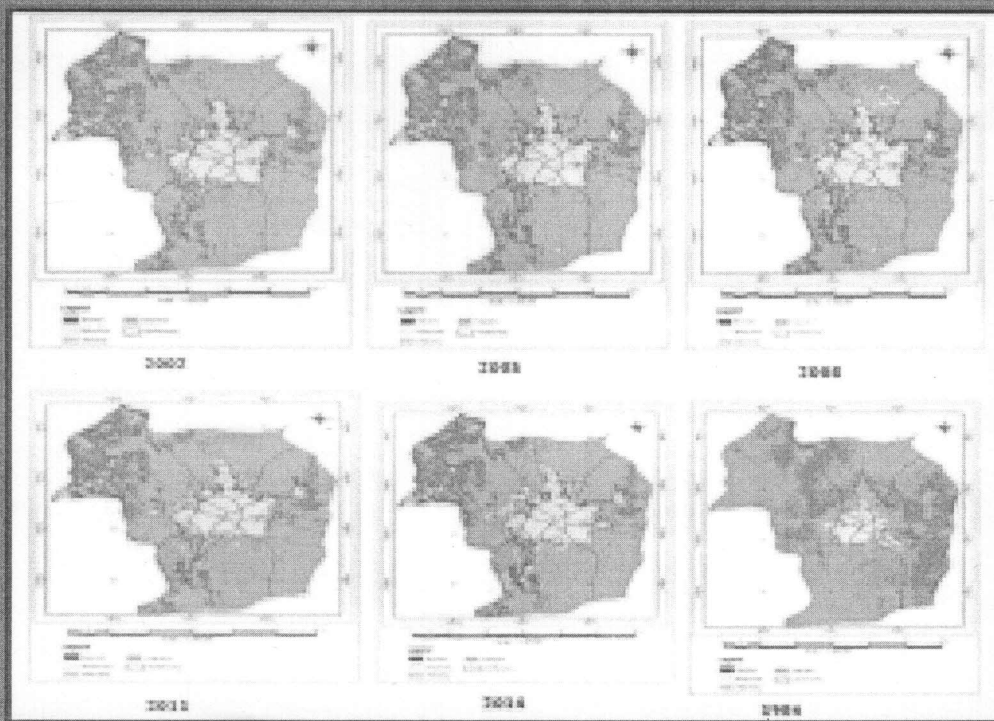


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RESEARCH ARTICLE

Community perception of deforestation and climate change in Ibadan, Nigeria

R.M. Olanrewaju, S.L. Tilakasiri* and F.B. Bello
*Department of Geography and Environmental Management,
University of Ilorin, Ilorin, Nigeria*

Abstract: The studies of urban climate are attracting significant attention in the present dispensation due to the global impacts of climate change, induced mostly by anthropogenic activities. This study examined the community perception of deforestation and climate change in Ibadan, Oyo State. Data for this study were obtained from both primary and secondary sources. A total of 400 questionnaires were administered randomly across the 11 Local Government Areas using purposive sampling technique while 365 were retrieved and analyzed using descriptive statistics of means and percentages. Deforestation data were derived from the LandSat imagery sourced from National Space Research and Development Agency (NARSDA) and constitute the secondary data. Supervised classification technique was used for image classification. Results obtained revealed that majority of the people (77%) are familiar with the concept of climate change and among them 39% and 29% of the respondents perceived variability in temperature and rainfall respectively as the two major causal factors of climate change. The result further shows that 95 per cent of the respondent agreed that deforestation account mostly for the incidence of climate change. However, 40% of the respondents described the impacts of deforestation on climate change as severe. Meanwhile, 37% of the respondents believed that afforestation and mixed farming are the most suitable solutions to address the problem of climate change. Based on the classification technique adopted, four types of Land use/Area cover emerged in the study area. Based on the findings of the present study, it can be recommended the use of environment friendly sources of energy such as solar vehicle, bio-fuel and promotion of green environment (tree planting) among others to prevent severe impact of climate change.

Keywords: *Deforestation, Climate Change, Community Perception, Greenhouse Gases.*

Introduction

Climate change and global warming arising from anthropogenic-driven emissions of greenhouse gases and land-use and land-cover change have emerged as one of the most important environmental issues in the past few decades (Singh et al., 2013; Tilakasiri, et al., 2016). The continued build-up of greenhouse gases may force changes to the climate system including increases in mean global temperatures. The global mean surface air temperature has been found to have risen by about 0.74°C from 1906 to 2005 and been attributed mostly to a rise in greenhouse gases (Intergovernmental Panel on Climate Change - IPCC, 2007).

Deforestation is the removal of forest or stand of trees where the land is thereafter converted to a non-forest use (Dictionary of Forestry, 2008). It is the

clearing or thinning of forests, the cause of which is normally implied to be human activity (Encyclopedia Britannica, 2012). Many people do not even know that this problem exists, although it may be occurring right in their own neighborhoods. Deforestation affects climate change because it releases the carbon stored in the plants and soils and alters the physical properties of the surface (Bala et al., 2007).

The status of Forest in Nigeria shows that as at 1897, Nigeria had 60 million hectares of forest as woodland. There was an array of plant species which according to Nigeria Environmental Study/Action Team (NEST, 1991), were above 4,614 out of which 255 were endemic. Threatened species of Nigerian flora due to deforestation are about 480 which represent about 10% of the total plant species. NEST (1991) put the number of gazette forest in Nigeria at about 1,160 covering an estimated area of 10 million

*Corresponding Author: sltilak@gmail.com

hectares. The conservation areas have spread over 366 local government areas in 30 States of Nigeria and the Federal Capital Territory. They include 12 Strict Nature Reserves (SNR), one biosphere reserve, 32 game reserves and eight National parks.

However, forest area in Nigeria started declining during the 1990s at an estimated annual rate of +2.6% or 398,000 hectares per year (FAO, 2005), this was caused by agricultural expansion, desert encroachment, over-harvesting, bush burning, illegal harvesting and de-reservations. The Federal Department of Forestry (FDF, 2001) corroborated this further that the annual depletion rate could be as high as 3.5%. The FDF (2001) also noted that the forest estate of Nigeria is highly depleted and that the Sahara Desert is encroaching southward at a rate of about one kilometer per year. Thus, the rate at which forest is disappearing in Nigeria will have a significant consequence on Nigeria's climate. In addition, the CO₂ released into the atmosphere due to deforestation will trap the outgoing radiation and hence increases the average temperature.

The studies of urban climate are attracting significant attention in the present world. Several studies have attempted to assess the effect of urbanization and industrialization on temperature trends (Singh et al., 2013). Some studies have tried to establish a link between some of the intense man-made activities of urban industrial areas and temperature trends and found rapid population growth, land use/land cover changes, reduction in the fraction of vegetative area, emission from fossil fuel burning from industries, automobiles and building construction activities (roads, buildings etc) are responsible for the changing trends in temperature.

Deforestation figures show Nigeria has the worst rate of 55.7% (FAO, 2005). With the current rate of deforestation, according to food and agricultural organization of United Nations (FAO, 2005), the forest will disappear by 2020. Nigeria original forest cover was 600,000 sq. km in the 20th century but now it is 38,000 sq. km, less than 6% of its original size. A study conducted from 1901 to 2005 shows that there was a temperature increase in Nigeria of 1.1°C, while the global mean temperature increase was only 0.74°C. Similarly, at this same time the amount of rainfall decreased by 81 mm. It was noticed that both trends simultaneously had sharp changes in the 1970 (Odjugo, 2010).

The climate change experience in Ibadan is observable in the form of global warming attributed to rapid urbanization process in the community due

to population increase over the past years. With the introduction of high-rise buildings in Ibadan in recent years, the city is able to absorb more solar radiation. Aside the gases released through burning of fossil fuels, deforestation is also a major contributor to the climate change in Ibadan in form of increase in air temperatures as most forest lands are being cleared for agricultural, residential and economic uses to be able to meet the increasing population demands. It is therefore imperative to investigate the perception and practices of deforestation which will provide an insight into the magnitude and contribution of deforestation to climate change by the community people in Ibadan. It will also help to optimize actions to be prioritized in the prevention and mitigation against devastating climate change phenomenon. Therefore, this study aimed at examining the community perception of deforestation and climate change in Ibadan, Oyo state.

Causes of Deforestations in Nigeria

Deforestation is inevitable when about 90% of a population is depending on wood as fuel for cooking and heating. Poor agricultural practices such as slashing and burning also contribute to deforestation (Akinbami, 2003). Study shows that about 60% of Nigerians use firewood for cooking because of the high cost of kerosene (ibid). Some persons ignorantly set fire on forests thereby contributing to deforestation. According to (FAO, 2010), developing countries from the tropics suffer most from deforestation between 2000 and 2005. This suggests a relationship between poverty and deforestation. Poverty induced human activities are the major causes of deforestation in Nigeria (Akinbami, 2003).

Corruption is a serious issue in Nigeria and contributes immensely to illegal logging by companies and forest officials (Global Witness, 2013). Activities of illegal logging lead to deforestation. According to Goncalves, Panjer, Greenberg and Magrath (2012) as cited Singh et al. (2013), an area of forest about the size of a football field is clear-cut by illegal loggers every two seconds. Illegal trading in timber and its products leads to massive economic losses and environmental damages (Transparency International, 2011). The rising demand for wood products has made the forestry lucrative and this invariably promotes illegal logging (ibid). Logging is said to be the first threat to existing tree population. Corruption is also observed at the level of government institutions, wealth and power due to harvesting of forest riches. Unfortunately, all these are done on the platform of short term economic benefits. Lack of integrity in the judiciary

to check illegal logging further promotes deforestation (ibid).

Poverty is also a strong factor in the issue of deforestation. Poverty leads to the felling and burning of trees for fuel. Charcoal produced from the burnt trees is sold for money to make ends meet. At the other hand, the felled trees are also sold as timber; cleared land is used as pasture for livestock, plantations of communities and settlements (Akinbami, 2003).

With the trees gone the air warms up, creating large rising masses of warm air. When these air masses hit the upper reaches of the atmosphere, they create ripples called "teleconnections" that flow towards the mid and higher latitudes. These changes to the

atmosphere in the tropics can flow out to the atmosphere of temperate regions and alter their climate.

Study Area

Ibadan, the capital of Oyo State is located in the Southwestern part of Nigeria between latitude $7^{\circ}23'$ and $7^{\circ}54'$ North of equator and longitude $3^{\circ}53'$ and $3^{\circ}54'$ East of the Greenwich Meridian. The city is elevated at about 234 meters above sea level and it is situated on gently rolling hills running in a Northwest/southeast direction (Agbola and Olurin, 2000). Figure 1 shows the map of Ibadan.

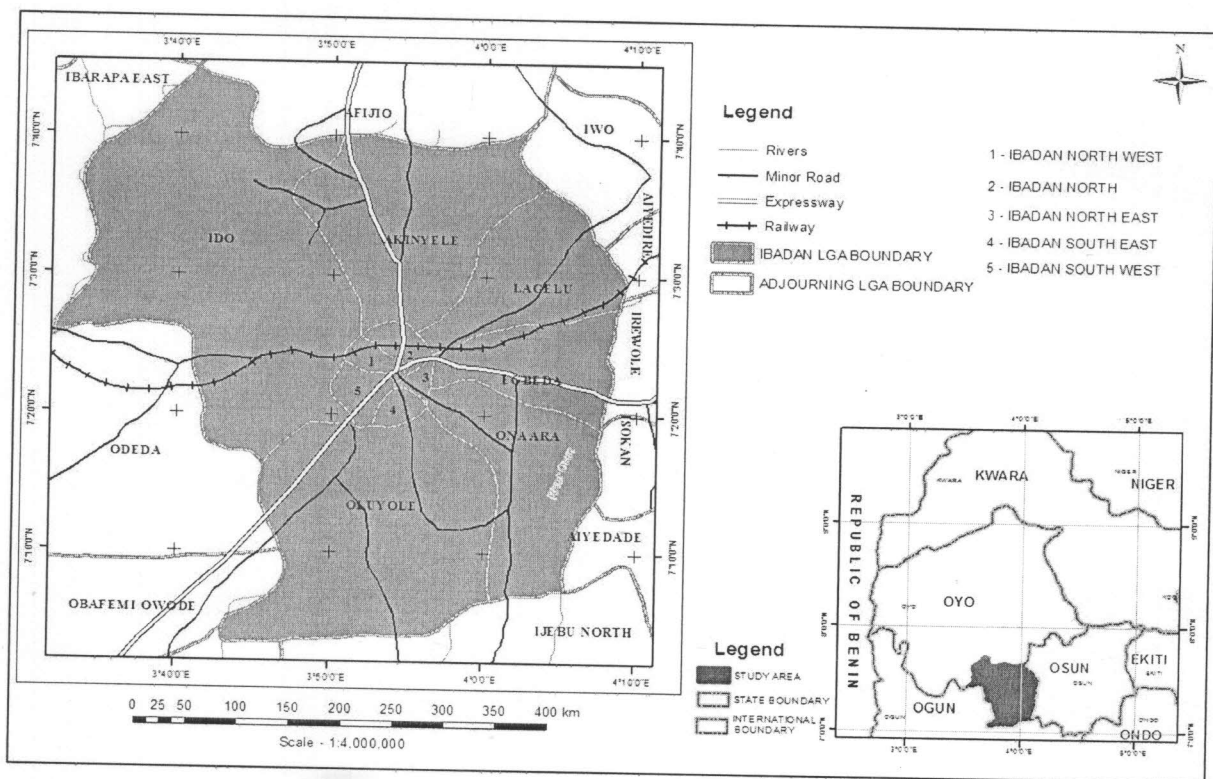


Figure 1: Map of Ibadan Metropolis Showing Local Government Areas (Inset: Oyo State Showing the Study Area).

Source: Office of Surveyor General of the Federation (OSGOF, 2014).

Ibadan enjoys the West African monsoon climate which has two major seasons (rain: March and October and dry: November and February season). Ibadan is found in the Guinea savannah, thus it is naturally a belt of a mixture of trees and tall grasses in the South, with shorter grasses and less trees in the

North. The vegetation pattern in Ibadan is a patchwork of broken forest, savannah woodland, dense thickets and large tracts of forbs vegetation dominated by chromolaena (*Eupatorium*) and odorata (Siamweed), (Fagbami, 1976) as cited in Odjugo (2010).

Agricultural activities in Ibadan metropolis are characterized mostly by secondary and quaternary services; there are still features of primary functions such as farming in the metropolis. In most of the urban periphery where there is availability of large expanse of land areas, farming activities are usually practiced in form of settlement farm, livestock rearing or plantation agriculture. The population of Ibadan rose to 1,829,300 in 1999 at a growth rate of 1.65% from 1963 and increased to 1,338,659 in 2006 at a growth rate of 2.35% (National Population Commission - NPC, 2006).

Methodology

The study utilized both primary and secondary sources of data. The primary sources of data include questionnaire administration and reconnaissance survey of the study area. A total of 400 questionnaires were administered randomly across the 11 Local Government Areas (LGA) using purposive sampling technique. Secondary data used are deforestation data from Landsat Satellite imagery of the study area which spanned between 1984 - 2014 sourced from NARSDA, journals and internet materials were also used. To monitor changes and analyse difference in land use/land cover over time, supervised classification technique was adopted following the initial image processing and rectification. This will enhance the images for a better visual interpretation and comprehension of the

tonal presentation, the nature and types of characteristics of the land use obtained from the images.

Purposeful sampling technique was used to determine the sample size which represents the projected population of Ibadan. Also the population of each LGA was obtained and from these the number of questionnaire administered was determined by dividing the population of each LGA by the total population of Ibadan and multiplied by the number of questionnaire copies. This step was taken to achieve a representative sample of the population. Descriptive statistics such as means, simple percentages, graphs and frequency were used to analyze the data obtained from the field survey.

Results and Discussions

Description of the Land Use Classes in the Study Area

Table 1 shows the description of the four identified land use types in the study area from 1984-2014. The Table revealed that the initial forest cover in the study area was 96.82% of the total land area. However, by 2014, which was 31 years after, the total forest area covered has dramatically reduced to 49.95% (See also Figure 2a and 2b). This indicates that the forest area of about 46.87% have been lost from the original size (96.82%) in the base year

Table 1: Land Use Classes and the Area Covered in the Study Area.

Years	Bare land		Built-up Area		Water body		Forest Cover	
	Hectares	%	Hectares	%	hectares	%	Hectares	%
1984	38.16	0.73	123.30	2.35	5.81	0.110	5085	96.82
1987	545.2	10.38	197.30	3.76	6.56	0.12	4503	85.73
1990	949.16	18.07	385.37	7.34	6.80	0.13	3911.01	74.46
1993	1225.00	23.32	410.20	7.81	12.93	0.25	3604.00	68.62
1996	1394.00	26.54	613.60	11.68	8.41	0.16	3236.00	61.61
1999	1402.08	26.69	652.40	12.42	9.42	0.18	3188.00	60.69
2002	1397.00	26.60	762.30	14.51	11.17	0.21	3082.00	58.68
2005	1418.00	26.99	812.81	15.48	10.06	0.19	3011.52	57.34
2008	1358.01	25.86	985.04	18.75	11.26	0.21	2898.02	55.18
2011	1108.01	21.09	1364.79	25.98	10.58	0.20	2768.82	52.72
2014	1119.10	21.31	1498.21	28.53	11.01	0.21	2623.7	49.95

Source: Authors' Computation based on Data from NARSDA (2016).

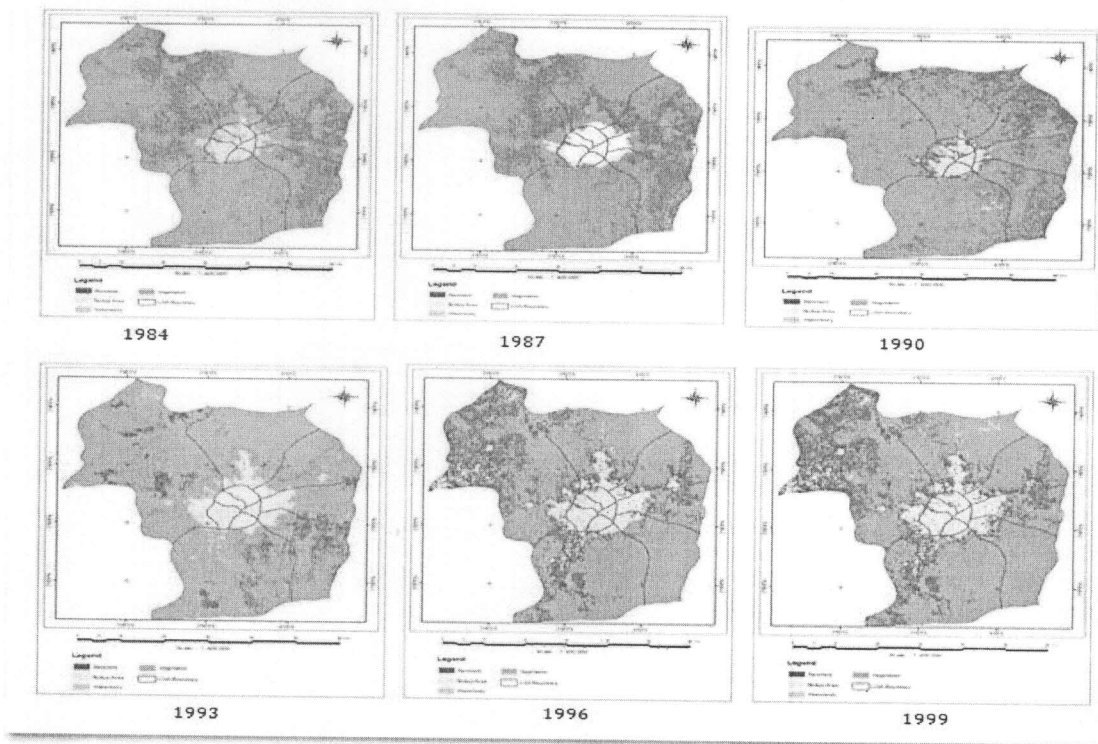


Figure 2a: Land use/Land Cover Change, 1984-1999.
Source: Authors' Computation based on NARSDA information (2016).

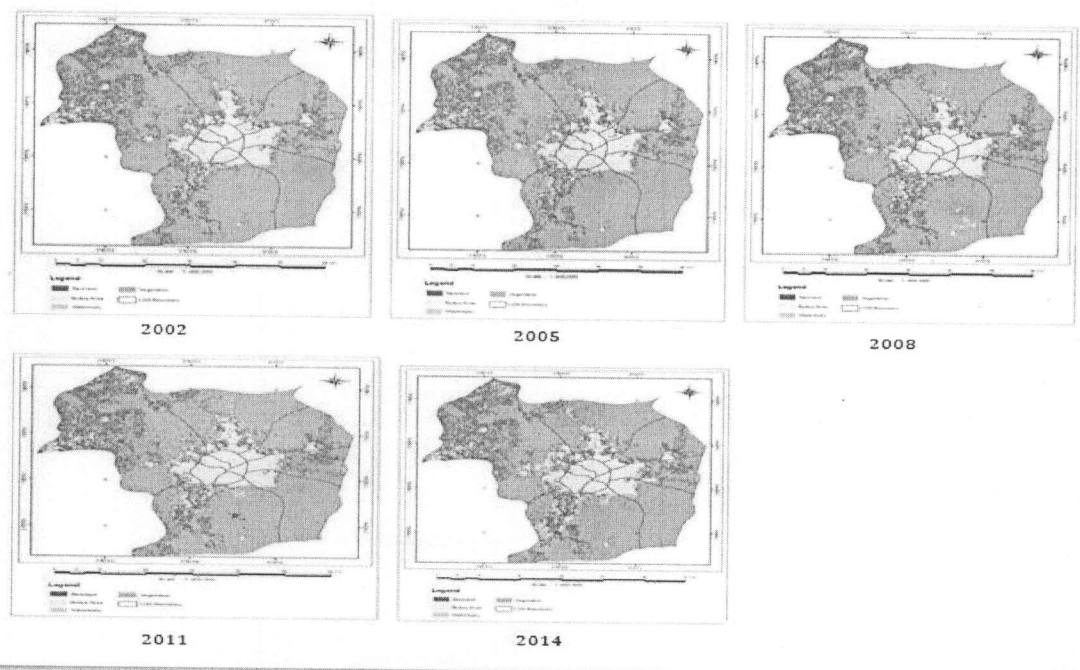


Figure 2b: Land use/Land Cover Change, 2002-2014.
Source: Authors' Computation based on NARSDA information (2016).

Demographic Characteristics of Respondent

Table 2 presents the demographic characteristic of the respondents. It is however worthy to note that the copies of questionnaire were administered purposively and randomly which means 60% of the

total copies of questionnaire were distributed between ministry of forestry (Ibadan), Saw mills and Local Restaurant Operators while the remaining 40% were administered between schools, Households and Passers-by.

Table 2: Demographic Information of the Respondents.

		Frequency	Percentage
Gender:	Male	242	66.3
	Female	123	33.7
	TOTAL	365	100
Age:	21 - 30	137	37.5
	31 - 40	123	33.7
	41 - 50	101	27.7
	51 Above	4	1.1
	TOTAL	365	100
Educational Level:	No Formal Education	4	1.2
	Primary Education	14	3.8
	Secondary Education	91	24.9
	Tertiary Education	256	70.1
	TOTAL	365	100
Occupation:	Farming	58	15.9
	Lumbering	65	17.8
	Restaurant Operation	25	6.9
	Civil Service	155	42.5
	Others	62	16.9
	TOTAL	365	100

Source: Authors' Field Compilations (2016).

Table 2 shows that 66.3% of the sampled population was male while the remaining 33.7% were female. This is not surprising because male constitutes greater number of work force for some of the occupations listed e.g farming, and lumbering. The age bracket 21-30 years represents the larger percentage of the population. Furthermore 70.1% of the respondents are educated up to the tertiary level while the secondary, primary school leavers and people with no formal education represent 24.9%, 3.8% and 12% respectively which means few

percentage of the population have the tendency of involving in direct deforestation activities which explain one of the reasons for decline in the deforestation rate in the past few years. Farming (15.9 %), Lumbering (17.8%) and Restaurant Operation (6.9%) represents the economic activities of the sample while 42.5% of the respondents were civil servants. It should be known that some of these civil servants working under the Ministry of Forestry are indirectly involved in deforestation process.

Pattern of Lumbering Activities in the Study Area

Table 3 denotes the pattern of lumbering activities in Ibadan Metropolis. Based on the opinions of the

respondents, deforestation activity has been going on for over two decades and most of the respondents (47.2%) have been involved in lumbering activity in the study area.

Table 3: Pattern of Lumbering Activities in the Study Area.

		FREQUENCY	PERCENTAGE
Lumbering Experience:	1 – 5yrs	26	18
	6 – 10yrs	7	4.9
	11 – 15yrs	7	4.9
	16 – 20yrs	36	25
	21yrs Above	68	47.2
	TOTAL	144	100
Frequency of Tree Felling:	Weekly	7	4.9
	Monthly	7	4.9
	Fortnightly	29	20.1
	Quarterly	86	59.7
	Annually	15	10.4
	TOTAL	144	100
Deforestation Experience:	1 – 5yrs	93	25.5
	6 – 10yrs	76	20.8
	11 – 15yrs	69	18.9
	16 – 20yrs	61	16.7
	21yrs Above	66	18.1
	TOTAL	365	100

Source: Authors' Field Compilations (2016).

A reduction in the rate of deforestation from 6-20 year is reflected in Table 3. This reduction could be attributed to the awareness created by the Environmentalists on the contribution of tree felling to climate change. However, over the past 5 years deforestation seems to have increased in the periphery (developing areas) of the city. This confirm the study by FAO, (2005) which states that between 1990 and 2005, the primary forest has been reduced by 79% which can be attributed to ever increasing population that in turn escalate the demand for forest resources which includes; logs, pulp, timber, charcoal, planks among others. Ibadan being the third largest city in the country with the population of 3.5 million (populationlab.com 2015), the city had a large percentage of its forest area

reduced in form of land clearing for building, timber for construction as well as transformation of forest land to agricultural land in order to feed the ever-increasing population of the city.

Awareness and Perception of People to Climate Change

Table 4 presents the level of awareness of the people to climate change as well as their perception on what climate change entails. From the Table, majority of the people in this area are familiar with the concept of climate change and due to their level of awareness there has been a reduction in deforestation activity in Ibadan.

Table 4: Awareness and Perception of People to Climate Change.

		FREQUENCY	PERCENTAGE
Climate Change Awareness:	Never	0	0
	A week ago	14	4
	A month ago	40	11
	6 months ago	29	8
	A year and above	282	77
	TOTAL	365	100
Perception of Climate Change:	High Temp	193	39
	Low Rainfall	145	29
	Flooding	69	14
	Increased Sunshine Hour	90	18
	Others	0	0
	TOTAL	497	100

Source: Authors' Field Compilations (2016).

It was revealed through the questionnaire administered that most people perceive variability in temperature and rainfall as the major causal factors of climate change. This support the assertion by Intergovernmental Panel on Climate Change (IPCC

2007) which the global mean surface air temperature has been found to have risen by about 0.74°C from 1906 and 2005 and has been attributed mostly to a rise in greenhouse gases.

Table 5: Factors Causing Climate Change.

		Frequency	Percentage
Causes of climate change:	Deforestation	283	57
	Construction	111	22
	Overgrazing	48	10
	Farming	55	11
	Others	0	0
	TOTAL	497	100
Deforestation as a factor of climate change:	Strongly Agree	256	70
	Agree	90	25
	Undecided	4	1
	Disagree	15	4
	Strongly Disagree	0	0
	TOTAL	365	100

Source: Authors' Field Compilations (2016).

The factors causing climate change as shown in Table 5 reveals that a large percentage (95%) of the respondents agreed that deforestation accounts mostly for the incidence of climate change. The total number of 497 respondents for factors causing climate change as against the 365 questionnaires recovered is attributed to the fact that some of the respondents felt more than one climatic variables

could bring about climate change. Although other factors such as farming, construction (buildings), overgrazing among others contribute to climate change phenomenon, deforestation activities seem to exhibit greater impacts. This is because deforestation leads to the removal of the forests which serve as reservoir of carbon. Thus, the process of deforestation leads to the release of carbon stored in

trees and at the same time left the generated greenhouses released from different sources on earth hanging in the atmosphere. The above finding shows that deforestation is an important factor in global climate change because of its capacity to affect the quantity of atmospheric carbon dioxide and hence the concentration of greenhouse gases. Thus, if deforestation is not curbed, we should expect the climate of our planet to change dramatically over the next decades. It is estimated that more than 1.5 billion tons of carbon dioxide are released to the atmosphere due to deforestation, mainly the cutting and burning of forests, every year. It is important to add that forest constitutes a major sink for the carbon dioxide released from the earth surface since it is an important component of photosynthesis, the end products of which are carbohydrate and oxygen.

Hence, deforestation also robs the earth of its life supporting oxygen gas.

The Impacts of deforestation on Climate Change

The impacts of deforestation on climate change were perceived from being severe (40%) to no effect (3%) as shown in Table 6. It also depicts how it affects socio-economic activities of man. Singh et al. (2013) in their study stated that the impact of Tropical deforestation have been a global problem in the sense that by cutting down trees in the Rainforests; the cooling effect from the additional moisture obtained from turning water in the soil into moisture in the air will be removed. This is because when plant transpires water is released into the atmosphere through the stomata.

Table 6: Impacts of deforestation on Climate Change.

		FREQUENCY	PERCENTAGE
Decline in Forest Resources due to Deforestation:	Strongly Agree	209	57
	Agree	101	28
	Undecided	22	6
	Disagree	33	9
	TOTAL	365	100
Effects of Climate Change on Farm Produce:	No Effect	11	3
	Minimal	87	24
	Moderate	105	29
	Severe	162	44
	TOTAL	365	100
Degree of impact of Climate Change:	No Effect	11	3
	Minimal	108	30
	Moderate	98	27
	Severe	148	40
	TOTAL	365	100

Source: Authors' Field Compilations (2016).

Coping Mechanisms for Climate Change in Ibadan

The respondents also identify some coping mechanisms to climate change as well as the problems associated with the various mechanisms. Table 7 shows that, 37% believe afforestation as the

most suitable solution to address climate change problems, followed by mixed Farming (26%), going green (20%) and lastly irrigation (17%). This thus implied that majority of the respondents perceived afforestation method should be adopted in order to mitigate the negative impacts of climate change.

Table 7: The Coping Mechanisms for Climate Change in the study area.

		FREQUENCY	PERCENTAGE
Coping Mechanisms:	Afforestation	184	37
	Mixed Farming	129	26
	Going Green	99	20
	Irrigation	85	17
	Total	497	100
Problems of Coping Mechanisms:	Financial Problem	108	22
	Inadequate Information	150	30
	Technological Constraints	81	16
	Inadequate Knowledge	158	32
	Total	497	100

Source: Authors' Field Compilations (2016).

It should be noted that the total number of 497 respondents as against the 365 questionnaires recovered is due to the fact that some of the respondents suggested more than one coping mechanisms as well as the problems associated with them. Some of the problems related to these coping mechanisms include; inadequate information, problem of finance, technological constraints among others. These problems are peculiar to developing countries of the world including Nigeria.

Conclusion and Recommendations

It is obvious from the study that indigenous people are very much aware of the changes going on in their environment. This corroborates the conclusion of Olanrewaju (1999) for farmers in the sub humid region of Nigeria.

The perception of the respondents agrees strongly with the contribution of deforestation to climate change compared with other factors facilitating the incidence of climate change. This is in line with the study of Inyang and Esohe (2014) which reported that deforestation accounts for 87% of total carbon emission in Nigeria. Although other factors such as farming, construction (buildings), overgrazing among others contribute to climate change phenomenon, deforestation activity seem to have most effect because deforestation leads to the removal of the

forests which serve as reservoir of carbon. Therefore, the process of deforestation leads to the release of stored carbon in trees and at the same time left the generated greenhouses released from different sources on earth hanging in the atmosphere.

However, to mitigate the impacts of deforestation on climate change, the following recommendations were made:

1. The community People should be sensitized on how to preserve and nurture their environment so as to mitigate the severe impacts of climate change.
2. The use of environment friendly source of energy should be encouraged such as the use of solar vehicle, the use of bio-fuel and promotion of green environment among others to prevent severe impact of climate change.
3. The contribution of anthropogenic activities to climate change should be identified and efforts should be geared towards putting them under control.
4. Furthermore, rapid population growth seems to be one of the reasons for deforestation; birth control should therefore be encouraged so as to reduce the need to expand space for man to live.

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