Vol. 3, No. 4, pp. 346-356, (December2022)
DOI: **10.21608/aujes.2022.145259.1074**
Aswan University Journal of Environmental Studies (AUJES)
Online ISSN: 2735-4237, Print ISSN: 2735-4229
Journal homepage: https://aujes.journals.ekb.eg/ E-mail: AUJES@aswu.edu.eg
Article Review

Towards a Sustainable City Environment: Resolving the Challenge of Flooding in a Growing Tropical City in Osun State, Nigeria- A Review

***Ogunbode Timothy Oyebamiji[1] and Oyebamiji Victor Oyedeji[2]**

[1]*College of Agriculture, Engineering and Science, Environmental Management and Crop Production Unit, Bowen University, Iwo, Nigeria*
[2]*Department of Geography, Obafemi Awolowo University, Ile-Ife, Nigeria*

Received: 17/6/2022 Accepted: 27/9/2022

Abstract:

A major sustainable development goal (SDG) is the attainment of desirable living in cities. However, one serious environmental problem confronting Iwo, Osun State, Nigeria is flooding. Consequently, a critical review of literature was done to ascertain causes and establish remediation strategies for achieving a virile and sustainable city now and in no distant future. Causes of flood disaster include heavy rainfall, poor urban planning, indiscriminate refuse dumps, sedimentation of stream and reservoir beds, lackadaisical attitude towards expert warnings and forecasts among others. The effects range from farmland destructions, community displacement, destruction of public utilities and loss of lives. The accompanying disaster often led to unplanned and unprecedented expenditure by governments at different levels in an effort to alleviate negative impacts on those affected; repair and rebuilding of damaged infrastructures etc. Current growth and anticipated development of Iwo township demand efforts of all stakeholders to put in place reliable policies, projects and programmes that will lessen flood disaster for sustainability. It is expected that all stakeholders would work towards mitigating the occurrence of the flood disaster by enacting relevant legislation; proactive and mitigating measures to prevent the disaster; timely provision of adequate and relevant data/information; adherence to modern town planning rules and expert warnings in order to achieve sustainable living in cities.

Key words: Sustainable environment; SDG, flood disaster; growing city; Nigeria.

1- Introduction

Goal 11 of the global Sustainable Development Goals (SDGs) is making cities and human settlements inclusive, safe, resilient and sustainable. The target was to significantly reduce, by the year 2030, *"the number of deaths and the number of people affected and substantially decrease the economic losses relative to gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations" (Target 11.5)*. However, one fundamental characteristic of many urban centers in developing nations, and particularly the sub-Saharan region is the challenge of flood disaster (Adaku, 2020; Adelekan, 2020).

Corresponding author*: E-mail address: timothy.ogunbode@bowen.edu.ng

The prevalence was attributed to various factors such as poor urban planning, indiscriminate dump of refuse, river and stream siltation, human uncontrolled tampering with the channel of surface flows, dam spills and lately the influence of climate change which has resulted in extremes of climatic events (Olawuni *et al*., 2015; Adaku, 2020; Anabaraonye, 2021; Ogunbode and Asifat, 2021). Also, the incidence of flooding around the globe are aftermaths of actions geared towards development like deforestation, agriculture, engineering works that involved land clearing, among others. All these anthropogenic factors engender surface erosion that could initiate flooding. The associated disasters have left several people homeless, destroyed properties and disrupted business activities and high susceptibility to various water-borne diseases. Many cities have fallen victim of flood disaster in Nigeria including Ibadan, Lagos, Kano, Osogbo, Sokoto, Owerri among others. The problem of flooding is becoming almost a characteristic feature with which one could describe and identify urban centres in developing nations, especially in Nigeria. This observation is attributed to the fact that most of these cities share similar tropical climatic characteristics. For instance, one of the factors to identify urban centres is the number of inhabitants. Many cities of the world are 'millionaire cities' indicating that such cities harbour a population numbered millions. For instance, Ibadan with a population of five million according to the 2006 census head count while Lagos has over twenty million people living in it (National Population Commission, 2006). A consequence of such huge number of inhabitants is the development of slums, and enormous refuse generated which the urban management needs to battle with to ensure pollution-free and sustainable living. In developing countries where poverty level is extremely high and corruption is prevalent, populous countries are prone to poor urban planning, encroachment into and usurpation of every space available and many other unsustainable risks taken by people in order to make a living. Aluko (2004) mentioned building at floodable plains and across drainage pathways as typical examples. For their peculiarities, many of the growing towns need to be managed in such a way to avert flood disasters as they grow in size and number. This has, however, not been the experience, as many growing urban centres are currently wallowing through the same environmental challenges experienced by the larger grown cities. For instance, Iwo has no traditional history of flood disaster but, in the last decade, reports have suggested trend of perennial flood disaster. Thus, this investigation aimed at analyzing the immediate and remote causes, also consequences of flood disaster in Iwo town so as to recommend appropriate remedial solutions to avert the trend for a sustainable growth and development of the town.

Brief History of Flooding in Nigeria

The incidence of flooding in Nigeria could be described as old as the country itself. The attendant disaster is, however, not peculiar to Nigeria as it happens in many other big cities throughout the world, be it developed or underdeveloped. This is because the factors behind its occurrence, which is common to all areas that are prone to flooding, is torrential downpour at least. The mitigation and response to the disaster are however different across nations. Many developed nations have developed mechanisms and institutions that are already established to checkmate the incidence and the negative impacts of flooding on man and other components of the environment (Mehryar and Surminski, 2020). Several cases of flood disaster have occurred in Nigeria. The generalized cause is heavy rainfall in view of the location of the country in the tropical climate environment. Most of the States/cities in Nigeria had one time or the other experienced flooding. For instance, the history of flood disaster in Ibadan, Oyo State, Nigeria could be traced to July 9th and 10th, 1933 which was recorded as the first flood disaster in the

town. Apart from that of 1933, the city had been hit by flood disaster like in June 1955, July 1960, August, 1963 and August 1980 among others (Agbonkhese *et al.*, 2014). Kano State in Northern part of the country also experienced flood disaster on August 7, 1988), the event that led to the collapse of Bagauda Dam and resulted in the loss of lives and destruction of properties worth millions of dollars. Ilorin, the Kwara State capital also had the tastes of excessive surface flow of water in 1976, the event that led to the destruction of vegetable and sugarcane farmlands and the flooding of urban roads with about 40 houses submerged. The flood events of September, 1989 in Cross River State resulted in submergence of over 130,000 hectares of farmlands while, in the same year, over 150,000 farming families became homeless and destruction of economic trees in Akwa Ibom State (Agbonkhese *et al.*, 2014; Nemine, 2015; Saediman *et al*., 2021). Similarly, in the early July of 2012, about 363 people were killed while over 2 million people were displaced and properties worth millions of dollars were destroyed including farmlands in Kogi, Edo, Cross River, Rivers, Benue, Delta and Bayelsa States of the Federation (Nemine, 2015). It is on record that 2012 flood disaster was the most devastating in the history of Nigeria according to Social Action (2012). Apart from this, there are other incidences of the event. For instance, Yobe State experienced flooding in August 2011 in which about 140 lives were lost apart from many hectares of farmland that were destroyed. Other States that were hit with similar disaster in 2011 include Zamfara, Oyo, Delta, Ebonyi, Borno, Imo, Taraba and Benue (Social Action, 2012; Magami *et al*., 2014). The former Federal capital, Lagis, had also witnessed similar disaster including the incidence of 1988 and 2011. All these cities and many other ones that have witnessed flood disaster showed that urban congestion, poor urban planning and or non-adherence to modern planning regulations are important contributing factors apart from heavy rainfall and terrain characteristics of the areas. Other critical factors include, non-compliance to the predictions of Nigeria Meteorological Agency (NIMET) and their recommendations, massive concretization of the surface among others. It is of no doubt that flood disaster is not only peculiar to urban centres but also in the rural or semi-urban areas. It is important to note that enormous volume of water often generated from the cities contributes a lot to rural flood (Olaniyan *et al.*, 2020). The characterized forest cover in the rural areas is significant in the absorption and retention of water to a large extent, the feature that is almost zero in cities.

From the foregoing, it is clear that Iwo, Osun State, has not been recorded to witness flood disaster of remarkable magnitude and losses although there have been slight cases of flooding in the town which resulted in various degrees of damages, especially to road infrastructures, electricity facilities, houses, farmlands that are adjacent to flooded streams like Aiba and Yanyanhun within the town. Losses have been recorded in various fish ponds, piggeries and various crop farms and at times loss of lives. The value of such destructions are often scary because most of the farmlands are practiced at subsistence level.

The growth of Iwo Town

Iwo is a Yoruba town and also one of the cities in Osun State. It occupies an area of 245km^2 with a population of about 191,377 according to the 2006 Nigeria head count. Iwo is located between latitudes 7^{o}37’ and 7^{o}40’ north of the equator and longitudes 4^{o}09’ and 4^{o}13’ east of Greenwich Meridian (Fig. 1). It is found in the tropical zone and endowed with two climatic seasons namely rainy and dry seasons The town is situated on an elevation of between 202 and 315 metres above mean sea level. Iwo was the headquarters of Iwo District Council (DC) which was established in

1940. This DC metamorphosed into Local Government Area in 1976 with the headquarters in Iwo by the enactment of Edict Number 5 of the old Oyo State of Nigeria.

The growth of Iwo could be traced to several factors including the effort of religious groups, private philanthropists and entrepreneurs, educationists among others. Iwo is the site of Bowen University, one the globally known University owned by the Nigerian Baptist Convention. The University is located in the former site of popular Baptist Teachers' Training College along Ikire/Gbongan Road in the town. The University became operational in 2002 having obtained operational license from the Federal government. Today, the University is being patronized globally. The establishment of the University has led to the springing up of corporate entities such as guest houses, event centres among others. Also, the approval of Westland University in 2019 has contributed to the expansion of the town. Many other post primary institutions have sprung up to benefit from the increase in the population of the town. The 5-day periodic Odo-Ori Market has also added to the growth of the town. Many people patronize the market from Lagos, Ibadan, Oyo, Ede, Ejigbo, Oshogbo apart from other neighboring towns and other smaller communities. The activities of both Christians and Moslems cannot be overlooked in the growth of Iwo town. Several primary and secondary schools are established in the town by these religious groups which have added to its expansion and growth. Presently, Iwo is served with potable water from Aiba Water Reservoir located in the town (Ogunbode *et al*. (2019). It is important to mention that with the approval of the Federal College of Education by the Federal Government, and the just enacted legislation establishing Institute of Communication Technology (both to be sited in Iwo) the town is expected to witness increased growth by the time they fully become operational.

The trend in the growth of Iwo is a signal to all stakeholders in the development of the town and its environs that all hands should be on deck to build a city that is disaster-free in the nearest future.

Map os Osun State showing the location of Iwo (The headquarters of Iwo LGA)
(Inset: Map of Nigeria showing the loacation of Osun State

The causes of flooding in Iwo can be discussed under principal and isolated (remote) factors that contribute to the incidence in the growing city.

Principal Causes of Flood in Iwo

The main causes of flooding in Iwo are traced to (1). Heavy rainfalls (2). Heavy deposits of wastes on river beds and drainage channels (3). Blocked and damaged culverts/gutters (4). Reduced capacity of the Aiba Reservoir and (5). Reduced capacity of the Aiba Reservoir. Nevertheless, the magnitude of flooding cannot be compared with that of Ibadan and other big cities especially in terms of magnitude of destruction, volume of water, coverage among others. Iwo is a growing town and agriculture-based economy. The causal incidences are discussed:

(1). Heavy rainfall

The location in the tropical climatic region implied the experience of rainfall over eight months annually. The rainfall in this region is characterized with double maxima in both July and September. Record shows that annual rainfall I about 1,500mm per year. Thus, incessant rainfall over days or even weeks could result into drainages being overflown its banks (Lucas, 2021; Ogunbode and Ifabiyi, 2019).

(2). Heavy deposits of wastes on river beds and drainage channels

Another crucial reason for flooding in. Iwo is attributed to the continuous deposition of debris and solid wastes on the river sides which encourages siltation of the river bed (see also Amadi, 2013; Hula and Udoh, 2015; Olaniyan *et al*., 2020). Thus, the drainages and river beds become shallower over time with diminishing capacity to accommodate much water. This scenario creates avenue for the overflowing of their banks, even with scanty rainfall. The experience of flooding even of August 2022 was partly as a result of indiscriminate deposition of wastes around river channels, especially Aiba downstream. Odo Ori River close a popular market in the town has become refuse dump site, and thus made the environment prone to flooding during the raining season.

(3). Blocked and damaged culverts/gutters

Iwo is a growing town with dilapidated infrastructures lacking upgrading and proper maintenance. The Local Government administration has almost become powerless in maintaining infrastructures as State Government oversees most of these responsibilities. This a serious challenge as LG has become incapacitated to attend to the damaged culverts not to talk of building a new one on urban roads- thus, pathways of flowing water are susceptible to diversion which could be into residential and other peopled areas (Olaniyan *et al*., 2020).

(4). Reduced capacity of the Aiba reservoir

The only water reservoir in the town on Aiba River has continuously become silted up in view of farming activities and the removal or ageing of the forest trees in its environment. Agricultural activities being carried out within the forest have impacted on the depth of the dam through sedimentation, thus silting up the bed of the dam (Zimmerman *et al*., 2003; Ogunbode *et al.*, 2019; Bispo *et al*., 2020; Ogunbode *et al.*, 2021) The consequential effect of this is the drastic fall in the capacity of water that the dam could hold. The excess water overflows its embankment causing overflowing downstream which is also equally facing sedimentation challenges.

(5). Activities of oil palm mills

One of the sources of livelihood to the inhabitants of Iwo town is the milling of oil palm in view of the favourable climate for the growth of palm trees. Most of these mills are sited along most of the streams that flow through the town to enjoy good access to water which is an important input in the factory. These activities generate a lot of wastes such as fronds, empty fruit bunches, mesocarp fibre, palm kernel shell and oil palm trunk among others which are often dumped on the river banks or its bed directly, thereby contributing to the blockage of the stream flow. This induces flooding in the town (Saediman *et al*., 2021Ogunbode et al., 2022a; Ogunbode et al., 2022b)

Remote Causes of Flooding

Other remote and incidental causes of flooding in Iwo could be traced to (1). Poor urban planning (2). Poor drainage network and (3). Buildings along the river channel.

(1). Poor urban planning

The growth of Iwo could be traced to the development of ancient villages which now turn out to attract several settlers in the town. The evidences of this could be seen in the housing structure, human activities which are mostly agro-based, dominance of Yoruba settlers, transportation networks among others. This scenario has impacted on the urban planning. Proper and modern layout is just springing up in the town as a result its administrative significance (Cirella and Iyalomhe,.2018; Lucas, 2021). This modernization is still beset by dearth of industries, poor administration and illiteracy/sentiments.

(2). Poor drainage network

It is important to note that, even within the core/centre of the town, the drainage channels are still poorly maintained, badly blocked and almost turning into refuse dump areas. This situation could impact on the flow of water as the volume and the capacities of the few open channels are flooded from the main town (Olaniyan *et al*., 2020).

(3). Buildings along the river channel

The erection of buildings, be it residential or commercial types along river channels has remotely contributed to the problem of flooding in the town. Though, Iwo is not yet congested and too peopled to be challenged with the problem of land space for building, experience has revealed that many people who house are located close to channel of streams in the town do so either due to the cheapness of the land or on the ground of land heritage. Some of these buildings could be found along Aiba, Yanyanhun, Moremi and Odo-Ori streams. In addition, many commercial structures are also found along Odo-Ori stream especially, car wash points, eateries, piggeries and poultries among others. Nurashikin *et al*. (2015) also corroborated this point in their review work.

Effects of Flooding in Iwo

Though, the event of flooding in Iwo has not been overwhelming as in bigger cities in Nigeria like Ibadan, Lagos among others, the disaster has resulted into a lot of damages and destruction of properties. Cases of damages to public utilities such roads, electric wires and poles, destruction of farmlands, most especially urban farmlands, fisheries and piggeries, among others. Cases of loss life and destruction of residential buildings erected on river beds and or close to it have also been reported. Despite its negative effects, flooding has been a blessing in disguise to

the urban dwellers who often engage in dry season farming. Flooded water often carry sediments and materials that enrich the soils where they are deposited- such are beneficial to the dry season farmers.

Resolving the challenge of flooding in Iwo town

Iwo is a growing town which should not be confronted with the problem of flooding at the stage of its development as it is the case with cities and metropolis in Nigeria like Ibadan, Owerri, and Lagos and so on. It is still a pleasant town that requires to attract people of diverse professions like industrialists, entrepreneur, tourists among others. It is therefore imperative that urgent remedies that are sustainable and continuous are sought so that resources are diverted to develop the town in the nearest future. This report presents the following as suggestions for remediating the problem of flooding in Iwo.

(1). A functioning local administration

One of the constitutional roles of local government areas in Nigeria is the maintenance of basic social amenities at local level such as feeder roads, building of culverts, cleaning the drainages among others. It is unfortunate that most of the local authorities were found wanting in their civil performances probably as a result of constitutional loopholes, influence of political parties that had been in power, usurpation of such roles by the State administration, diversion of fund meant for local government allocations among others. It is therefore expected if all these challenges hindering the effective administration at third tier level in the country, then relevant roles to the control of flooding in the town would have been partly resolved (Olaniyan *et al*, 2020).

(2). Ecosystem maintenance and its sustenance

Maintenance of ecological environment and its balance in the Aiba Water Reservoir ecosystem has the potential to enhance the minimization of the contribution of the Reservoir to the incidence of flooding in the town. Effort should be geared towards the resuscitation of the ecology of the Aiba Water Reservoir to minimize sedimentation of the dam bed caused by surface flow into the dam, especially from the forest side of the reservoir (Ogunbode *et al*., 2019; Ogunbode et al, 2021). Further recommended by Ogunbode *et al* (2019) is reforestation and enhancing tree regrowth, banning crop farming under the forest, prohibiting human encroachment for any purpose into the forest are some of the actions that could be encouraged to curb surface erosion into the reservoir and eventual decline in the water contributing to flooding at the downstream of the dam.

(3). Adherence to the modern town planning regulations

Though, Iwo is a growing town just being hatched from village status, aligning with the modern layout and planning of urban centres will enhance the control of flooding challenge in the town. Such an effort may be inadvertently resisted by local inhabitants but proper education and enlightenment will assist to achieve this point. Iwo has the potential of becoming the nucleus for other communities surrounding it, and so adherence to the modern planning regulations and its continuity is a necessity to work over the flooding challenge that are often characterized large number of urban centres in the developing nations of the world (Serre *et al*, 2010; Dabi and Kporha, 2015; Miguez *et al*., 2019; Abdrabo, *et al*., 2020; Echendu, 2021).

(4). Appropriate legislation and sanctions for the erring members of the community

As a fallout from the adherence to modern planning regulations is the ability of the appropriate authority to execute appropriate legislations to curb all actions that pose threat to the environmental harmony and environment-related hazards including flooding (Adebayo, 2014; Mehryar and Surminski, (2020; Sarah and Swenja, 2021). Apart from this, appropriate sanctions according to the regulations should be meted out to the erring members of the community. Indiscriminate dumping of refuse, illegal encroachment into urban spaces, illegal building structures and emanating slums, trading in areas without any legal backing among others should be legislated against with attached measurable sanctions for the violators are desired to checkmate flooding in the town (Cirillo and Albrecht, 2015).

(5). Relocation of the oil palm mills away from river sides

One of the means of livelihood to the Iwo inhabitants is oil palm milling. Quite a number of people process their oil palm fruits in most of the mills sited along streams within the town and so contribute to the flooding as most of their wastes and other residues from milling activities often found their ways into the adjacent streams. With the growth and expansion being recorded in Iwo, it is expected that alternative locations will be decided by the appropriate authority with all facilities required for the millers' performance should be provided. Improved technology on the oil palm processing needs to be introduced and embraced to checkmate the contributions of this sector to river channel redirection through dumping of their wastes and residues into the river bed (Merten *et al*, 2017; Ogunbode et al., 2022a; Ogunbode et al., 2022b)

(6). Capacity building, empowerment and enlightenment

Another area of importance to avert flooding in this growing urban centre and also emphasized by Hulah and Udoh (20115) is through capacity building and empowerment (especially economic areas) for the inhabitants and other stakeholders in the development of the town especially in the areas exposure to modern ways of carrying out tasks in line with the new technology, improved methods of disposing wastes, waste recycling/reuse, greening of our natural and built-up environment, public facilities maintenance among others. Also, enlightenment on the constitutional roles of citizens to the sustenance of human environment, the significance of environmental harmony among others, should be embraced for attaining disaster-free urban centre (World Bank, 2017; Nurashikin *et al*., 2019).

(7). Proper channelization of the streams within the town

The responsibility of ensuring that drainage channels and that of stream bed expansion and its clearing is that of the government. However, some of these activities may go beyond the ability of the local administration, especially in terms of financial requirement, personnel and technology involved, then the second-tier of the level of administration which rests with the State Government and/or Federal administration can take up the responsibility. Nwoko (2013), Hula and Udoh (2015) and Nkwunonwo, (2016) considered the significance of the need for regular dredging/channelization and/or stream-bed widening/expansion to checkmate flood disaster in view of unwholesome practice of refuse dump on stream channels, importantly within the core of the town which may impede free flow of water.

(8). Contribution of Non-Governmental Organizations (NGOs)

According to Adetunji *et al*, (2020) different NGOs at local, national and international organizations could be involved in various efforts that are geared toward eliminating flood disaster including in growing cities like Iwo. All socio-cultural groups, religious organizations, professional bodies among others domicile at all levels can initiate activities or programs that can

sensitize the inhabitants in the town to the menace of flooding, its cause and possible ways out of the challenge.

Conclusions

One of the challenges faced by urban cities globally, and in developing nations especially is flood disaster. The causes of flood disaster include heavy rainfall, poor urban planning, indiscriminate refuse dumps, uncontrolled sedimentation of stream and reservoir beds, lackadaisical attitude towards expert warnings and forecasts among others. The effects range from farmland destructions, displacement of the people in the prone areas, destruction of public utilities to even loss of lives in many instances and regions. The disaster has often led to unprecedented expenditure of the government at different levels, probably to alleviate the impact of the disaster on those affected, repair/rebuilding damaged infrastructures and so on. It is therefore expected that frantic efforts would be made by all stakeholders to mitigate the occurrence of flood disaster through enactment of relevant legislations, being proactive on preventing the disaster, timely provision of adequate and relevant data/information, adherence to modern town planning rules especially in those urban centres that are still in the process of infrastructural development and expansion in order to achieve sustainable living in cities as being canvassed by the United Nations through its Sustainable Development Goals.

References

Abdrabo, K. Kantoush, S. A., Saber, M., Sumi, T., Habiba, O. M. and Elboshy, B. (2020) The role of Urban Planning tools in flash flood Risk Reduction for the urban and semi-arid Regions, https://doi.org/13140/RG.2.2.31397.12.000

Adebayo, W. A. (2014) Environmental Law and Flood Disaster in Nigeria: The Imperative of legal control. *Int. J. Education and Research,* 2(7):447-468

Adaku J. E.(2020) The impact of flooding on Nigeria's sustainable development goals (SDGs). *Ecosystem Health and Sustainability*, 6:1, 1791735, https://doi.org/10.1080/20964129.2020.1791735

Adelekan, I.O. (2020) Urban Dynamics, Everyday Hazards and Disaster Risks in Ibadan, Nigeria. *Environment and Urbanization*, 32(1):213-232. Doi:10.1177/0956247819844738

Adetunji, O. S., Owolabi, O. S. and Faboye, S. O. (2020) Rethinking roles of Local Non- Governmental Organizations (LNGOs) in Managing Disaster Risks in Historic Neighborhoods: Experiences from the city of Lagos, Nigeria.*in External Intervention for Disaster Risk Reduction,* DOI:10.1007/978-981-15-4948-9_9

Agbponkhese, O., Agbonkhese, E.G., Aka, E.O., Joe-Abaya, J., Ocholi, M. and Adekunle, A. (2014) Flood menace in Nigeria: Impacts, Remedial and Management Strategies. *Civil and Environmental Research*, 6{4):32-40.

Akinola, A. K., Suleiman, A. A. and Akinluyi, F. O. (2015) A Review of floo risk analysis in Nigeria: *American J. Environmental Sciences*, 11(3):151-166. https://doi.org/10.3844/ajesp2015.157.166

Aluko, M. A. O. (2004) Sustainable Development, Environmental Degradation and the entrenchment of poverty in the Niger Delta of Nigeria. *J. Human Ecology*, 15(1):63-68

Amadi, E. C. (2013) Evaluation of Flooding on the Secondary Students in Ogba/Egbema/Ndoni Local Government Area in Rivers State, Nigeria. *Kuwait Chapter of Arabian J. Business and Management Review*, 3(3):14-19

Anabaraonye, B., (2021) A Brief Look at Flooding and Its Impacts on Nigeria's Health Sector. MAR Case Reports 2.6 (2021) 1.

Bispo, DFA, Batista, PVG, Guimarães DV, Silva MLN, Curi N, Quinton JN. (2020) Monitoring land use impacts on sediment production: a case study of the pilot catchment from the Brazilian program of payment for environmental services. *Rev Bras Cienc Sol o*. 2020;44:e0190167. DOI: 10.36783/18069657rbcs20190167

Cirella, G., & Iyalomhe, F. (2018). Flooding Conceptual Review: Sustainability-Focalized Best Practices in Nigeria. *Applied Sciences*, *8*(9), 1558. https://doi.org/10.3390/app8091558

Cirillo, G. and Albrecht, E. (2015) The importance of Law in flood risk management. *River Basin Management VIII, WIT Transactions on Ecology and the Environment,* 197:91-102.

Dabi, M. and Kporha, M. A. (2015) Unstainable development, Climate change and floods: Interactions and Impacts. *The Int, J. Sci. Technoledge*, 3(6), 278.

Echendu, A. J. (2021) Relationship between urban planning and flooding in Port Harcourt City, Nigeria: Insights from planning professionals. *J. Flood Risk Management*, 14, e12693, httsp://doi.org/10.1111/jfr3.12693

Hula, M. A. and Udoh, J. C. (2015) A Assessment of the impact of flood events in Makurdi, Nigeria. *Civil and Environmental Research,* 7(10):53-60

Lucas, B. (2021). Urban flood management in Nigeria. K4D Helpdesk Report 948. Brighton, UK: Institute of Development Studies. https://doi.org/10.19088/K4D.2021.018

Mehryar S and Surminski S (2020) The role of national laws in managing flood risk and increasing future flood resilience. *Centre for Climate Change Economics and Policy Working Paper 365/Grantham Research Institute on Climate Change and the Environment Working Paper 334. London: London School of Economics and Political Science*

Magami, I.M., Yahaya, S. and Mohammed, K. (2014) Causes and consequences of flooding in Nigeria- A Review. *Biological and Environmental Sciences Journal of the Tropics*, 11(2): 154-162.

Merten, J., Röll, A.; Tarigan, S.; Hölscher, D. Hein, J.(2017) Expanding oil palm cultivation in Indonesia: changing local water cycles raises risks of droughts and floods, *Briefing Paper, No. 1/2017, Deutsches Institut für Entwicklungspolitik (DIE), Bonn*

Miguez, M. G.m MAscarenhas, F. C. B., Magalhâes, L. P. C. and D'Alterio, C. F. V. (2019) Planning and Design of Urban flood control measures: Assess effects combination. *J. Urban Planning and Development,* 135(3), https://10.1061/CASCE.UP.1943-5444.0000012

National Population Commission (2006) *2006 Population census in Nigeria, Abuja, Nigeria*

Nemine, E.L. (2015) Flood disasters in Nigeria: Farmers and Government's mitigation efforts. *Journal of Biology, Agriculture and Healthcare*, 5(14):150-154

Nurashikin, M., Rodger, E. and Rumaizah, M. N. (2019) Reducing flooding impacts to the built environment: A Review. MATEC Web of Conferences, 266, 02001, https://doi.org/10.1051/matecconf/201926602001

Nwoko A.U. (2013) *Flooding in Nigeria Cities: Problems and Prospects- A case study of Aba Urban, Abia State, Nigeria. Abia State University, Uturu, Nigeria, Geography and Planning Department*

Olawuni, O.P., Popoola, A.S., Bolukale, A.T., Eluyele, K.P. and Adegoke, J.O. (2015) An Assessment of the factors responsible for flooding in Ibadan Metropolis, Nigeria. *Journal of Environment and Earth Science*, 5(21), 2015.

Ogunbode, T.O. and Ifabiyi, I.P. (2019) Temporal Water Balance Analysis in Different Climatic Scenarios in Oyo State, Nigeria. Sustainability, Agri, Food and Environmental Research, 7(2):163-177. http://dx.doi.org/10.7770/safer-V0N0-art1476

Ogunbode, T. O., Akande, J. A., Ogungbile, P. O. and Odekunle, O. (2019) Sustainability and Resilience of Aiba Dam Reservoir in Iwo, Nigeria. J.Applied and Environmental Management, 23(10):1937-1942. httsp://doi.org/10.4314/jasem.v23i11.5

Ogunbode, T. O., Omotayo, O. E., Olatubi, I. V., Ogungbile, P. O., Asifat, J. T., and Oyebamiji, V.O. (2021) Challenges of degradation in the Tropical Environment: Causes, Footprints and Remedies. Aswan University Journal of Environmental Studies (AUJES), 2(4):218-239.
DOI: 10.21608/aujes.2021.89948.1035

Ogunbode, T.O. and Janet T. Asifat, J.T. (2021) Sustainability and Challenges of Climate Change Mitigation through Urban Reforestation - A Review. *Journal of Forest and Environmental Science*, 37(1):1-13. https://doi.org/10.7747/JFES.2021.37.1.1

Ogunbode, T.O., Ogungbile, P.O., Olatubi, I.V., Aliku, O., Adeniyi, V.A., Akintunde, E.A., and Asifat, J.T. (2022a) Impact of Local Oil Mills (*Ebu Epo Pupa*) on the On-Site Environmental Resources Quality in a Growing Urban Center in Nigeria. *Manila Journal of Science*, 15 (2022):14–25.

Ogunbode T. O., Aliku O. , Ogungbile P. O., Olatubi, I.V., Adeniyi, V. A and Akintunde, E.A. (2022b) Environmental impact of palm oil processing on some properties of the on-site soil in a growing city of Nigeria. Frontiers in Environmental Science, 10:918478.
doi: 10.3389/fenvs.2022.918478

Olaniyan, F. A., Adelekan, I. O. and Nwokocha, E. E. (2020) The role of Local Government in Reducing Disaster caes and vulnerabilities in IbadanCity, Nigeria. *Urban Africa Risk Knowledge Working Paper*.

Saediman, H., Mboe, I. S., Zani, M., Daud, L.. and Padangaran, A. M. (2021) Perceived impact of oil Palm Plantation in Agriculture and Environment. *IOP Conference Series: Earth and Environmental Science, 810.012027*

Serre, D. Brroca, B. and Diab, Y. (2010) Urban flood mitigation: Sustainable options. *The Sustainable City VI, WIT Transactions on Ecology and the Environment*, 129 (VI):299-309

Ukwunonwo, U. C. (2016) A Review of flooding and flood risk reduction in Nigeria. *Global J. Human Social Science & Geography, Geo-Science, Environmental Science and Disaster Management*, 16(2):23-42

Social Action, (2012) *The 2912 floods: Social Action briefing, No. 5. December 2012, pp 2-14.*

Sara, M. and Swenja, S. (2021) National laws for enhancing flood resilience in the context of climate change: potential and shortcomings, *Climate Policy*, 21(2):133-151, https://doi.org/10.1080/14693062.2020.1808439

Zimmerman, J . K. H., Vondracek, B. and Westra, J. V. (2003) Agricultural land use effects on sediment loading and Fish assemblages in two (USA) in two Minnesota Watersheds. *Environmental Management*, 32(1):93-105 https://doi.org/10.1007/s00267-003-2589-3

World Bank (2017) Implementing nature-based flood protection: Principles and Implementation guidance., Washington D.C.. World Bank.