

**Environmental Impact of Urbanization in Nigeria****ABSTRACT**

This review had revealed that there are several evidences of environmental impact of urbanization in Nigeria. The linkages between urbanization process and the environment are so profound that the major components of the environment-air, water and land are adversely affected by the daily anthropogenic activities of urban residence and in the process of exploiting the natural resource base. The goal of ensuring environmental sustainability is greatly threatened by urbanization, which has created several serious environmental problems, such as pollution, deforestation and wetland destruction, erosion and flooding, urban sprawl, slum and squatter settlements, heat island and aesthetic degradation that have had negative impacts on man and other living organisms in the environment. If the threats posed by urbanization in Nigeria are not adequately managed, the capacity of the environment to continuously support life may be jeopardized with dire consequences on human life.

*Keywords: Environmental Impact, Nigeria, Pollution, Urbanization*

**1. INTRODUCTION**

Man continues sustenance on earth and the quality of his living is heavily dependent on the environment.

The major components of the environment-air, water and land are supporting pillars of man, which he depends on directly or indirectly for his survival and well being. Unfortunately, man seems to be at war with his environment, which is evident in his over exploitation and inadequate management of the basic components of the environment. This unsustainable exploitation of the natural environment has posed serious challenges and great threat to Nigeria's natural resource base. One of the major threats to the Nigeria environment is urbanization. Mabogunje [1] stated that urbanization is a process of human agglomeration in multi-functional settlement of relatively substantial size. Urbanization process is one of the most powerful and visible anthropogenic forces on earth [2]. This process, as explained by [3], has been responsible for transforming towns, cities and metropolitan areas, while at the same time depopulating the rural setting through a process of direct rural-urban migration.

Studies have shown that rapid urbanization has greatly accelerated economic and social development, and global cities are engines of economic growth and centres of innovation for the global economy and

28 the hinterlands of their respective nations [4]. Hence, the world continues to experience high rates of  
29 urbanization, especially in developing countries like Nigeria, which has an estimated 5.3 per cent annual  
30 growth rate. The United Nations [5] noted that 30 per cent of the global population lived in urban areas in  
31 1957; while the figure reached 50 per cent in 2008, and an estimated 70 per cent is projected for the year  
32 2050. It stated further that in the foreseeable future, virtually all of the world's population growth will be  
33 absorbed by the urban areas of the less developed regions, whose population is projected to increase  
34 from 2.4 billion in 2007 to 5.3 billion in 2050. Today there are over 400 cities in the world with populations  
35 of over 1 million people [6]. In Nigeria, the Human Development Report (2004) cited in [7] observed that  
36 of the 2002 estimated population of 120.9 million people, 45.9 per cent of the population resides in urban  
37 centers. According to [8], residents of urban centers in Nigeria in 1950 were less than 15 per cent of the  
38 population; while it rose to 23.4 per cent and 43.3 per cent in 1975 and 2000 respectively; with an annual  
39 urban population growth rate of 4.8 per cent. He also noted that Nigeria has 359 urban settlements of at  
40 least 20, 000 people according to the 1991 National Population Census.

41  
42 The high influx of people into the urban centres from the rural areas to take advantage of the perceived  
43 opportunities offered by these urban centres, without adequate planning and effective management  
44 strategies to accommodate this influx by the government, results to serious pressure on both the socio-  
45 economic supporting infrastructure and the environment. For instance, urbanization has been identified  
46 as the cause of numerous environmental problems, which include and not limited to air, water, land and  
47 noise pollution, deforestation, local climate alteration, and traffic congestions, which ranges from local to  
48 the global scale [9; 10; 11; 12; 13].

49  
50 In Nigeria, [9] cited in [14] identified several types of environmental problems classified as ecological,  
51 poaching and habitat loss, increasing desertification and soil erosion. These are further subdivided into  
52 pollution, deforestation, global warming, slum development etc. Nigeria's coastal regions are currently  
53 experiencing widespread contamination from petroleum exploration (gas flaring, oil spillage) while the  
54 general poor living conditions in urban areas in the country constitutes an affront to human dignity [14].  
55 These environmental problems continue to increase as the urban growth rate continues to rise.

56 The National Population Commission [15] observed that most urban areas in Nigeria have grown beyond  
57 their environmental carrying capacities and existing infrastructure. For instance, data from the National  
58 Population Census (2006) revealed that most of the urban areas in Nigeria with small land mass have  
59 already exhausted or have extremely limited capacities to accommodate further increase in population  
60 [16]. With a population figure of more than 140 million and land mass of about 924,000 Km<sup>2</sup>, current  
61 estimates indicated that 10 per cent of the land area accommodated 28 per cent of the country's total  
62 population [17]. The implication of this is that there is disequilibrium between the population and the  
63 environment, and this has adversely affected the carrying capacity of the urban areas in the country;  
64 hence the increasing poor quality of the living conditions and the low livability index of urban areas in  
65 Nigeria [14].

66

67 The goal of ensuring environmental sustainability is greatly threatened by urbanization, which has created  
68 several serious environmental problems that have had negative impacts on man and other living  
69 organisms in the environment. If the threats posed by urbanization in Nigeria are not adequately  
70 managed, the capacity of the environment to continuously support life may be jeopardized with dire  
71 consequences on human life.

72


73 In spite of the importance of the environment for human sustainability, not much study has been carried  
74 out in Nigeria to investigate the fundamental linkages between the environment and urbanization. Past  
75 studies on impact of urbanization are broad based, focusing on socio-economic and environmental issues  
76 [14; 18), which have created gaps in the in-depth analysis of environmental and urbanization linkages.  
77 However, without an adequate understanding of the intricate linkages between the environment and  
78 urbanization process, it would be difficult to propose effective and efficient strategies to resolving or  
79 ameliorating the plurality of the impacts of urbanization on the environment. Hence, this study was aimed  
80 to fill the gap in the understanding of the environment and urbanization linkages through a comprehensive  
81 review. It is hoped that this understanding will prove valuable to Nigerian policy makers, urban developers  
82 and environmentalists in the sustainable management of the environment and urbanization linkages to  
83 the benefit of man and other living organisms. This review is presented under the following subheadings:

84 introduction, study area, pollution, deforestation and wetland destruction, erosion and flooding, urban  
85 sprawl, slum and squatter settlement, heat island, aesthetic degradation and conclusion.

## 86 87 **2. POLLUTION**

88  
89 Human activities generate tremendous amount of waste materials, which increases as production and  
90 consumption activities increases, especially in urban areas as population agglomerates. The waste  
91 generated may find their way into the major components of the environment (air, water and land) bringing  
92 about environmental pollution. Environmental pollution is an undesirable change in the physical, chemical  
93 or biological characteristics of air, water or land that will be or may be harmful to human and other life,  
94 industrial process, living conditions and cultural assets or cause wastages of our raw material resources  
95 [19].

### 96 97 **2.1. Water Pollution**

98 In most Nigerian urban areas, waste management is a big challenge, which has brought about severe  
99 pollution of the major environmental components, with dire consequences on the inhabitants. For  
100 instance, [20] reported that rain water in Warri metropolis contain a high level of acidity due to the high  
101 emission of particulate matters and gases into the urban atmospheric environment. He stated further that  
102 the resultant acid rain pollutes both surface and groundwater sources with negative effects on the health  
103 of the inhabitants. Similarly, [21] reveals that some of the selected quality parameters of hand-dug wells  
104 in Warri-Effurun metropolis have concentrations, which are not within the World Health Organization  
105 (WHO) thresholds. For instance, pH concentrations in all the sampled well water are not within the 6.5-8.5  
106 WHO thresholds for drinking water, as all the values are below the minimum 6.5 WHO range. This shows  
107 that well water supply in the metropolis is acidic, (which agrees with [20]). Also, the report revealed that all  
108 well water samples contain total coliform counts, as against the WHO zero thresholds. This indicates that  
109 there might be the presence of disease causing pathogenic bacteria, which may pose a threat to human  
110 health if such water is consumed without treatment [21]. 

111  
112 This scenario in Warri metropolis is not different from what is obtainable in other urban areas in Nigeria.  
113 For instance, a study by [22] reveals that some of the selected quality parameters of borehole water in

114 Yenagoa metropolis, have concentrations above the WHO thresholds for potable water. They reported  
115 that turbidity values in all the sampled water were above the WHO 5 NTU thresholds; while 46.67%  
116 samples have pH values below the WHO minimum value of 6.5, indicating acidity.

117

118 Studies have identified several human activities that cause water pollution. These activities pollute both  
119 surface and groundwater resources in Nigerian urban centres. One of the major sources of water  
120 pollution in the urban areas of the Niger Delta is oil spills, which has brought about massive pollution of  
121 the water resources in this area, killing aquatic life and rendering the affected water sources unsafe for  
122 human consumption. In addition, buried chemical waste and poorly maintained dumpsites, which are  
123 common features in most Nigerian cities can pollute both surface and groundwater sources. The poor  
124 sewage treatment and solid waste disposal in most cities in Nigeria, is another veritable source of water  
125 resources pollution (Plate 1). Unrestricted use of pesticides, insecticides, herbicides and indiscriminate  
126 dumping of refuse, excreta and animal dung as well as spillages from refineries, large scale bush burning  
127 are identified as some of the leading factors of environmental pollution in Nigeria [23; 24]. Furthermore,  
128 soil erosion, siltation, salinization, irrigation, saltwater incursion and pollution from urban and municipal  
129 sources each pose grave threats to Nigeria's freshwater resources. In times of drought, and/or with areas  
130 confronted with desertification these threats are even more exacerbated. In the dry land areas of the  
131 north, human habitation relies heavily on groundwater resources that are recharged from freshwater  
132 percolation and runoff during the rainy season. Anything that upsets this balance threatens the livelihoods  
133 and economy of the people who live there [25].

134

135 A major source of water pollution in Nigeria urban areas is fertilizer used in agriculture. Urban agricultural  
136 practices make extensive use of fertilizers, which usually contain large amounts of nitrogen and  
137 phosphorus. When it rains the fertilizer is washed into streams, rivers and creeks, which pollutes and  
138 facilitates the process of eutrophication that degrade the quality of the surface water, which makes it unfit  
139 for human consumption.

140

## 141 **2.2. Air Pollution**

142 In Nigeria, ambient air pollution emanates from three major sources-energy generation, industry and  
143 transportation-all of which increase with population and economic growth. Rapid urbanization is a major  
144 contributing factor to all the three major sources. Degraded air quality in key urban centers, such as  
145 Lagos, Port Harcourt, Kano amongst others, is as a result of the heavy dependence on oil-dominated  
146 transportation. Motor vehicles produce more air pollution than any other single human activity [26].  
147 Transportation requires huge amounts of energy. Globally, 20% of all energy produced is used for  
148 transportation. Of this, between 60 and 70% goes toward transporting people, and the rest toward moving  
149 freight [27]. In addition, power plants, factories, and other stationary sources including the thousands of  
150 privately owned petrol and diesel generators used for power failure backups degrade the air quality of  
151 major urban centres in Nigeria.

152  
153 The situation is compounded by poor urban transportation planning as manifested by congestion in both  
154 large and small cities of Nigeria. Clogged city streets exact a major toll on economic productivity and  
155 exacerbate air pollution. In highly congested city centers, traffic can be responsible for as much as 90 to  
156 95% of the ambient carbon monoxide levels, 80 to 90% of the nitrogen oxides and hydrocarbons and a  
157 large portion of the particulates, all posing a significant threat to human health and natural resources [26].  
158 Nigeria's current use of leaded gasoline contributes to the high levels of lead in the ambient air.  
159 Producing the energy required to run modern urban systems often involves burning fossil fuels, which  
160 releases such greenhouse gases as carbon monoxide, carbon dioxide, and nitrogen oxides. These  
161 emissions lead to global warming, which can cause destruction of the ozone layer, climate change, rising  
162 sea levels, changes in vegetation, and severe weather events [25].

163

### 164 **2.3. Land Pollution**

165  
166 Several studies have identified industrial and agricultural activities, indiscriminate waste disposal and oil  
167 spills as major causes of land pollution in Nigeria [28; 29]. In the urban areas where there is more  
168 concentration of industrial activities and high rate of waste generation, coupled with poor disposal and  
169 management in most urban areas in Nigeria (Plate 1), the probability of land pollution is very high. For  
170 instance, the World Health Organization [30] observed that almost all industrial activities cause some

171 pollution and produce waste. However, relatively few industries (without pollution control and waste  
172 treatment facilities) are responsible for the bulk of the pollution. Adebisi and Fayemiwo [29] identified  
173 three kinds of industrial pollution, which affect the land. They include construction debris, petrochemicals  
174 from transport and fuel and heavy metals and chemicals. Industrial wastes and emissions contain toxic  
175 and hazardous substances, most of which are detrimental to human health [31; 32]

176

177 In most urban centres in Nigeria there are heaps of municipal solid wastes unattended to (Plate 1); and  
178 many of the objects that are thrown away contain toxic substances, which leach into soil and water  
179 affecting the health of plants, animals and humans. Electronic waste contains mercury, lead, arsenic  
180 cadmium, chromium and other metals that have environmental health implications. Construction waste  
181 may contain asbestos, fossil fuel derivatives, and other toxic substances. Measures to control these  
182 substances are hampered by the fact that they are dispersed within less toxic trash in millions of tons,  
183 making their removal very problematic. As a result, some of these toxic wastes linger in the soil  
184 surface for a long time and makes it unsuitable for human use.

185



186

187

188 Plate 1: Indiscriminate Disposal of Municipal Solid Waste, Court Road  
189 Gyadi-gyadi, Kano

190

191 Source: Adapted from Butu, A. W and Mshelia, S. S (2014)

192

193 **3. Deforestation and Wetland Destruction**

194

195 The threats to biodiversity, tropical forests and the rest of the many ecosystems and natural habitats in  
196 Nigeria are overwhelming and escalating. A key feature of Nigeria's ecology is its large and burgeoning  
197 human population and the increasing pressure this population growth is putting upon the natural  
198 environment. Urban areas are congested and growing, without adequate environmental safeguards [25].

199

200 Most land areas in Nigeria have been converted to agricultural or pastoral uses and agricultural  
201 encroachment threatens the natural areas that remain. In addition, the escalating practices of overfishing,  
202 uncontrolled logging, and many other unsustainable uses of the natural resources pose serious threats to  
203 the survival of significant component of Nigeria's biodiversity [2]. Echoing the same view point, [34]  
204 stated that agricultural development, urban growth, industrial expansion and pressure from an increasing  
205 population have reduced the extent, diversity and stability of the Nigerian forest. Unfortunately, the  
206 capacity to integrate environmental concerns into economic development planning and activities is  
207 extremely weak in Nigeria.

208

209 Mba [9] cited in [14] identified deforestation resulting from road projects, subsistence activities, logging,  
210 mining, and dam constructions constituting the greatest threat to environmental sustainability in Nigeria.  
211 In the loss of biodiversity, for instance, [14] reported that the World Fact Book (2005) identified Nigeria as  
212 one of the countries with the highest rates of forest loss (3.3 per cent) in the world. Since 1990, the  
213 country has lost some 6.1 million hectares or 35.7 per cent of its forest covers. The record also indicated  
214 that Nigeria's most biodiversity systems are fast depleted at an unbelievable rate. For an example,  
215 between 1990 and 2005, the country lost a staggering 79 percent of these forests and since 2000 Nigeria  
216 has consistently been losing an average of 11 percent of its primary forests per year. These constitute  
217 serious challenge to environmental sustainability. The various species of plants and animals that are  
218 required to establish and sustain the various food webs and chains as well as natural cycles are  
219 systematically being depleted and thus resulting in ecological imbalance and threatening the survival of  
220 man in the environment [14]. Ajibola [35] noted that urbanization is a major cause of loss of coastal  
221 wetlands. Urbanization impacts wetlands in numerous direct and indirect ways. For example, construction  
222 reportedly impacts wetlands by causing direct habitat loss, suspended solids additions, hydrologic



223 changes and altered water quality. Indirect impacts include changes in hydrology and sedimentations  
224 which substantially alter wetlands. It also exerts significant influences on the structure and function of  
225 coastal wetlands, mainly through modifying the hydrological and sedimentation regimes, and the  
226 dynamics of nutrients and chemical pollutants. The loss and degradation of wetlands has resulted in  
227 increased risks from coastal storms and tidal surges, leading to unintended consequences for both  
228 human and natural systems [35]. The hydrological changes caused by urbanization process have the  
229 potentials of exerting severe stress on a wetland's sustainability.

230

#### 231 **4. Erosion and Flooding**

232 Flooding and erosion are common environmental challenges in southern Nigeria. Flooding had forced  
233 millions of people to leave their homes, destroying lives and properties, polluting water resources and  
234 increasing disease outbreaks. These environmental challenges are attributable to urbanization process.  
235 Environmental conditions in cities have gradually deteriorated due to the rapid growth of the cities and the  
236 attendance inability of social services and infrastructures to keep pace with the rate of growth. Inadequate  
237 storm drains, dumping of refuse in drainage lines and construction of houses close to and even on the  
238 natural water channels have been shown to be responsible in that order for the increasing cases of flood  
239 in the urban centres [36]. Also, the concrete nature of urban land surface accentuates runoffs, which is a  
240 veritable aid to erosion and subsequent flooding.

241

242 Furthermore, when forest is cleared, the soil is exposed to erosion devastation, floods occur, and rivers  
243 and lakes, are filled up with silt. The water becomes dirty and impure for mankind. The remover of tree  
244 canopy (particularly the leaves) has effect on the rainfall of that area, as there is less leaf surface area for  
245 the transpiration of water, which in turn affects the relative humidity of the atmosphere [34].

246

247

#### 248 **5. Urban Sprawl, Slum and Squatter Settlements**

249


250 Sprawl is the spreading out of a city and its suburbs over more and more rural land at the periphery of an  
251 urban area. This involves the conversion of open space (rural land) into built-up, developed land over  
252 time (<http://www.sprawlcity.org/defining.html>). Increasing urban population necessitates the provision of

253 more roads to accommodate an ever growing number of vehicles, thereby creating sprawling  
254 metropolises. This situation is very common in Nigerian urban centres, due to lack of effective urban  
255 planning. This claim is supported by [33] in their study in Kano state, observed that urbanization affects  
256 land use and when not properly controlled causes emergence of illegal structures and neighbourhoods,  
257 which is the characteristics of some quarters within Kano metropolis. This has affected the city master  
258 plan, thereby affecting social services such as waste collection, and eventually leading to indiscriminate  
259 dumping of waste in illegal areas

260  
261 Sprawl has directly contributed to the degradation and decline of natural habitats such as wetlands,  
262 woodlands and wildl... It also reduces farmland and open spaces. Sprawl is used as an aesthetic  
263 judgment about a general urban development pattern. Generally, sprawl is widely known as ugly  
264 development with tendency to discontinuity and haphazard layout [37].

265  
266 Urbanization in Nigeria is characterized by city slums with serious environmental consequences.  
267 According to [36] millions of Nigerians live in sub-standard and sub-human environment, plagued by  
268 slum, squalor and grossly inadequate social amenities. The result is manifested in growing overcrowding  
269 in homes and increasing pressure on infrastructural facilities and rapid deteriorating environment. The  
270 problems of slum formations and urban degeneration in Nigeria are common occurrence in major cities-  
271 particularly, in Lagos and Ibadan which are probably among the largest cities in the country [38]. Over the  
272 past decades, these problems have constituted major challenges to sustainable urban development [39].  
273 Similarly, [8] stated that today's Nigerian city is typified by substandard and inadequate housing, slums  
274 and lack of infrastructure.

275  
276 The environmental problems in urban centres outweigh the experience in the countryside, as the  
277 environmental problems are seen as the results of human activities which are higher in the urban centres  
278 [18]. Slums developments in urban centres deplete the physical environment, increases crimes and  
279 violence. In the same vein, [18] noted that the proliferation of these slums, which he refers to as  
280 shantytowns results in the unwieldy expansion of the urban centers which poses a major planning

281 problem as provision and management of roads, drainage and sewage systems among other  
282 infrastructure, proves very difficult. Furthermore, shantytowns, a consequent of urbanization, cause  
283 increases in the incidence of urban poverty,  diseases and epidemics, environmental pollution, urban  
284 conflicts and crimes.

285

## 286 **6. Heat Island**

287 Urbanization leads to alterations of the local climate, and in particular creates a significant urban heat  
288 island (UHI) effect [41; 10]. Urban development, including land use changes, dense building  
289 developments, heat emissions, human activities, etc., have a great impact upon the local climate of a city.  
290 Urban areas are often jungles of asphalt, concrete, brick and other dark materials for the construction of  
291 roads and buildings. All of these man-made materials have a low reflectivity, and function to absorb  
292 incident solar radiation [42]. This effect causes the city to become 2 to 10<sup>o</sup> F (1 to 6<sup>o</sup> C) warmer than  
293 surrounding landscapes, which reduce soil moisture and intensification of carbon dioxide emissions [43].  
294 In addition, it may lead to thermal physiological discomfort of people living in the affected areas.

295

## 296 **7. Aesthetic Degradation**

297 Aesthetic degradation or visual pollution occurs, when the outer ambient atmosphere contains materials  
298 in concentrations which are harmful to man and affect the aesthetic value of his environment. There are  
299 several sources of aesthetic degradation in Nigeria, which include urban sprawl, indiscriminate waste  
300 disposal, billboards amongst others. Although signs and billboards are works of graphics which have  
301 contributed immensely to the development of Nigerian cities [44], however, it has contributed to visual  
302 pollution in Nigerian cities. There are several instances where billboards are pulled down and destroyed by  
303 wind, torn or have peelings and are not replaced for years; which constitute visual environmental pollution  
304 (Plate 2). According to [45] such billboards project visual disorder and visual clutter perpetuating visual  
305 pollution, visual chaos and visual obstruction which tend to diminish aesthetic sensibility and visual  
306 literacy in Nigerian cities. He stated further that environmental pollution of billboards is assuming global  
307 magnitude, and its frontiers are no more confined to any particular part of our planet.

308

309 Indiscriminate wastes disposal, which are common occurrence in most Nigerian urban centres harbours  
310 pests and rodents and produce foul odour that degrades the aesthetic quality of the environment [46]. In  
311 addition, the indiscriminate erections of communication masks and other unsightly structures degrade the  
312 aesthetics of the urban environment.

313



314  
315

316 Plate 2: Urban Aesthetic Degradation: A Billboard Constituting  
317 Visual Pollution, Akure, Nigeria.

318

319 Source: Adapted from Oladumiye, E. B. (2013)

320

321

322

## 323 8. CONCLUSION

324

325 This review had highlighted the linkage between urbanization and the environment and had revealed that

326 the linkage is so profound. Hence, there is the need for a proper understanding of this linkage in other to

327 effectively and efficiently develop programmes and strategies that will enhance the drive towards

328 sustainable environmental management. In Nigeria, urbanization process has created severe negative

329 environmental impacts, such as pollution, deforestation and wetland destruction, erosion and flooding,

330 urban sprawl, slum and squatter settlement, heat island and aesthetic degradation, which have had dire

331 consequences on both human and other living organisms. In order to be on the desirable path to

332 sustainable environmental management, urbanization process should be controlled and managed

333 effectively, without exceeding the carrying capacity of the environment. This can be achieved by

334 designing rural development programmes which could reduce rural-urban migration. In addition, other

335 anthropogenic activities, which have negative impact on the environment, should be effectively and  
336 efficiently managed.

337  
338 **REFERENCE**

- 339  
340  
341 1. Mabogunje, A. Towards an urban policy in Nigeria. In: Onobokun, P (Ed.), Housing in Nigeria. A book  
342 of readings. Ibadan, Nigeria. NISER, 1985  
343
- 344 2. Dawson, R. J; Hall, J. W; Barr, S.L; Batty, M; Bristow, A.L; Carney, S; Dagoumas, A; Evans, S; Ford,  
345 A; Harwatt, H Köhler, J; Tight, M. R; Walsh, C.L and Zanni, A. M . A blueprint for the  
346 integrated assessment of climate change in cities, Tyndall working paper 129. 2009; 26  
347
- 348 3. Adesina, A. O. Legibility and the Nigerian urban environment: Experiences from Ilorin: In: Adekunle,  
349 V. et al (Eds.)  
350 Proceedings of the conference on the challenges of environmental sustainability in a democratic  
351 governance,  
352 Environment and Behaviour Association of Nigeria. Lagos, Nigeria; 2003.  
353
- 354 4. De Sherbinin, A; Schiller, A and Pulsipher, A. The vulnerability of global cities to climate hazards,  
355 Environment and Urbanization, 2007; 19: 39–64  
356
- 357 5. United Nations. World urbanization prospects: The 2007 revision, Population Division of the  
358 Department of Economic and Social Affairs, 2007a; pp. 244.  
359
- 360 6. United Nations. State of the world population: Unleashing the potential of urban growth, United  
361 Nations Population Fund, 2007b; pp. 108  
362
- 363 7. Awosusi, O. O. and Jegede, A.O. Challenges of sustainability and urban development: A case of  
364 Ado-Ekiti, Ekiti State, Nigeria, International Education Research. 2013; 1(1): 22-29

- 365 8. Mabogunje, A. Re-constructing the Nigerian city: The new policy on urban development and housing,  
366 paper presented at a national conference on the city in Nigeria, Ile Ife, 2002  
367
- 368 9. Mba, H.C; Ude, B.C; Ume, L.C and Uchegbu, B. (eds) (2004) Management of Environmental  
369 Problems and Hazards in Nigeria, Hants: Ashgate Publishing Ltd  
370
- 371 10. Zhou, L; Dickinson, R. E; Tian, Y; Fang, J; Li, Q and Kaufmann, R. K. Evidence for significant  
372 urbanization effect on climate in China PNAS. 2004; 101: 9540–9544  
373
- 374 11. Liu, J. G and Diamond, J. China's environment in a globalizing world, Nature. 2005; 435: 1179-1186  
375
- 376 12. Yuan, F. Land-cover change and environmental impact analysis in the Greater Mankato area of  
377 Minnesota using remote sensing and GIS modeling. International Journal of Remote Sensing. 2008;  
378 29 (4): 1169–1184  
379
- 380 13. Jago-on, K. A; Kaneko, S; Fujikura, R; Fujiwara, A; Imai, T and Matsumoto, T. Urbanization and  
381 subsurface environmental issues: An attempt at DPSIR model application in Asian cities, Science of  
382 the Total Environment, 2009; 407 (9): 3089- 3104  
383
- 384 14. Daramola, A and Ibem, E. O. Urban environmental problems in Nigeria: Implications for sustainable  
385 development, Journal of Sustainable Development in Africa. 2010; 12(1): 124-145  
386
- 387 15. National Population Commission. 1991 Population Census of the Federal Republic of Nigeria:  
388 Analytical report at the national level, Abuja: National Population Commission, 1998  
389
- 390 16. Federal Republic of Nigeria. Official gazette on the breakdown of the national and state provisional  
391 totals of 2006 census, S.I No. 23 of 2007, 94 (24), Lagos.  
392

- 393 17. Taylor, R.W. Urban development policies in Nigeria: Planning, housing and land policy. New Jersey:  
394 Centre for Economic Research in Africa, Montclair State University, 2000  
395
- 396 18. Oyeleye, O. I. Challenges of Urbanization and Urban Growth in Nigeria, American Journal of  
397 Sustainable Cities and Society. 2013; 1 (2): 79-95  
398
- 399 19. Asthana, D.K and Asthana M. A textbook of environmental studies for undergraduate students, S.  
400 Chand & Company Ltd, New Delhi. 2012  
401
- 402 20. Efe, S. I. Urban effect on precipitation amount, distribution and rainwater quality in Warri metropolis,  
403 unpublished Ph.D thesis, Delta State University, Abraka. 2005  
404
- 405 21. Ohwo, O. Quality of water supply from hand-dug wells in Warri-Effurun metropolis, Delta State,  
406 Nigeria, Nigeria Geographical Journal, New Series. 2012; 8 (1): 121-134  
407
- 408 22. Ohwo, O and Abotutu, A. Access to potable water supply in Nigerian cities evidence from Yenagoa  
409 metropolis. American Journal of Water Resources. 2014; 2 (2), 31-36. Available online at  
410 <http://pubs.sciepub.com/ajwr/2/2/1> © Science and Education Publishing DOI:10.12691/ajwr-2-2-1  
411
- 412 23. Jande, G. G. Legal mechanisms for the control of pollution on the high seas, African Journal of  
413 Environmental Law and Development Studies, 2005; 1 (1): 1 – 13  
414
- 415 24. Aja, J. O. Environmental education as a panacea for a sustainable development in Nigeria: Schools  
416 environment in focus, African Journal of Environmental Laws and Development Studies. 2005; 1(1):  
417 114-127  
418
- 419 25. ARD Inc. Nigeria environmental analysis final report, under USAID contract No LAG-1-00-  
420 9900013-00. Biodiversity and sustainable forestry (BIOFOR) Indefinite Quantity Contract. 2002

- 421 26. World Resources Institute. The urban environment 1996-1997. WRI with the World Bank and the  
422 United Nations, Washington, DC. 1996; pp. 86  
423
- 424 27. World Energy Council. Energy for tomorrow's world: The realities, the real opportunities, and the  
425 agenda for achievement, Kogan Page, London/New York, 1993; p. 51.  
426
- 427 28. Galadima, A and Garba. Heavy metals pollution in Nigeria: Causes and consequences. *Elixir*  
428 *Pollution*. 2012; 45: 7917-7922  
429
- 430 29. Adebisi, S. A and Fayemiwo, K. A. Pollution of Ibadan soil by industrial effluents. *New York Science*  
431 *Journal*. 2010; 3(10): 37-41  
432
- 433 30. World Health Organization. Rapid assessment of sources of air, water and land pollution, WHO offset  
434 publication, No. 62, England, 1982  
435
- 436 31. Ogunfowokan, A.O., Okoh, E.K., Adenuga, A.A. and Asubiojo, O.I. An assessment of the impact of  
437 point source pollution from a university sewage treatment oxidation pond on a receiving stream – a  
438 preliminary study. *Journal of Applied Sciences* 2005; 5(1):36 – 43.  
439
- 440 32. Jimena, M.G., Roxana, O., Catiana, Z., Margarita, H., Susana, M. and Ines-Isla M. Industrial effluents  
441 and surface waters genotoxicity and mutagenicity evaluation of a river of Tucuman, Argentina. *J. of*  
442 *hazardous Material*, 2008; 155(3): 403- 406.  
443
- 444 33. Butu, A. W and Mshelia, S. S. Municipal solid waste disposal and environmental issues in Kano  
445 metropolis, Nigeria, *British Journal of Environmental Sciences*. 2014; 2 (1): 1-16  
446
- 447 34. Omofonmwan, S. I and Osa-Edoh, G. I. The challenges of environmental problems in Nigeria, *J.*  
448 *Hum. Ecol.* 2008; 23(1): 53-57



- 449 35. Ajibola, M. O; Adewale, B. A and Ijasa, K. C. Effects of urbanization on Lagos wetlands,  
450 International Journal Business and Social Science. 2012; 3 (17): 310-318  
451
- 452 36. Lanrewaju, A. F. Urbanization, housing quality and environmental degeneration in Nigeria, Journal of  
453 Geography and Regional Planning. 2012; 5(16): 422-429,  
454
- 455 37. Haregewoin, B. Urbanization and urban sprawl, unpublished Master of Science thesis No. 294,  
456 Department of Infrastructure Section of Building and Real Estate Economics, Kungliga Tekniska  
457 Högskolan, Stockholm, 2005  
458
- 459 38. Fourchard, L. Urban slums reports: The case of Ibadan, Nigeria, understanding slums: Case studies  
460 for the global report on human settlements. Institut Francais de Recherche en Afrique (IFRA),  
461 University of Ibadan, Nigeria, 2003; Accessed 5 July 2011. Available: [http://www.ucl.ac.uk/dpu](http://www.ucl.ac.uk/dpu/projects/GlobalReport/pdfs/Ibadan.pdf)  
462 [projects/GlobalReport/pdfs/Ibadan.pdf](http://www.ucl.ac.uk/dpu/projects/GlobalReport/pdfs/Ibadan.pdf)  
463
- 464 39. Jiboye, A. D. Sustainable urbanization: Issues and challenges for effective urban governance in  
465 Nigeria, Journal of Sustainable Development. 2011; 4 (6): 211-224  
466
- 467 40. Aina, T. The shanty town economy. In: Datta, S (Ed.), Third world industrialization: Reappraisals and  
468 perspectives, Uppsala: Ordinary & Form; 1990.  
469
- 470 41. Kalnay, E and Cai, M. Impact of urbanization and land-use change on climate, Nature. 2003; 423:  
471 528–531  
472
- 473 42. Oke T. R. The energetic basis of urban heat island. Journal of the Royal Meteorological Society. 1982;  
474 108: 1–24  
475

- 476 43. Akinluyi, M. L and Adedokun, A. Urbanization, environment and homelessness in the developing  
477 world: The sustainable housing development, Mediterranean Journal of Social Sciences. 2014; 5 (2):  
478 261-271  
479
- 480 44. Oladumiye, E. B. The place of graphic design art symbol and way finding signs in national unity,  
481 Journal of Arts and Social Sciences Forum, 2002; 4(4): 90-98  
482
- 483 45. Oladumiye, E. B. Urban environmental graphics: Impact, problems and visual pollution of signs and  
484 billboards in Nigerian cities, International Journal of Education and Research. 2013; 1 (6): 1-12  
485
- 486 46. Ohwo, O. An assessment of the problems and impacts of solid waste management in Amassoma,  
487 Bayelsa State, Nigeria, Journal of Applied Sciences in Environmental Sanitation, 2013; 8 (4): 267-276