

Environmental Effects of Cutting Down of Trees for Road Construction in Kaduna Metropolis, Kaduna, Nigeria

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ABSTRACT

This study has been carried out to examine environmental effects of cutting down of urban trees for road constructions in Kaduna Metropolis and was anchored on the concept of sustainable development. Primary data were generated through administration of 174 structured and semi structured survey questionnaires in areas where road constructions are on-going. Secondary data were obtained from desk review of other literatures. Descriptive statistic and model were employed for analyses of the data. Findings reveal (strongly agree and agree) that 95%, 71% and 56.3% are of the view that cutting down of urban trees lead to intense heat, stormwater runoff and stronger greenhouse effects resulting to climate change respectively. The study also shows that the respondents (strongly agree and agree) with 77.6% are of the view that urban trees absorbs contaminants, provides ecosystem service (69.4%), aids hydrological cycle (59.4%), absorbs and retracts noise (61.6%), places of pastime, relaxation and petty trading while 57% reports that urban trees are of medicinal and culinary values. The study further reveals that majority of the populous have limited knowledge on environmental issues such as climate change. The study recommends that The State Government should always consider impacts assessment of any projects it intends to execute, carryout genuine projects not on political basis, residents should be encouraged to plant trees in the environment and further research on climate change.

KEYWORDS:Sustainable development, greenhouse, climate change, contaminant, environment

I. INTRODUCTION

Over the years, the world has been witnessing tremendous urban upsurge as a result of quest for better life especially in developing economy. This has resulted to over half of world's population presently lives in urban centres and it is expected that by the year 2030 the number will

increase to about five billion (Stephen *et al*, 2017; World Urbanization Prospects, 2004). In Nigeria, urbanization and population growth have roots dated back to the oil boom period of 1973 – 1983. The period witnessed the largest wave of urban growth in terms of both social and physical infrastructures at the detriment of the environment. It continues to pose threats to lives in the urban centres and to the much preached concept of environmental sustainability (Zankan *et al*, 2019). According to Brody (2013) most of the developing world; including Nigeria are facing environmental problems ranging from climatic change, poor or inadequate infrastructures, pollution, wastes, slums and social vices among others.

In the face of growing population in city centres, the need for physical infrastructure such as roads to meet the teeming population and ease mobility problem becomes inevitable. This is because transportation arguably is one of the most determining factors for economic growth of any city or nation (Mshelia, *et al*. 2020; Olagunju, 2015). In the quest to attain physical and economic development through road constructions among others to ease or reduce traffic congestions (one off the characteristics of cities in Nigeria) as well as to minimize the gap between developed and developing countries, environmental resources such as vegetation (urban trees) are being annihilated without recourse. These acts have unduly over stretched the environment and causing a negative marks or hazards and in-turn has affected the ecosystem (UN-Habitat, 2009).

Of no doubt, road constructions in urban centres especially in Nigeria is a very welcomed development and commendable. However, it pertinent to note that the kinds of development being carried out in most cities in Nigeria are done with little or no consideration to environmental impacts or plans and its sustainability compared to that of British, America and France. In Nigeria, indiscriminate cutting down of trees to construct roads, build houses, airports, schools and other structures are done to either satisfy the political

elites, seek re-elections or just to have similar things in developed countries (Arokoyu 2004; Alexander, 2017). This is what d'Huart (1999) called "unplanned development" when nature or vegetation is not protected. d'Huart (1999) further opined that it is what people have in their minds, nurture it in their hearts and what they want in their pockets that move them to some extent protect the nature.

Kaduna metropolis, once a land occupied by few locals came to limelight during the colonial period; is today one of the towns in Nigeria that is presently undergoing unprecedented urban and population growth which has led to the demand of both social and physical infrastructures (roads). Some of the few ones that have been in existence since the colonial are overstretched and no longer efficiently meeting the upsurge population. In reaction to this, the State Government called for the review of the Kaduna Urban Renewal and it gave birth to the various constructions of roads going on in some selected parts of the metropolis. Single lanes are being expanded to double lane and some areas within the core centre of the metropolis that have no tarred roads are receiving attention. Daily trust of 7th December, 2019 reported that the constructions and expansions of the metropolitan roads have led to the cutting down and uprooting of no fewer than 150 trees of different species while another 50 have been marked to be cut down. The trees were cut down to pave ways to road constructions along the popular Waff Road, Kaduna, which has popular spots like the Hamdala Hotel, Command Guest House, foreign rug shops and others. Similarly, over 50 trees were cut down and stumps uprooted along Yakubu Gowon Way, others areas of the metropolis that have been affected are Lugard hall, Alkali Road, Murtala Square and Commissioner of Police roundabout.

The irony of urban tree cutting in Kaduna metropolis is that it is being championed by the State Government who is understandably supposed to be the advocate of the campaign against cutting of economic and historical trees to give way for infrastructural development such as road with little no considerations for the effects of the actions. Road constructions are good and very imperative but should not be done at the expense of the environment. It on this basis that the study seeks to examine the environmental effects of cutting down and uprooting of urban trees in Kaduna metropolis with a view to identify the environmental consequences and possible ways forward towards sustainable development practices to key into the 2015 Sustainable Development Goals (SDGs) 11; aim to "make cities and human settlements

inclusive, safe, resilient and sustainable" and 15; aim to "protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation, and halt biodiversity loss" by the year 2030.

1.1 The Concept of Sustainable Development

Alexander (2017) is of the view that it is imperative to thoroughly comprehend the concept of sustainable development before it can be applied or used appropriately in the different parts of the globe. This is because sustainable development places emphasis on three specific aspects which many tends to ignore when implementing. These strategic aspects are: *Vision, process and product*. The idea goes beyond the common knowledge that sustainable development is the development that the environmental resource should be explored in such a way that it meets the need of the present and of the future generation. It includes philosophy that takes into cognizance vision in respect to the nature of future communities or environment. In this aspect, attention is given to attaining the basic needs of human beings such as achieving equity as well as justice for both the present and future generation. It also includes security of the biophysical systems, achieving self-reliance and empowerment, integrating various environmental and economic processes and welcoming future options or possibilities. Sustainable development is also a process which takes into account system of governance and management where transparency, openness, accessibility and decentralization where decisions such as the constructions of roads which will no doubt lead to cutting down of urban trees will be treated in accordance to the concept of the sustainable development (Aloni and Alexander, 2019).

According to Dearden and Mitchell (2009), the concepts marries both the ideas or legitimacy of local or indigenous knowledge and the contemporary opinions to seeks to apply both knowledge to come up with ideas or plans that sustains the environment. It also recognizes that conditions are bound to change because none is permanent and also is often accompanies with much uncertainty. Therefore, it is pertinent to be flexible and adaptable to accommodate emerging issues or other policies and practices that may evolve thereafter when dealing with the environment. This concept of sustainable development is applicable in this study in order to ensure that the felling of the urban trees for road infrastructural development in the metropolis are done in such a way that the trees are sustained to

meet the need of future generations. One of the three strategic aspect of sustainable development is “product”. It seeks to maintain that environmental, social and economic aspects are kept together and inter-related. It also emphasizes that environment is not a material or object to be inherited but everybody’s land and abode, therefore, it is imperative to comprehend that the environment is a legacy that must be religiously conserved from generation to generation. In view of the above, it is the collective responsibility of everyone to wisely deal with the environment to avoid it exposure to hazards. Thus, there is the need for trees in our urban centres to be conserved (Alino and Alexander, 2019).

II. MATERIALS AND METHODS

2.1 Study Area

The study was carried out in Kaduna metropolis which comprises of Kaduna north, Kaduna South, Igabi and Chikun Local Government Areas Figure 1. The investigation was conducted in Kaduna North and Kaduna South LGAs only because there is little or no road construction, expansion or rehabilitation and other infrastructural development in Chikun LGA. The places are: the Yakubu Gowon Way, Waff Road, Ahmadu Bello and Independence Way. Others are Ungwan Rimi, Lugard Hall, Alkali Road, Murtala Square, and Commissioner of Police Roundabout.

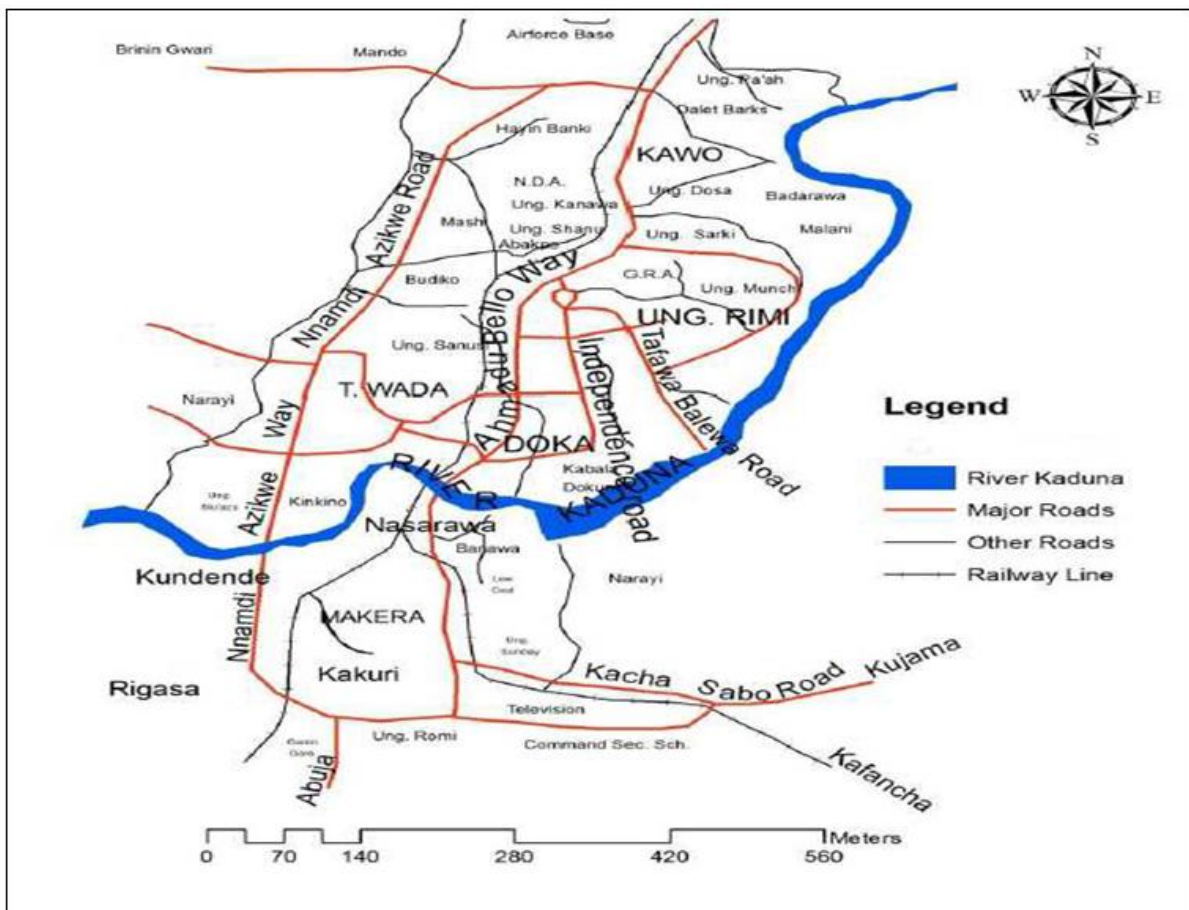


Figure 1: Kaduna Metropolis

Adopted from Rigasa *et al* (2014)

Kaduna metropolis is located between Latitudes 10°20' N and 10°37' N of the Equator and Longitudes 7°22' E and 7°31' E of the Greenwich meridian (Figure 1). The state is bounded to the South-West by Abuja and Niger State, Katsina, and Zamfara at the North-West, Kano and Bauchi share boundaries with Kaduna at the North-East while

Plateau and Nasarawa are bounded at the South-East (Al-Amin and Dadan-Garba 2014). The metropolis covers an area of about 260Km².

2.2 Climate and Weather

The climate of Kaduna State is tropical in nature with divergent seasonal trends and

variability that swings back and forth between cool to hot dry and from humid to wet, with average annual temperature of 25.2°C and sometimes it reaches 29- 30°C (Benedine and Adamu, 2017). Rainfall durations fluctuates between 150days to 190days amounting an annual rainfall of between 1500mm to 2000mm. The relative humidity falls between 20% and 30% in January and rises to between 60% and as high as 80% in July (Al-amin and Dadan-Garba, 2014).

Vegetation divides into northern Guinea savannah in the north and southern Guinea savannah in the south of the State. The trees species identified in the study area include *Eucalyptus* spp, *Azadiracta indica*, *Psidium guajava*, *Terminalia catapa*, *Mangifera indica*, *Anacardium occidentale*, *Khaya senegalensis*, *Gmelina arborea*, *pinus* spp, *Carica papaya*, *Gliricidia sepium*, *Ficus* spp, *Azalia* spp, *Balanite egyptiaca*, *Borassus aethiopum*, *Persae americana*, *Polyantha longifolia*, and (*Entandrophragma cylindricum*) among others (Ogunkalo *et al*, 2017).

2.3 Methods of Data Collection

Data for the study were obtained on: socioeconomic and demographic characteristics of the respondents, felling of trees for road constructions in the metropolis, effects of cutting down of trees and its importance. The study employed direct observations (reconnaissance survey) at the preliminary level of the research to ascertain with the places where the trees in the metropolis are being cut and uprooted for the constructions of roads. Primary data were generated from structured, semi structured, open survey questionnaires and field interview questions in a pre-formulated form where follow up questions were asked for further clarity of questions and responses during the course of the interview (Agbesola, 2013; Bergn, 2009 and Bryman, 2004). Some staff of Kaduna State Ministry of Works, Ministry of Environment and Environmental Cleaning Awareness Initiative (Non-Governmental Organisation) as well as 174 residents of the metropolis was randomly; systematically and purposefully selected for interviews and administered questionnaire. Preference was accorded to the civil/public servants and traders/business men/women operating along the streets where the trees were cut down. The civil servants whose offices are within the state secretariat, close to the sampled points were administered questionnaires and interviewed. The secondary data were obtained from desk review of literatures and records from the local government council and Kaduna State Ministry of Works on the

status of road infrastructure in the LGA. Other sources of data were obtained from documents or materials such as journals, textbooks, the proceedings of seminars and other research works. Photographs of trees at the sampled areas, the ones cut down and the open spaces were taken at different locations.

The sampled points in the metropolis were purposely selected because of the construction activities taken place at the areas. The locations are: Kaduna North and Kaduna South LGAs only because there is little or no road construction, expansion or rehabilitation and other infrastructural development in Chikun LGA which also form part of the metropolis. The places are: the Yakubu Gowon Way, Waff Road, Ahmadu Bello and Independence Way. Others are Ungwan Rimi, Lugard hall, Alkali Road, Murtala Square and Commissioner of Police Roundabout.

Descriptive statistics was employed and analyzed data in tables and charts in simple arithmetic mean and frequency. Similarly, Likert Rating Scale of Strongly Agree (SA), Agree (A), Neutral (N), Disagree (D) and Strongly Disagree (SD) was employed and used where necessary.

III. RESULT AND DISCUSSION

This section presents data obtained from the field on the cutting down of trees for road constructions in Kaduna metropolis. Observations and opinions of different groups or individuals were presented using descriptive statistics in form of tables, charts and figures.

3.1 Socio-Demographic and Economic Characteristics of Respondents

Demographic variables as age, educational status and occupations have considerable impact on the perception of self and the environment especially on impacts or effects of cutting down of trees in urban centres (Alm 2015; Butu and Mshelia, 2017). The study therefore, considered the demographic characteristics of the respondents who are mostly civil servants and purposefully selected because it was believed that their level of education and exposure will aid in obtaining nearly perfect results on the effects of tree felling and associated terms and of course it helped. Out of the 174 respondents, 74% males and 26% females of the population were administered questionnaires and interviewed. This was because majority of the workforce around the sampled points are males as shown on Table 3.1. Majority of the respondents of 56.3% are within the age group 41 – 50. This was because they were assumed to be experienced and mature enough to make good judgment on the

effects of cutting down of trees in the metropolis. Preference was also accorded to those with tertiary education (55.2%) and civil/public servants

(56.3%) for better feedback on the questions administered.

Table 3.1: Socio-Economic Characteristics of Respondents

Characteristics	Frequency	Percentage
Age		
21 – 30	17	9.2
31 – 40	26	14.9
41 – 50	98	56.3
51 – 60	20	12.6
61 and above	11	6.3
Gender		
Male	128	73.6
Female	46	26.4
Educational Status		
No Formal Education	19	10.9
Primary Education	28	16.1
Secondary Education	31	17.8
Tertiary Education	96	55.2
Occupation		
Traders/Business men/women	42	24.1
Civil/Public Servants	98	56.3
Labourers (Mason, Carpenters)	19	10.9
House Wives	06	3.4
Others	09	5.2

Source: Field Survey, (2020)

3.2 Cutting Down of Trees Lead to Intense Heat due to High Evaporation

The highest percentage of 58.6 agrees that cutting down trees in the metropolis leads to intense heat and high evaporation and it is being followed by 36.3% of those who strongly agrees. Neutral view records 4.6%, 1.1% disagrees while strongly disagree reports zero. This clearly reveals that cutting down of urban trees subject the environment to intense heat which makes it unfavourable for habitation and affects biodiversity as also reported by Babalola *et al* (2015). One interesting thing revealed by the study was that most of the trees in the metropolis were planted during the colonial era before independents as opined by a sixty eight year old gate man; Mallam Usman Ibrahim, at Obasanjo House, Yakubu Gowon Way as shown Plate 1 and 2. Some aged individuals that were interviewed also attested to it. The colonial masters understood the significance of trees in urban centres, around settlements and planted the trees that have tremendously helped modification of weather as pointed by the study. Similarly, Olumuyiwa and Tobi (2017) reported in their studies that even temperate countries such as

France have for long cultivated the habit of having trees around houses and buildings because plants and trees cool themselves and the surrounding environment as shown on Plate 3

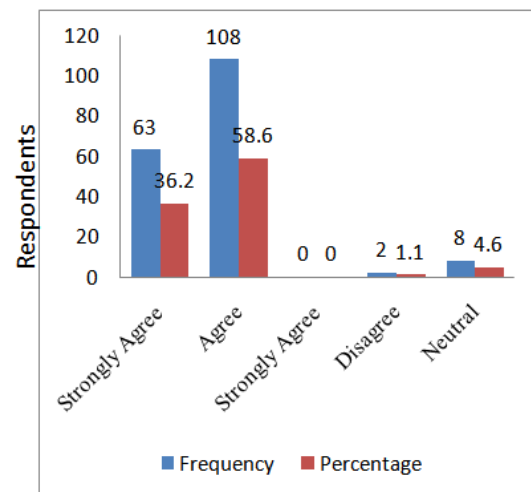


Figure 3.1: Cutting Down of Trees Lead to Intense Heat due High Evaporation
 Source: Field Survey, (2020)



Plate 1: Plants and Trees around Building to Cool the House

Source: Adopted in Olumuyi and Tobi (2017)



Plate 2: Trees Marked for Cutting Down
 Source: Field Survey, (2020)



Plate 3: Yaibu Gowon Way once Full of Trees
 Source: Field Survey, (20)

3.3 Felling of Trees in Metropolis Leads to Stormwater Runoff and Erosion

Figure 3.3 show that 51% and 20% of the respondents agrees and strongly agrees with the view that felling of trees facilitates storm runoff and erosion respectively. Neutral records 23% while 5% disagrees and only 1% strongly disagrees. This implies that cutting down of trees in the metropolis leads to stormwater runoff and consequently erosion. However, the study also reveals that the knowledge of the residents on stormwater runoff in relation to cutting down of urban trees is limited due to the percentage of the respondents of 23% who reported neutral and this calls for further study on prevention of stormwater runoff in Kaduna metropolis. Mcpherson, *et al* (2005) are of similar view that preservation, protection and planting of trees helps in the stabilization and maintenance of the ecosystem such as soil prevention from erosion and aids sedimentation as well as reduces stormwater runoff and the probable danger or damage it may cause. Trees furthermore, increase recharging capacity of groundwater and this means more or adequate potable water in the metropolis.

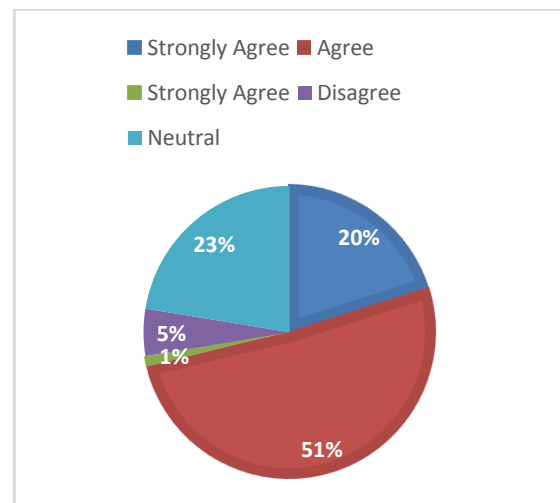


Figure 3.1: Tree cutting leads to storm runoff
 Source: Field Survey, 2020

3.4 Tree Felling Leads to Stronger Greenhouse Effects Causing Global Warming and Climate Change

Figure 3.4 shows the highest percentage of 40.2 of those administered questionnaires agrees that cutting of trees in urban centres contributes to stronger greenhouse effects and followed by neutral with response of 28.7%. Strongly agree reports 14.3%, disagree 10.3% and strongly disagree records only 1.7%. Although, the study reveals that

both strongly agree and agree represent 55.5% of the view, neutral response also carries reasonable percentage of 29% which indicates that not many people in the study area are aware of the concept of greenhouse effects as well as global warming and climate change. The result which was equally viewed by BBC World Service on Talk Climate (2008) calls for further investigation as reported. The perception of cutting down trees in relation to climate change can better be explained as illustrated on Figure 3.5

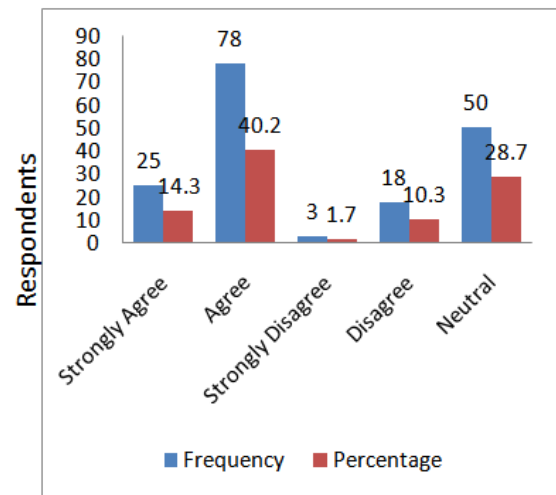


Figure 3.4: Tree Felling Leads to Stronger Greenhouse Effects causing Global Warming and Climate Change
 Source Field Survey, (2020)

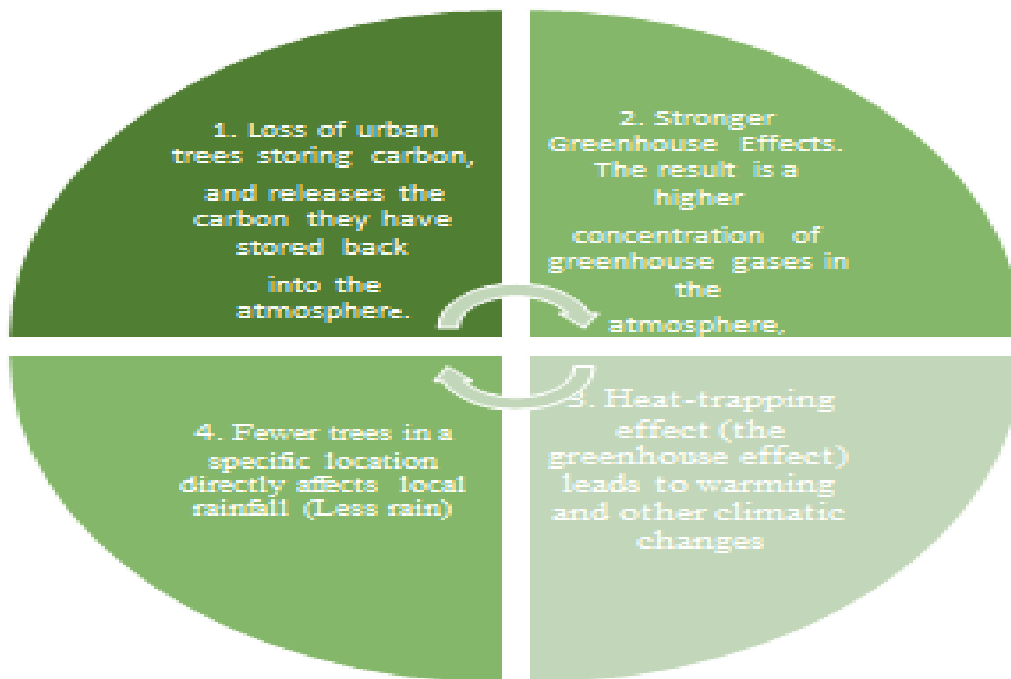


Figure 3.5: How Cutting Down of Trees Lead to Climate Change and Results to Less Rain
 Field Survey, (2020)

3.5 Importance of Trees in Urban Centre of Kaduna Metropolis

Investigations on Table 3.2 show various opinions of the respondents on the importance of trees in the urban centre. The views represent the positive effects of the urban trees in the metropolis. Highest responses of 56.3% and 21.3% agrees and strongly agrees that trees using their leaves absorb contaminants and intercept pollutants in the air that have been released into the atmosphere from industries, vehicles and other domestic activities in three ways: absorption, trapping through aerosol on leaves and settling on the downwind (leeward) as also reported also by Yang *et al* (2005); Kuchelmeister and Braatz, (1993). Trees also aid in the production of oxygen. This further reveals that the resultant effect of the cutting of trees is air pollution and consequently health implications.

The study also reveals that 55.2 % the highest percentage agrees that trees in the urban centres provide ecosystem services such as carbon storage and oxygen. Strongly agree records 13.2% and strongly disagree reports 1.7%. Disagree 4.6% and neutral has the second highest response of 25.3% as shown on Table 3.2. This further elucidates that the knowledge of urban trees in relation to ecosystem service is minimal despite that the study shows that trees maintains ecosystem services in the metropolis.

Results on Table 3.2 further shows that 43% agrees that trees in urban centres aids hydrological cycles and followed by neutral with 29.3%. Strongly agree 16.1%, disagree 9.8% and strongly disagree has the least percentage of 2.9%. Similarly, 49% agrees that trees absorbs and refracts or dissipates noise from vehicles, generators and construction works. It is also followed by neutral response of 23.6%. Strongly disagree 12.6%, disagrees 10.9%, while strongly disagree reports 4.6%. The respondents of 47.7% strongly agrees that trees in the metropolis provide place for pastime, recreation, petty trading and for food vendors (*mama put*) among others. 40% agrees, Neutral 5.2%, disagree 1.1% while strongly disagree reports nil that trees provide recreational, relaxation and petty trading areas. The last view on the Table 3.2 shows that 39.7% agrees that trees in the urban areas are of medicinal and culinary values, 29.9% disagrees with the view because most of the species to trees in the metropolis are for shade purposes. Strongly agree reports 17.2%, strongly disagree 3.4% and neutral records 13.2%.

Table 3.2 generally reveals that trees are generally very significant in the biodiversity of the urban centres. Trees aid in the absorbing and refracting or dissipating noises produced by the heavy vehicular traffic which characterizes urban areas.

Table 3.2: Importance of Trees in Urban Centre of Kaduna Metropolis

Importance of tree in cities	SA		A		SD		D		N	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Absorbs contaminants and intercepts pollutants	37	21.3	98	56.3	01	0.6	07	4.0	31	17.3
Provides ecosystem services (Carbon storage and oxygen)	23	13.2	96	55.2	03	1.7	08	4.6	44	25.3
Aids hydrological circles in form water, vapour or moisture	28	16.1	73	43	05	2.9	17	9.8	51	29.3
Absorbs and refracts or dissipates noise	21	12.6	85	49	08	4.6	19	10.9	41	23.6
Provide places of pastime, recreation and petty trading	83	47.7	80	46	00	00	02	1.1	09	5.2
Barks, roots and leaves use as medicine and culinary	30	17.2	69	39.7	06	3.4	52	29.9	23	13.2

SA= Strongly Agree, A=Agree, SD=Strongly Disagree, Disagree=D, N=Neutral, Freq = Frequency. %=Percentage

Source: Field Survey, (2020)

Similarly, interviews reveal that urban trees play a very important social role in easing tensions and improving psychological health. If they are cut down or uprooted, environmental hazards are bound to occur as well as increase in social issues. Furthermore, some processes in the atmospheres such as hydrological and carbon cycles will be affected. The percentages of those who remain neutral exposes the facts that knowledge on the emerging issues of trees capacity to absorb contaminants and purify air, prevent global warming and climate change in Africa calls for further studies and education of the populous.

IV. CONCLUSION AND RECOMMENDATIONS

Of no doubt, road is very important urban infrastructure and key facilitator of economic growth but should not be carried out at the expenses of the ecosystem. Road construction requires soil excavation and land clearing among others. The clearing of the land to a large extent has diverse effect on the ecosystem. The study reveals that over 150 trees have been cut down at Waff Road and no fewer than 50 along Yakubu Gowon Way of the metropolis for road construction and expansion purposes. This is worrisome because trees and other vegetation are often cleared to give way to paved surfaces in metropolis and often result into environmental consequences such as intense heat, contamination and pollution of the air, biodiversity loss, stronger effects of the green house, global warming and climate as well as affect health related issues, social and economic effects are immersed and devastating as revealed by the study.

Trees in urban centres have the capacity to absorb environmental contaminants emanating from the cities such as carbon gases, obnoxious smells, provides ecosystem services such as carbon storage, produce very significant element oxygen, regulation of the circulation of vapour or hydrological cycle, purification of water, help in reduction of global warming and mitigate climate change among others. These are the reasons why trees are addressed as “the lungs of cities” (McPherson *et al*, 2005; Yang *et al*, 2005). Similarly, the study reveals that the neutral percentages of the respondents on the environmental hazards of cutting down trees and their importance in towns are relatively high and should not be pushed aside. It reveals that the awareness of people in the study area on climate change, global warming, stormwater runoff, and hydrological cycles in relation to vegetation is limited and this calls for further survey.

It is on the basis of the wanton felling of the urban trees and the enormous present and future adverse environmental effects that the study recommends the following:

- i. Government should consider alternative places devoid of many trees for road constructions in the metropolis.
- ii. The residents should be educated on the importance of trees such as the capacity to absorb contaminants, intercept and mitigate of pollution, reduces storm runoff and erosion among others. They should be encouraged to plant trees in the community
- iii. The knowledge of residents on global warming and climate change if limited. Residents should be educated on the occurrences of the climate change and the effects on the environment to encourage both government and the residents to appreciate the presence of trees in the community
- iv. Political leaders or office holders (the reasonable ones) are often in haste to either fulfill their electioneering campaign promises or to copy development in other cities without taken into cognizance the long term and short term environmental effects. Effort and laws should be made compulsory for the leaders to comply.
- v. In the case where trees have been cut, efforts must be made to plant more in the environment.
- vi. Permit on tree cutting should not be given without due consultations and impact assessment no matter how much money is paid for.
- vii. Vegetation (plant, tree) is useful to meeting the quality of life that makes a great city and feasible for people to live a meaningful life in the metropolis. In this regard, people and leaders should be made to realise that in as much as cities are important to development and civilization as well as the conditions of urban residents are to improved, especially the poor, under privileged and the low class of civil and public servants it is pertinent people must comprehend that vegetation is an integral part of the city environment referred to as “lungs of the cities” and must be conserved and protected.

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