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Drainage Problems in a Tropical Environment: Perspectives on Urban Quality Management

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ABSTRACT This research effort is an assessment of drainage problems in the tropical environment of Ilorin, Nigeria. In order to achieve the philosophy of the work, the following data have been sourced from direct fieldwork. Such data include drainage dimensions, types of wastes in drainage channels, problems of wastes and techniques for waste management. These data have been analyzed through the application of descriptive statistics and cross tabulations as a basic method of data analysis. The results of the finding include: (a) the dimensions of drainage channels are adequate to permit free flow of water bodies given a good culture of drainage system maintenance, (b) various types of waste materials but in different proportions have been found to be blocking the drainage channels, (c) the problems of drainage channels ranges from the occurrence of street flooding to environmental deterioration and the splashing of water on other road users; and (d) an obvious method for managing drainage channels is the adoption of environmental education with emphasis on the technique for drainage channel management.

INTRODUCTION

Rainfall factor is the most fundamental in the emergence of overland flow (Strahler and Strahler, 1977). This climatic factor initially results into the emergence or the development of parallel rills. Certainly, for one reason or the other, some of the parallel rills assume dominance over others and a sort of micro piracy develops. This consequently leads to the emergence of a developed overland flow. The overland flows have the potential to occupy either natural channels or empty into artificial drainage water channels (Jimoh, 1997a).

The waters of the natural channels usually empty into artificial channels. In essence, all the materials constituting nuisance as the loads of the natural drainage systems empty into the artificial drainage systems. The performance of this function depends essentially on both the competence and capability of the overland flow (Jimoh, 1997b, 2002).

The loads emptied into the waterways may result from source and moved by water through natural water channel and emptied into the artificial water channels. Also, this incidence may equally result from the dumping of wastes in waterways (Cooke and Doornkamp, 1974). Thus, the poor method of waste disposal has the effect of blocking drainage systems and thus causing a number of problems to the pedestrians, environmental quality and residential buildings etc.

Certainly, a number of factors explaining the incidence of blocked water channels include the following: First, at construction sites especially along highways, construction materials are often left for too long before been used. Thus, rainfall incidence easily wash such construction materials into artificial waterways and thus blocking them (Oyegun, 1987).

Secondly, poor attitudes to refuse management. Usually, different categories of wastes arising from household activities are often deposited at inconvenient places. In most cases, such deposits completely block water ways (Ahmed, 2000; Olawepo, 2000). Thirdly, patching tarred roads that have numerous potholes with earth materials; but, traffic pounding easily dislodges the patching materials (sand, or red earth materials) and washed into water channels (Jimoh, 1997). Fourthly, there are roads without drainage networks, and in such circumstance, surface run-off makes effort to create its own channel, thus leading to complete destruction of the road networks.

Generally, the overall problems of blocked water channels are one of deterioration in environmental quality, breeding points for mosquitoes among others. Efforts at properly understanding and appreciating the relevance of water ways are crucial to understanding the management techniques required to solve the problems. This indeed, constitute the focus of investigation in this research work.

Aims and Objectives of the Study

The prime focus of this work is to gain deeper understanding of the problems of drainage channels in an urban environmental setting. To achieve this central tenet demands that a thorough appreciation of the study of the:

(a) nature of drainage channels,
(b) problems of the drainage channels,
(c) compositions of materials blocking the drainage channels; and
(d) techniques for managing the blocked drainage channels.

THE STUDY AREA

This research effort is based largely on Ilorin City, Nigeria which covers the four urbanized drainage basin of Okun, Aluko, Alalubosa and Agba (Fig.1). Ilorin lies on latitude $8^{0}3^{0W}$ and longitude $4^{0}35'$E. The climate is humid and characterized by both dry and wet seasons and the annual mean total rainfall is about 1150mm and it exhibits the double maximal pattern (Jimoh, 1997). Also, the mean monthly temperatures range from 25^{0}C to 28.9^{0}c reaching 29^{0}C in the month of March.

Various types of human activities thrive in the study area. Such activities include farming, transportation and a host of other professionals. These activities call for serious ability to move from one place to the other so that the activity will thrive well. In this regard, a good road network system should be in place. However, in the recent time, majority of these road networks systems are being confronted with obvious problem of drainage channel blocking whose consequences are obvious and hazardous on both man and the environment. Thus, studying this environmental based problem becomes a crucial issue in the hope of alleviating the status of human health and environmental quality.

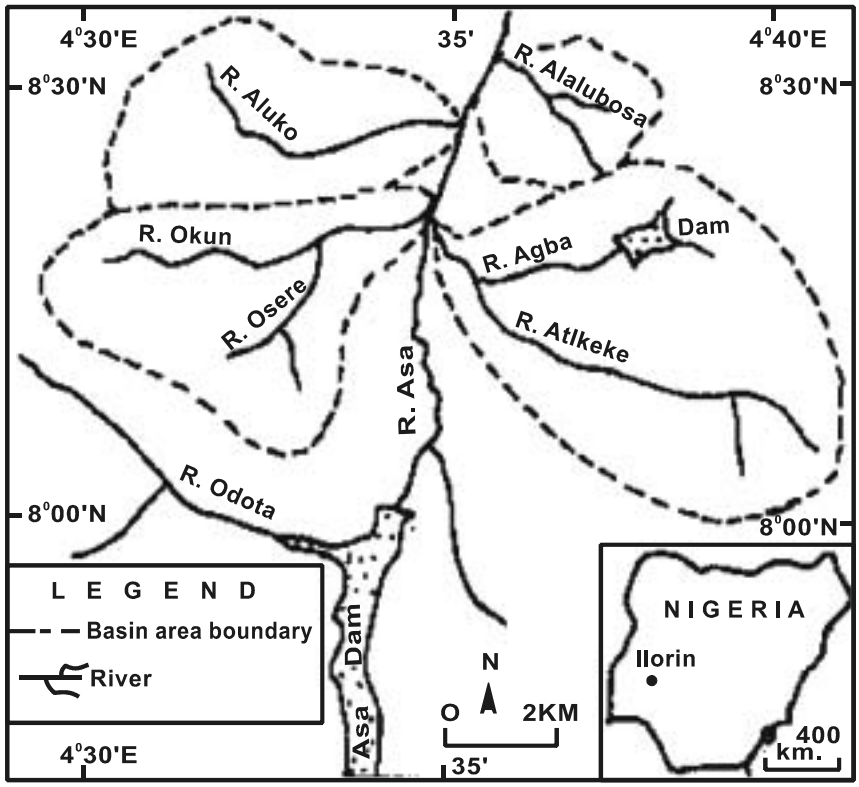

Fig. 1. Ilorin, showing the four drainage basins as the study area
Source: Oyegun (1986)

MATERIALS AND METHODS

This research work depended largely on the utilization of two categories of data.

First, the estimation of the width, depth and mean length of each water channel in the study area with measuring tape at about twenty different points and then the mean values recorded accordingly. The procedure also involves dipping a two metre metal rod into the drainage channel and from which the measuring tape is used to estimate the depth of the immersed metal rod into the waste materials as representing the depth of the drainage channels. The method adopted for estimating the width of the drainage channels involve measuring with measuring tapes across the surface of the drainage channels, while the lengths of the drainage channels were estimated with measuring tapes too. Also materials blocking or found inside each sampled drainage channel have been closely inspected to identify their type and name too. Also, such samples were taken for further separation into types and expressed in percentage as well (Table 2). Secondly, the administration of questionnaire on the residents, pedestrians along or around the sampled drainage channels so as to solicit for information on the problems of blocked drainage channels and the appropriate techniques for managing the environmental menace.

Table 1: The dimensions of drainage channels in Ilorin city

S. No.	*Dimensions of the drainage channels*		
	Mean depth (cm)	*Mean width (cm)*	*Mean length (m)*
1.	49.1	72.6	57.4
2.	58.6	82.3	47.9
3.	61.2	57.9	65.3
4.	59.5	66.9	128.9
5.	48.7	55.4	95.9
6.	55.4	66.8	155.0
7.	49.8	79.6	115.9
8.	65.9	65.1	78.9
9.	50.7	82.7	104.0
10.	61.7	80.4	117.4
11.	58.9	48.7	56.0
12.	53.5	65.4	57.3
13.	61.7	70.3	71.5
14.	69.2	78.7	124.4
15.	50.3	64.2	94.3
16.	60.7	65.7	16.9
17.	58.0	62.0	62.4
18.	57.9	57.2	35.0
19.	47.3	69.7	50.5
20.	63.1	60.8	80.6
21.	56.8	49.5	49.5
22.	58.9	83.8	65.2
23.	66.9	60.9	64.3
24.	62.6	60.0	49.0
25.	58.0	52.5	52.4
26.	58.4	65.1	63.2
27.	82.8	74.1	60.3
28.	64.4	64.2	96.1
29.	58.1	66.8	114.5
30.	52.6	71.6	56.5
Mean	58.7	66.7	77.8
STD	7.2	9.6	29.9

Source: The Author.

RESULTS AND DISCUSSION

(a) Nature of Drainage Channels: The geometry of the drainage channel in the study area has been observed to be of various dimensions (Table 1). For example, the depth of drainage channels ranges between 47.3cm to 69.2cm. Indeed, the mean depth of the drainage

Table 2: Percentage composition of waste deposit materials in drainage channels

S. No.	*Composition of wastes (%)*			
	Leaves and nylons	*Sands and stones*	*Wasted papers and feaces*	*Cans and plastic containers*
1	12.8	23.1	11.1	53.0
2	32.5	22.2	28.7	16.6
3	25.9	19.4	19.6	35.1
4	19.1	28.2	28.6	24.1
5	16.8	12.9	37.9	32.4
6	14.4	35.2	21.8	28.6
7	21.1	29.7	19.6	29.6
8	17.2	22.5	24.8	35.5
9	22.8	16.9	23.7	36.6
10	15.7	27.9	18.3	38.1
11	18.2	31.8	19.3	30.7
12	21.6	32.8	23.6	22.0
13	16.9	36.2	17.6	29.3
14	15.8	31.5	18.3	34.4
15	20.6	37.4	12.6	29.4
16	18.5	39.8	20.2	31.5
17	17.3	31.7	18.4	32.6
18	21.4	37.3	14.3	27.0
19	18.1	30.7	22.3	28.9
20	16.2	29.2	14.4	40.2
21	19.3	34.1	19.3	27.3
22	20.6	29.7	12.2	28.5
23	12.9	31.2	23.5	29.4
24	21.3	36.4	14.7	27.6
25	16.2	28.6	21.9	33.3
26	19.4	31.8	24.6	24.2
27	21.5	38.2	21.5	18.8
28	17.1	31.8	18.2	32.9
29	23.6	21.5	16.4	38.5
30	14.5	34.7	25.3	22.5

Source: The Author.

channels is 58.7cm with a standard deviation of 7.2. Also, the width of the drainage channels range from 48.7cm to 82.3cm. The mean width is calculated to be 88.7cm and a standard deviation of 9.6. Finally, the length of the water channels ranges from 35m to 128.9m. And as a matter of fact, the mean drainage channel length is 77.8m and a standard deviation 29.9.

(b) Waste Deposits in Ilorin: As is expected with the dimension of the drainage channels in Ilorin City, wastes should flow freely through them without water spillage and the attendant problems. However, most of the drainage channels have been blocked following the anthropogenic activities in the city of Ilorin. In the drainage channels, the following categories of wastes exist: leaves, faeces, cans and plastic containers. These waste deposits are in various proportions and indeed, the concentration in each drainage channel varies (Table 2).

For ease of discussion, the waste deposits have been clarified on the basis of types. Thus, four main categories of wastes exist. In the category of leaves and nylon wastes, the degree of the concentration ranges from 12.8% to 32.5%, sands and stones (12.9% to 37.4%), waste papers and feaces (11.1% to 37.9%) and cans and containers (16.6% to 53.0%). In essence, the bulk of the deposits in drainage channels are of cans and plastic containers in nature. Waste papers and feaces, and sands and stones follow this respectively.

Generally, the concentrations of these waste deposits have created a number of environmental related problems in Ilorin. This issue indeed constitutes the thrust discussed in the next section of this work.

(c) Problems of Drainage Channels: Many problems of diverse dimensions have been observed in association with the incidence of drainage problems in Ilorin City, Nigeria and these are as follows. First, about 31.5% of the respondents are of the view that one of the effects of drainage channel problem is the incidence of temporary street flooding. Secondly, the development of environmental deterioration consequent upon waste materials that spilled away from the drainage channels onto the land surfaces. The problem accounted for about 43.0% of the respondents.

Finally, is the problem of water being splashed on pedestrians or road users due to either drainage blockage or non-existence of drainage channel. Indeed, this problem attracted about 25.5 percent of the respondents.

(d) Managing the Problems of Drainage Systems: In spite of the seemingly intractable problems of drainage channels and their effects in the urban area of Ilorin, Nigeria, a number of measures have been suggested for minimizing the incidents of the problems of drainage systems as follows:

a. Drainage systems should be cleared with shovels on regular basis (20.5%).
b. The need to avoid dropping waste materials into drainage channels (25.5%).
c. The need to accentuate efforts on the construction of concrete drainage systems, which should be made very functional by ensuring, that waste are not dumped into them (15.0%).
d. The need for environmental education with an emphasis on the techniques for interacting with drainage systems (39.0%). As a matter of fact, Jimoh and Ajibade, (1995) really highlighted the adoption of environmental education as a panacea to solving an environmental problem of this nature.

These measures will certainly resolve the problems inherent in the blockage of drainage systems occasioned by man and his activities in Ilorin. However, the most effective and efficient control method being solutions d,,b,a, and c respectively. But certainly, these measures are likely to double in performance when combined. Therefore, this current research effort suggests that the aforementioned measures for addressing the problems of drainage systems should be combined for a good and speedy result.

Generally, for a very long period of time, Ilorin has been with serious drainage problems. However, once in a while, it is often observed that blocked water drainage systems are being cleared at irregular intervals. Indeed, such effort comes up when reports of drainage problems frequently comes up in the offices of the authorities concerned. But, it is hoped that this work will stimulate a renewed interest in improving environmental standard with a view to improving the well-being of man and his environmental setting.

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