of EF does not present a thorough reflection of situation in cities because the calculation was based on countries. There are some cities that would have had an overshoot of EF which other cities would have compensated for. There is a divergent between the EF of urban area and rural communities when it comes to EF calculation and use of resources, therefore, the rural area is compensating for the excess of EF of cities.

There are several ways of reducing the ecological impact of urban lifestyle on rural setting. The cost of alternatives to wood fuel is not helping individuals especially the urban poor to shift to alternative sources. Though the use of Kerosene and LNG can reduce IAP, it has higher tendency to increase EF of cities and does not prevent deforestation because of agriculture and urban sprawl.

Government have to promote policies that will enhance the capacity of the rural and urban poor to earn a living before they could stop the production and usage of wood fuel and charcoal as many households depend on this trade for their livelihood. Therefore, to have sustainability in environmental management, it requires the effort of all the stakeholders (individual, traders, community and government) in its management.

Urban development in Africa has been an interesting aspect of urban planning. Urban planners can see urban development as a threat to ecosystem, habitat and biodiversity, therefore, ecologist have a prominent role in the process of urbanisation. This will help the urban households and service providers, by providing necessary information in the development of the cities. There are many problems associated with urban development which include health problem management, liveability and congestions; urban planners can help in the dissemination of information on new

trend of diseases, disaster in the cities, causes and how to ameliorate it. This will have a greater influence on the management and development of peri-urban area of African cities.

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Table 1: Population of Africa and its Urban Population

Year	Africa Pop (Million)	Urban Pop (Million)	Urban Pop. (%)
1950	227.94	28.26	12.4
1960	285.10	41.91	14.7
1970	365.90	69.89	19.1
1980	478.08	86.12	23.5
1990	633.23	177.93	28.1
2000	810.43	274.74	33.9
2010	1,016.52	406.60	40.0
2020	1,251.94	563.37	45.4
2030	1,507.90	735.86	48.8

Source: Adapted with modification from Geohive.com/defaut.aspx, 2013

Table 2: EF of African through time

Year	Africa Pop. (Million)	Total EF (Mil. gha)	Total Bio-Capacity Capacity (Mil. gha)	Africa as % of World EF	Africa as % of World Bio-Capacity
1961	280	282	848	6	9
1965	312	321	865	6	9
1970	356	387	885	6	9
1975	406	437	906	5	9
1980	468	514	929	6	9
1985	539	580	930	6	9
1990	620	655	979	6	9
1995	704	742	994	6	9
2000	792	817	1,062	6	10
2003	847	889	1.093	6	10
2008			1,146	7	12

Source: Adapted with modification from GFN, 2010

Table 3: Used Vehicles Imported into Nigeria between 1988 and 2000 and their Estimated Pollutants Emission Contents.

Year	Number of Used Imported	Emissions in grams per average mile of air pollutants						Total emission by Used Vehicles
		New Vehicles			Used Vehicles			
		NOx	CO	HC	NOx	CO	HC	NOx+CO+HC
1988 47,520	432	1,512	6,480		1,512	1,728	38,880	6,912
1989 84,260	766	2,681	11,490		2,681	3,064	68,940	12,256

1990	1,878	6,573	28,170	6,573	7,512	169,020	30,048
206,580						
1991	5,304	18,564	79,560	18,564	21,216	477,360	84,864
583,440						
1992	10,554	36,939	158,310	36,939	42,216	949,860	168,864
1,160,940						
1993	15,140	52,990	227,100	52,990	60,560	1,362,600	242,240
1,665,400						
1994	9,551	33,429	143,265	33,429	38,204	859,590	152,816
1,050,610						
1995	15,130	52,955	226,950	52,955	60,520	1,361,700	242,080
1,664,300						
1996	21,551	75,429	323,265	75,429	86,204	1,939,590	344,816
2,370,610						
1997	26,568	92,988	398,520	92,988	106,272	2,391,120	425,088
2,922,480						
1998	22,732	79,562	340,980	79,562	90,928	2,045,880	363,712
2,500,520						
1999	27,730	97,055	415,950	97,055	110,920	2,495,700	443,680
3,050,300						
2000	30,388	106,358	455,820	106,358	121,552	2,734,920	486,208
3,342,680						
2001	33,046	115,661	495,690	115,661	132,184	2,974,140	528,736
3,635,060						
2002	35,704	124,964	535,560	124,964	142,816	3,213,360	571,264
3,927,440						
2003	38,362	134,267	575,430	134,267	153,448	3,452,580	613,792
4,219,820						
2004	41,020	143,570	615,300	143,570	164,080	3,691,800	656,320
4,512,200						
2005	43,678	152,873	655,170	152,873	174,712	3,931,020	698,848
4,804,580						

NB: Emissions is in grams per average mile of air pollutants.
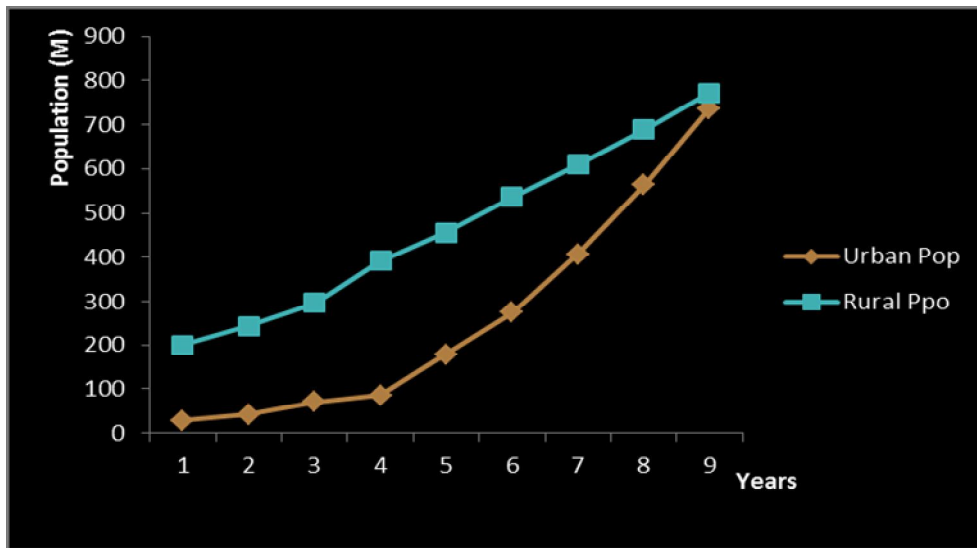**Source:** Adapted from Ajayi and Dosunmu, 2002.

Figure 1: Ration of Urban population to Rural Population in Africa
Source: Adapted from geohive.com 2013.