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FLOOD AS THE MAJOR EFFECT OF INDISCRIMINATE WASTE DISPOSAL: A CASE STUDY OF TUDUN ILU NEIGHBOURHOOD KADUNA-NIGERIA

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ABSTRACT

This research investigates the effect of indiscriminate waste disposal along water channels in the Tudun Ilu neighbourhood of Kaduna Nigeria. The major problem manifest in this area is flooding with erosion, because of the problem of improper waste disposal. The major cause of flooding in the study area is waste disposal techniques that are influenced by waste disposal methods on open space along streams, as a result of urban growth, population increase, and business activities that influence the adverse effect of environmental problems. Data for this study is sourced from personal observation, interviews, questionnaires, and newspaper reports. A total of hundred questionnaires systematically distributed in Tudun Ilu areas, were sampled and analyzed, presented in the table for this study. Thirty samples were randomly collected from the selected sampled settlement close to the stream in order to identify and analyzed the effect of flooding those areas. Simple percentages were employed for data analysis while tables and figures are used to present the findings of the study. The physical observation was made on wastes that are being flushed into streams and thereby affecting the odor, taste, and coloration of water quality. Flooding accompanied by erosion is identified in this area and is majorly caused by indiscriminate waste disposal that blocks water drainages. Finally, the study recommends that adequate attention must be paid to the problem of drainage blockage in order to avoid flooding and provision of a waste management strategy that will ensure a tidy environment free from pollution of water with an effective refuse collection and disposal system within the study area, which will go a long way in solving physical problems in similar communities.

Keywords: Flood, erosion, coloration of water, indiscriminate waste disposal, Tudun Ilu

INTRODUCTION

Flood, according to the National Geographical Society (2013) happens when water overflows or soaks land that is normally dry. It can be described as the overflowing of high amounts of rainfall water on part of the earth's surface that is usually dry. Many parts of Nigeria are endangered by flooding due to inadequate and indiscriminate waste disposal at drainage systems. Stream water along Tudun Ilu is majorly used as the source of water for irrigation farming activities and domestic purposes like washing cloth, cars, etc. The stream is connected to river Kaduna, which provides both defense and transportation means for human beings. When the stream serves as a refuse dumping place the volume of water that remains stagnant starts to smell due to the disposal of indecent elements, it then starts to pose a threat to residents around its course. This method of disposal is harmful to human health for example high rate of death recorded in China town as a result of outdoor pollution and lack of effective and proper waste management death cases recorded in Zimbabwean cities are just but a few cases in most developing countries (Citiserve, 2004). The deadly flood event witnessed in Accra Ghana resulted in an act of negligence and manipulation of water channels with improper poor sanitation and management. Waste disposal becomes a huge task in most developing countries, as poverty, rapid population growth, and high rate of urbanization, combined with poor government funding, prevent efficient management of waste (Augustine 2021)

Waste could be a setback measure of prosperity; it can also be a major problem for man especially where it is not well managed. Unregulated growth of urban areas and inadequate infrastructural facilities for the collection, transporting treatment, and disposal of waste have all contributed to the increase in pollution. The heterogeneous mixture of plastics, cloths, metals, and organic solutions which are inevitable products of production and consumption are on the increase as a result of urbanization that give room for indiscriminate discharge of solid

and sewage waste into river channels thereby causing serious flooding which is a treat to life in general. (Abiodun 2014).

The present situation in the Tudun Ilu neighborhood in Kaduna South Local Government Area, Kaduna State is a problem that is applicable in several parts of Nigeria, a flood occurs in this area during raining season because of indiscriminate waste disposal, which causes erosion in part of public school. Flood occurs when there is an inundation of any area which is not normally covered with water, through a temporary rise in the level of a river, lake, or sea, and when excess precipitation exceeds natural infiltration, evaporation, and possible transmission (Ward,1978; Ayoade,1988; Akosile 2008; Akani 2011; Ololade, 2011). This study investigates the problem with a view to providing a sustainable solution to the phenomenon in this fast-growing neighborhood. Hence, the need for an adequate and efficient waste disposal system in the study area cannot be over-emphasized. An adequate and efficient waste disposal system is required for good health and a neat environment.

These studies were limited to waste management and the correlation between the quality of the environment and the health status of communities. The channel at which waste is disposed of or flushed into the drainages and stream in Tudun Ilu courses a major environmental problem, being located close to the major commercial center of the State. The bulk of waste generated in the area dumped into the stream, has led to a number of waste accumulation along the stream courses and drainages resulting in water pollution, drainage blockage, infrastructural degradation, land pollution, flooding, erosion, as well as the spread of diseases like cholera, diarrhea, typhoid fever which are water-borne.

Illiteracy and unconcern attitudes, from members of the public and official bodies lead to inefficiency of effective waste management. This study therefore designed to holistically investigate the effects of waste disposal along the stream channels in view to provide a sustainable solution to the defaced aesthetic configuration of the environment and drainage blockage in the study area. Generally, the study identifies the

types of waste deposited along river courses, examines the effect of indiscriminate solid waste deposited on the river courses and underground water, and determines the impact on aesthetic value and human health and sustainable solution to the problem of improper disposal of wastes.

STUDY AREA

Tudun Ilu is a residential area located in Kaduna State, Kaduna South local government area and situated within the latitudes of 10.51267˚ or 10˚ 30’ 46’’ north and longitudes 7.42152˚ or 7˚ 25’ 18’’ with an altitude of about 580 meters above sea level. The study area is bounded by a railway from the east, to the south by the burial ground and river Kaduna, to the west by Tudun Nupawa, and to the north by Sheak Abubakar Mahmud Gumi Central Market.

This area observes the dry season between October and March while the wet season is between April and September. The terrain is fairly flat.

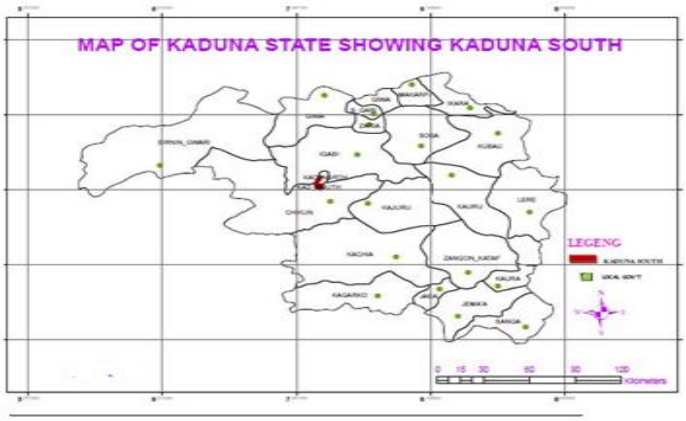

Plate 2: Map of the state showing the study area

MATERIALS AND METHODS

Data for this study is sourced from personal observation, interviews, questionnaires, and newspaper reports. A total of hundred questionnaires systematically distributed in Tudun Ilu areas, were sampled and analyzed, presented in the table for this study. Thirty samples were randomly collected from the selected sampled settlement close to the stream to identify and analyze the effect of flooding those areas. Simple percentages were employed for data analysis while tables, and figures are used to present the findings of the study. The physical observation was made to observe the residents' condition and the magnitude of loss caused by a flood. Pictures of the waste dumps at drainages, roadsides, and buildings were taken. Interviews were conducted among the residents during the visitation period, and it was done on focal persons who, according to them, have been residing in the study area long before the flooding began.

RESULTS AND DISCUSSION

Two categories of roads make up the circulation network of the area: the collector and the access roads. Their combined length is 1.5 km. Road width varies between 7m for access roads to 12m for collector streets. Two of the access streets (Ibrahim Arab and Markaz roads) are in poor condition, with the effect of indiscriminate waste disposal. Information collected from the questionnaire was examined to check completeness, accuracy, and consistency of responses. The data were analyzed for the cause of flooding using descriptive analysis. The respondent describes the main factor of flooding to waste disposal at drainage and building on waterways. Waste dumps constitute different types of particles, which after a period of time when decomposed will become detrimental to human health, physical observation was made to ascertain the different particles, that range from plastic, paper, nylon, metals, ceramics, and non-combustible material. Categories of plastic waste include plates, pet bottles, and buckets. Papers waste include Cardboard, newspaper, and magazine. Metals waste comprises

Cans, iron metals, and aluminum material. Nylon Polythene waste components include Ceramics Glass, tiles, and jars. Wood Wooden material and Non-combustible material Rubber.

`	Name	Length(m)	Width(m)	flood condition	Remark
A	Collector road				
1.	Ibrahim Taiwo road	519	12	Good	Tarred but poor Drainage, flood during Raining
2.	New Bida road	101	12	Fair	Tarred but poor Drainage
B	Access road				
1	Markaz road	122	8	Poor	Untarred surface and no drainage, building on Waterway
2.	Ibrahim Arab road A	378	7	Poor	poor drainage, water flow on the surface
3.	Ibrahim Arab road B	88	8	Fair	Untarred surface and no drainage no drainage

Table 1: Existing road in Tudun Ilu flood challenge.

HOUSING CONDITION

S/N	Type	H.H.H.	%
1.	Flood Defect	7	22.58
2.	Minor defect	24	77.42
	Total	31	100

Table 2: Houses with Flood Defects

Figure 2: Percentage of House flood defect with Water
Source: Researcher's field survey 2023

The survey indicated 77.42% are with minor defects and 22.58% are houses with major a defect that is not habitable for humans. This means that improvement can be carried out for a short period of time because the owners may want to improve the value of their property and the living conditions of the people.

MAJOR CAUSES OF FLOODING IN TUDUN ILU

Tudun Ilu just like any other part of Kaduna is facing similar problems that are causing flooding. The major causes of flooding in Nigerian urban areas include long hours of rainfall, type of land use pattern, dumping of refuse into water channels, lack of and poor drainage networks, topography, nature of urban land surface and building types, and stream basin parameters (Ayoade, 1988; Akintola, 1978; Babatolu, 1997; Ologe, 2002; Oriola, 2000; Ali, 2005; Ologunorisa and Tersoo, 2006).

Figure 3: Building on the water channel at the road leading to Ibrahim Taiwo Road

Research Interviews obtained indicated that the cause of flooding in Tudun Ilu is heavy rainfall, which is one of the causes of flooding in the study area. Rainfall intensity, duration, and amount are generally believed to be the principal factors in most flood events in the tropics which are partly or wholly climatological in nature (Ayoade, 1988). Other factors only aided the incidence of flooding in urban areas of Nigeria. This has been confirmed by several studies (Oriola, 2000; 2004; Ologunorisa, 2004; Daily Trust, 2007; This Day, 2008, Adedeji and Kuyoro, 2011; Ayado, 2011).

Figure 2: Waste disposal at drainage road leading to Ibrahim Arab Road

Floods are the most devastating natural disasters in the world, claiming more lives and causing damage to properties than any other natural phenomenon. (Etuonovbe 2011)

Lack of drainage network in the disposal of flood waters is believed to be a major factor substantially aiding flooding in the study areas. The respondents representing 87.3% of those sampled agreed that the lack of a drainage network is a chief factor that facilitated events of flooding in Kaduna Metropolis. Closely related is the factor of the poor drainage network, which is believed by 75% of the respondents to be inhibiting the disposal of flood waters. Based on the respondent opinion, factors identified to have influenced flood events in Kaduna Metropolis in order of magnitude are as follows: rainfall intensity, duration and amount, lack of and poor drainage networks, dumping of wastes/refuse on drainage and water channels, topographic characteristics, overflowing of river banks, low infiltration and climate change.

Figure 1: Area affected by flood in public school along Markaz Road

Table 3: Causes of Flooding in Tudun Ilu (n=95)

Major causes of flood	Strongly Agree	Agree on	Neutral	Disagree	Strongly Disagree
Heavy rainfall	37 (38.53%)	23(22.75%)	20(19.67%)	11 (11.05%)	9(8.00%)
Topography	16(15.85%)	21(20.47%)	11 (10.64%)	36(36.36%)	16(16.68%)
Infiltration	46(46.86%)	33(34.35%)	8(7.43%)	6(4.72%)	7 (6.64%)
Lack of drainage network	37(38.36%)	27(27.93%)	10(10.23%)	11(11.18%)	12(12.30%)
Poor drainage network	33(33.34%)	28(28.66%)	15(14.57%)	16(15.96%)	8(7.47%)
Building on the water	34(37.14%)	27(29.80%)	11(13.09%)	17(18.80%)	12(13.17%)

channels					
Dumping of waste on channels	38(39.36%)	25(24.85%)	22(22.12%)	9(8.05)	6(5.62)
Climate change	25(25.68%)	30 (30.23%)	17(15,33%)	21(21.78%)	7(6.98%)

Source: Fieldwork, 2023.

Human Response to Flooding in Tudun Ilu, responds to flood hazards through adjustment, flood abatement, and flood protection measures. Adjustment covers any action to minimize or ameliorate flood hazards; flood abatement relates to land use modification within a river basin to reduce the risk of flooding, and flood protection has to do with physical construction such as embankment, dykes, levees, river channelization, flood diversion channels and storage of flood waters (Ward, 1978). In this study, respondent was asked to 19 Flood Menace in Kaduna Metropolis: Impacts, Remedial and Management Strategies suggest appropriate measures to reduce the risks of flooding in Kaduna Metropolis. This result is presented in Table 4. For relocation from floodable areas to avoid flood hazards, a total of 52.2% of the respondents disagreed while 35.9% accepted. River re-channelization as a way of checkmating the risks of the flood was upheld by 68.4% of the respondents. However, 15.9% of the respondents, who do not experience river flooding, objected to the option.

RECOMMENDATION

The following non-structural measures could be adopted to curb the menace of flood in Tudun Ilu and Kaduna in general are:

1. There is a need for the engagement of both private and government, to be proactive by setting up a standing task force that will tackle the issue of flood once the rainy season is approaching. The government should plan ahead of the population so as to avert the occurrences of unplanned houses and cities. Town planning laws should be properly enforced and strictly adhered to as this will go a long way toward curbing the menace of floods.

2. Ensure that Management Strategies construct a flood-frequency curve based on historical records and an examination of vegetation to determine how often on average a flood of a certain size occurs in a particular area. Although this approach does not tell exactly when floods will occur, it gives an insight into how often they might occur based on past history. From the data obtained, a plan can be developed and applied. (Aliyu 2015).

3. Prohibit certain types of buildings or activities in flood risk areas, especially at water channels. Building constructed close to the water channel should be elevated and construct a floodway that allows floods to flow through the community with minimal or no damage.

4. The community should organize inspections and monitor drainage systems regularly to take note of any failure with a view to effecting repairs. Also, sedimentation and littering of the drainage systems should be guided against while vegetation like trees whose rooting system tends to or is likely to distort, break or undermine the drainage system should be removed.

5. Provision should be made to properly dispose of refuse/waste and not into drainage channels as improperly disposed of refuse/waste which comprises discarded plastic, foot-wears, clothes, etc. equally block the drains, especially at their narrow ends or points. Solid waste can be disposed of by use of incinerators, injection holes, and landfills. Landfills are the commonest means of solid waste disposal. Before any site can be investigated for its suitability or otherwise, for a landfill, it has to satisfy some criteria: the site must be extensive with flat topography, and it must be remote from major highways, rivers, and habitable areas.

Integrated surface geophysical, hydrogeological, and geotechnical investigations can help in generating subsurface models. The model will then be compared with the standard model for a sanitary landfill. Important features of a standard landfill are an impervious seal at its base and an appreciable vertical distance from the water table. Compaction at an appropriate level can reduce the permeability of the base while the groundwater level can be lowered by the use of state–of–the–art technique. If the proposed base of a landfill is not suitable,

suitable clayey soil has to be imported. Many lateritic soils have been found to possess the geotechnical and hydraulic characteristics of a good landfill seal. The government can play a vital role, by sensitizing at all levels on the reality of climate change and on possible risk reduction strategies is crucial in preventing flood menace in Tudun Ilu and other parts of Kaduna State that are having similar flood problems. (Gabriel 2017)

CONCLUSION

Waste dumped in water channels stops the free flow of water causing an unhygienic odor, which often results in flooding. A huge volume of waste is generated in most cities and towns in Nigeria as a result of rapid population growth and increased industrialization. (The Guardian 2023).

Cholera and Typhoid are the ones that kill many people in Nigeria, because, unknown to the public the pollution of groundwater, that we use for domestic and drinking. Our studies over the years have confirmed that water in wells located on the downslope section of spaces between carriageways and even landfill sites is being negatively impacted. Chemical analyses of water samples from hand-dug wells in the vicinity of illegal waste dumps and landfill sites have confirmed that the quality of groundwater improves with distance from waste sources and depths of wells. (Gabriel 2017)

Therefore, it is necessary to ensure our environment is clean and tidy, free from waste that hampers the free flow of water, and proper waste disposal, away from river channels. The problem of indiscriminate waste disposal often results in flooding of flood plains.

REFERENCE

1. Adelekan, I O. (2009). Vulnerability of Poor Urban Coastal Communities to Climate Change in Lagos, Nigeria. Fifth Urban Research Symposium 2009.

2. Akanni, O. and Bilesanmi, L. (2011). Flood: Lagos residents forced to relocate ... Drowning teenager rescued" in Vanguard: Towards a Better Life for the People. Lagos: Vanguard Media Limited. (Friday, July 10), p. 20.

3. Aliyu H. I and Suleiman Zubair A. (2015) Flood Menace in Kaduna Metropolis: Impacts, Remedial and Management Strategies. Science World Journal Vol 11 (No 2) 2016 www.scienceworldjournal.org ISSN 1597-6343

4. Bello Y. O. (1975). A Short-term Strategy For Controlling Physical Growth in Samaru. Unpublished M.Sc. Thesis, Urban and Regional Planning Department, Ahmadu Bello University, Zaria.

5. Gabriel Oladapo Adeyemi (2017). A case for safe disposal of solid waste in Nigeria. Guardian.ng VC 9 28 September 2017

6. Mokuolu, O.A, Odunaike A. K., Iji, J.O. Aremu, A.S. (2022) Assessing the Effects of Solid Wastes on Urban Flooding: A case study of Isale KokoState, Nigeria LAUTECH Journal of Civil and Environmental Studies Volume 9.

7. Oyebande, L. (1990). Aspects of Urban Hydrology and the Challenges for African Urban Environment. African Urban Quarterly, Vol. 5 No. 1/2, 39-63

8. Ugwu C.O, Ozoegwu C.G, Ozor P.A (2020) Solid waste quantification and characterization in the University of Nigeria, Nsukka campus, and recommendations for sustainable management. Heliyon. 23;6(6).

9. World Bank Group. (2017). Kitakyushu Model Subsector: Interplay between Solid Waste and Urban Flood Risk. World Bank.

10. Abbas, K. (2020) Rising incidence of urban floods: understanding the causes for flood risk reduction in Kumasi, Ghana. GeoJournal, 1-18.

11. Ayoade, J. O. and Akintola, F. (1980). Public perception of flood hazards in two Nigerian cities, Environmental International, Vol.4, 277-280.

12. Ali, P.I.O. (2005). Flood damage assessment in Makurdi town, Unpublished M.Sc Thesis, Department of Geography, Benue State University, Makurdi, Nigeria.

13. Akintola, F. (1978). The hydrological consequences of urbanization: A case study of Ibadan city In Sada, P. O. and Oguntoyinbo, J. S. (eds) Urbanisation processes, and problems in Nigeria, 151-160, Ibadan University Press, Nigeria.

14. Akintola, F. (1982). Flooding problems at Ibadan Western Nigeria, Nigeria Geographical Journal, Vo.9, 101-112.

15. Oriola, E. O. (2000). 'Flooding and Flood Management.' in H. I. Jimoh and I. P. Ifabiyi (Eds.) Contemporary Issues in Environmental Studies. Ilorin: Haytee Press & Publishing Coy. pp 100 - 109.

16. Ologe, K. O. (2002). "Nigeria – Relief and Hydrology." Atlas of Nigeria les Edition. J. A. Paris – France. pp57 - 59.

17. Ayoade, J.O. (1988). Tropical Hydrology and Water Resources MacMilan Publishers, Ibadan.

18. Daily Trust Newspaper (2007). September 2007: Kaduna metropolis ravaged by flood.

19. Ayuba KA, Manaf LA, Sabrina AH, Azmin SWN (2013). Current status of municipal solid practices of waste management in federal capital territory Abuja. Res. J Environ. Manag. Earth Sci. 5: 295–304

20. Babatolu, J.S. (1997).The June 24th, 1995 Flood in Ondo Antecedent and Incident, Ife Research Publications in Geography, Vol.6, 125-136.

21. Ologunorisa, E. T. (2004). An assessment of flood vulnerability zones in the Niger Delta, Nigeria, International Journal of Environmental Studies, Vol.61,31-38.

22. Ologunorisa, E.T. and Tersoo,T (2006). The changing rainfall pattern and its implication for flood frequency in Makurdi, Northern Nigeria, Journal of Applied Science and Environmental Management, Vol.10(3) 97-102.