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Olabisi Onabanjo University
College of Engineering & Environmental Studies
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Email: jee_oou@yahoo.com

Bolanle Wahab and Saheed Folarin
Department of Urban and Regional Planning,
Faculty of The Social Science
University of Ibadan, Ibadan.
&
Federal Character Commission
Oyo State Office, Ibadan, Nigeria

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Dear Sir,

ACCEPTANCE LETTER

I am pleased to inform you that your paper titled ***"Spatial Pattern of Disasters in Public Schools In Ibadan, Nigeria"*** has been reviewed and found publishable in the forth-coming ***Journal of Engineering & Environmental Studies, Vol. 5, No.2. 2014.***

Thanks for contributing to the sustenance of this journal.

Congratulations.

Yours sincerely,

Dr. Odufuwa, B. O *(Editorial Secretary)*

For: Editor-in-Chief.

The Spatial Pattern of Disasters in Public Schools in Ibadan, Nigeria

By:

Bolanle Wahab[1] and Saheed Folarin[2]

[1]Department of Urban and Regional Planning, University of Ibadan, Ibadan, Nigeria.

[2] Federal Character Commission, Oyo State Office, Ibadan, Nigeria.

[1]**Corresponding Author:** Bolanle Wahab (bolanle_wahab@yahoo.com)

Abstract

This research investigated the spatial pattern of public schools affected by disasters in Ibadan from 2009 to 2014. It also examined the occurrences and effects of disasters on educational facilities, the disaster preparedness facilities and users' knowledge of the facilities. Using the stratified random sampling technique, three urban out of five and two rural out of six local government areas (LGAs) in Ibadan were randomly selected for the study. All the 50 public schools affected by the 52 disaster events from 2009 to 2014 in the three urban and two rural LGAs, representing 87.7 per cent of the total number of public schools affected by disaster in Ibadan, were selected and geo-referenced. Copies of a questionnaire was administered to heads of schools and three teachers were randomly selected in each of the 50 schools, giving a total of 200 (19.4 per cent) of the total population. Staffs of Oyo State Ministry of Education, Oyo State Emergency Management Agency and Oyo State Universal Basic Education Board were interviewed. Informal interviews were also held with school prefects. Secondary data were obtained from published and unpublished sources. Descriptive and inferential statistics were used for data analysis. Between 2009 and 2014, 52 disaster events occurred and 50 public schools were affected. Sixty-eight (68) school buildings were affected and one life was lost. The public schools affected increased from six (6) in 2010 to seventeen (17) in 2011 owing to the rainfall of 26 August, 2011. About 42.0% of the schools located on steep terrain experienced gully erosion. Only 4.7% schools had fire extinguishers and 60.5% had first-aid kits. Roofs of school buildings were easily blown off by the rainstorm/windstorm. Nearest neighbour analysis revealed a random and a dispersed pattern of public schools affected by disaster in urban and rural areas, respectively. The study recommended that the Ministry of Education, in collaboration with Oyo State Emergency Management Agency and other relevant stakeholders in disaster management, should promote awareness about safe schools, develop vulnerability assessment guidelines for schools, and ensure that every school has disaster contingency plan.

Keywords: Disasters, Contingency plan, Nearest neighbour analysis, Public schools

1.0 Introduction

Disasters have remained a topical issue of concern globally in recent times. Disasters are a result of the combination of vulnerabilities that are present and insufficient capacity of measures to reduce or cope with the potential negative and catastrophic consequences (UNISDR, 2009). Disasters can result from forces of nature, such as floods, hurricanes, and earthquakes; as well as technological accidents, such as plane crashes, oil spills, and chemical discharges; or terrorism and other wilful acts of violence (Lori, 2008). Climate change, environmental degradation, population growth, increased urbanization, unsustainable development in hazard-prone areas, risky technologies and growing social and economic inequalities have all contributed to dramatic increase in disaster events (Perrow, 2006; Swiss Re, 2015).

The Intergovernmental Panel on Climate Change (IPCC) reveals that "more severe and/or frequent extreme weather events and/or hazard types are projected to increase losses and loss variability in various regions" (IPCC, 2014:19). In the first half of 2014, natural disaster losses worldwide summed up to US$42 billion for direct economic losses and US$17 billion for insured losses (Munich Re, 2014). The total economic losses generated by natural catastrophes and man-made disasters in 2014 were around USD 110 billion (Swiss Re, 2015). Homes, industries, businesses and schools are common victims of disasters the world over owing to their high level of exposure to risks.

United States Agency for International Development (USAID) notes that a school is "at risk" or "vulnerable" "when it is exposed to known hazards and is likely to be adversely affected by the impact of the hazards, if and when they occur" (USAID, 2014:1). In 2009, the Inter-Agency Network for Education in Emergencies (INEE) reported that, worldwide, approximately 1.2 billion students are enrolled in primary and secondary schools; of these figure, 875 million school children live in high seismic risk zones and hundreds of millions face regular flood, landslide, extreme wind and fire hazards (INEE, 2009). "Non-disaster resilient schools not only kill and injure children, but the damage to and/or destruction of the physical infrastructure is a great economic loss for a country; the cost of reconstruction can be a substantial burden on the economy" (INEE, 2009:3).

The earthquake in Sichuan China, on 12 May, 2008 killed 87,000 people with at least 5,335 students and more than 7,000 school buildings collapsed. Corruption and bad quality of building materials were linked to the collapse of the school buildings during the

earthquake (Consortium for Disaster Education, 2011). Disasters, which often destroy school buildings and displace students and teachers, may disrupt children's academic progress and diminish their long-term educational outcomes (Hewitt, 2007).

The United Nations Office for the Coordination of Humanitarian Affairs (UN-OCHA, 2014) estimated that 600,000 Nigerian children have difficulty accessing education due to natural and human-induced disasters. Across the twelve states affected by floods in 2012, a total of 4,199 schools (3,205 primary and 994 secondary schools) were either partially or severely damaged (UN-OCHA, 2014). The flood disaster resulted in the disruption of schooling activities and in the displacement of students to neighbouring schools. Parents who wanted to ensure continuous schooling for their children enrolled them in private schools that were not affected by the flood, leaving behind the children of low-income members of the local communities who could not afford the finances involved (UNICEF, 2013). This increased the gap between the rich and the poor children's access to education.

The Global Coalition to Protect Education from Attack's report revealed that, between 2009 and 2013, there were nearly 10,000 violent attacks on schools, pupils and teachers around the world (GCPEA, 2014). Nigeria is not left out of attacks on schools, as Boko Haram had launched recurrent and devastating attacks on schools in the north-eastern part of the country. With attacks on schools in Nigeria by Islamist sects and kidnapping on the increase, the Education in Emergency Working Group (EiEWG) reported that, in the Northeast where a state of emergency was declared, a total of eighty-eight (88) students and seven (7) teachers were reportedly killed in four attacks. In Borno State, 77 schools and 533 classrooms offering basic education were burnt, 5 teachers were killed and 9,546 desks were destroyed (UNICEF, 2013). Also, at the Federal Government College of Buni Yadi in Yobe State, 59 students were killed (Ajaja, 2014).

Salvesen, Zambito, Hamstead and Wilson (2008) observe that most public schools in North Carolina are located on or dangerously close to potential environmental threats, such as an industrial facility, underground gasoline pipeline, railroad tracks, floodplains or other hazards that threaten the health and safety of children as well as teachers, administrators, and others who work at schools. Children are most at risk for illness, injury, and death arising from the substandard structures and the proximity of their schools to hazard-prone locations.

This study, therefore, examined causes and degree of vulnerability of public schools to disasters in Ibadan, Oyo State, Nigeria and proposed strategies for a safer school. Findings of the study are aimed at assisting policy and decision-makers in promoting disaster-resilient schools capable of protecting students and teachers, and continuing education without disruption in emergency situations.

2.0 Conceptual Issue and Literature Review

The discussion in this paper is anchored to the concepts of resilience and vulnerability.

2.1 Concept of Resilience

The term "resilience" was introduced into the English language in the early 17th century from the Latin verb *resilire*, meaning to rebound or recoil (*Concise Oxford Dictionary, Tenth Edition, 2001*). There is no evidence of resilience being used in any scholarly work until Thomas Tredgold introduced the term in 1818 to describe a property of timber, and to explain why some types of wood were able to accommodate sudden and severe loads without breaking. Resilience is the ability of a system to absorb shocks, and regenerate after a disturbance (Resilience Alliance, 2007). The Intergovernmental Panel on Climate Change (IPCC) describes resilience as the "capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation" (IPCC, 2014:5).

Holling (1973), a US-Canadian ecologist, introduced the concept of resilience to ecology and environment. He conceptualises resilience for ecosystems as a measure of the ability of these systems to absorb changes and still persist. Many ecologists have argued that resilience is the key to sustainable ecosystem management and that diversity enhances resilience, stability and ecosystem functioning (Chapin *et al.*, 2000). Resilience has been used in two ways in ecology, one focusing on recovery and return time following a disturbance, the other focusing on how much a system can be disturbed and still persist without changing function (Miller *et al.*, 2010:3). However, a number of other ecologists have questioned the core assumption that ecosystems exist in an equilibrium state to which they can return after experiencing a given level of disturbance (Klein, Nicholls and

Thomalla, 2004). Their argument is that ecosystems are dynamic and evolve continuously in response to external influences taking place on a range of different scales. Also, Klein, Nicholls and Thomalla (2004) note that resilience, interpreted as facilitating and contributing to the process of recovery after a disaster, is irrelevant to those who lose their lives during a disaster.

Disaster resilience is a shared responsibility for individuals, households, businesses and communities as well as for governments (Dufty, 2012). This concept was used in Australia and the strategy identifies seven groups of actions to build community disaster resilience in the country (COAG, 2011:6):

i. leading change and coordinating effort;
ii. understanding risks;
iii. communicating with and educating people about risks;
iv. partnering those who effect change;
v. empowering individuals and communities to exercise choice and take responsibility;
vi. reducing risks in the built environment; and
vii. supporting capabilities for disaster resilience.

2.2 The Concept of Vulnerability

The term 'vulnerability' entered the disaster discourse in the 1970s (Manyena, 2006). Mechanical and systems engineers first used the expression "vulnerability" in relation to different forms of construction, such as housing, bridges and factories (Twigg, 1998, cited in Manyena, 2006). O'Keefe *et al.* (1976), cited in Manyena (2006), argue that disasters were more of a consequence of socio-economic vulnerability than natural factors.

United Nations International Strategy for Disaster Reduction (UN/ISDR, 2004:16) defines vulnerability as "the conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards". In contrast, the United Nation Development Programme (UNDP, 2004:11) defines vulnerability as "a human condition or process resulting from physical, social, economic and environmental factors, which determine the likelihood and scale of damage from the impact of a given hazard". Weichselgartner (2001) notes that the concept of "vulnerability" can be used to explore a contextual approach to the reduction of losses

due to natural hazards and to address the salient issues of sustainability and quality of life. Moreover, it enables both natural and human-induced disasters to be treated within a common theoretical framework.

Weichgartner and Bertens (2000), cited in Weichselgartner (2001), proposed a conceptual approach in vulnerability assessment which combines elements of both biophysical risk/hazard and social response within a specific geographic domain. The proposed technique was applied to an area in the Spanish municipality of Colindres, located 40 km east of Santander at the Cantabrian coast. The qualities that determine potential damage were identified as follows (Weichselgartner, 2001:89):

i. hazard (the physical process itself);
ii. exposure (all individuals and infrastructures which are exposed to hazard);
iii. prevention (all activities and measures in advance of a hazard event designed to reduce hazards and their effects and provide permanent protection from their impacts);
iv. preparedness (all precautionary activities and measures which enable rapid and effective response to hazard events), and
v. response (all activities and measures taken immediately prior to and following a hazard event to reduce impacts and to recover from and reconstruct an area affected by a hazard event).

2.3 Literature Review

2.3.1 Impact of Disasters on Schools: A Global Perspective

Studies of disaster trends and the likely results of climate change have revealed that, each year, 175 million children are likely to be affected by natural disasters alone (UNESCO, 2014). In Japan, in 2011, 733 school students/teachers died or got missing, 193 schools were destroyed, and 747 schools were significantly damaged, while 5,064 schools suffered minor damage as a result of the East Japan Earthquake and Tsunami (Shaw & Takeuchi, 2012, cited in ISDR, 2012). Table 1 presents examples of impacts of disasters on schools in seven countries from 2010 to 2014.

Table 1: Countries and Impact of Disasters on Schools

Year	Country	Type of Disaster	Disaster Impact
2010	Chile	Earthquake	Earthquake impacted 2 million people, but struck on a Saturday, outside of school hours. 80% of the 2 million students in the most affected areas resumed school one week late. School damage was estimated at $2.1 billion out of $30 billion infrastructure total (ISDR, 2012).
2010	Haiti	Earthquake	4,000 students and 700 teachers were estimated to have died in schools in the 7.0 magnitude earthquake. About 4,800 schools were damaged or destroyed (Laurente, 2010; Margesson and Taft-Morales, 2010:12; ISDR, 2012), including 1,300 schools and all three universities in Port-au-Prince. About half of the nation's 15,000 primary and 1,500 secondary schools were affected. The overall impact collapsed the school system. Two years later, 6000,000 children remained out of school (ISDR, 2012).
2011	Japan	Earthquake and Tsunami	733 school students/teachers died or missing, 193 schools were destroyed, 747 schools significantly damaged, 5,064 schools suffered minor damage. (Shaw & Takeuchi, 2012, cited in ISDR, 2012)
2011	Joplin, MO, USA	Tornado	Tornado destroyed Joplin High School on a Sunday when no one was in school. The storm hit shortly after the graduation ceremonies held nearby. 700-800 students needed trauma treatment (ISDR, 2012)
2012	Thailand	Floods	2,600 schools and 700,000 students and teachers were affected by Bangkok's floods. Damage to educational facilities estimated $224 m (Shaw, 2012, cited in ISDR, 2012)
2013	Philippines	Typhon Haiyan	More than 2,500 schools were damaged and some 1.4 million children were affected by Typhon Haiyan (Philippines Education Cluster, 2014).
2014	Solomon Islands	Flash Flood	Over 80 schools in Honiara and Guadalcanal combined were destroyed and some 52,318 school children were affected by the flash flood (UNICEF, 2014).

Sources: ISDR (2012); Laurente, (2010); Margesson and Taft-Morales (2010:12); Philippines Education Cluster, (2014); UNICEF, (2014)

Materials used in constructing school buildings influence the vulnerability of the structures. Out of about 17 thousands school buildings in Cambodia, 76% buildings were constructed from concrete or brick and the remaining 24 per cent from wood or bamboo. Wood and bamboo structures were found to be the most vulnerable to natural disasters, such as floods and storm, compared to concrete buildings (ADPC, 2008). A survey conducted by Asian Disaster Preparedness Centre (ADPC) in 2008 revealed that flood was one of the factors disrupting school study programme and thus affecting the quality of education in Cambodia, particularly in flood-prone provinces where school buildings were constructed without proper flood resilient features (ADPC, 2008).

In 2008, Actionaid conducted a research on school safety in Bangladesh and their findings revealed that, each time a disaster occurred, the majority of children were prevented from going to school and many never returned (ECHO, 2010). According to European Commission Humanitarian Aid Office (ECHO), the education sector in Bangladesh was hardest hit along with other sectors in the event of disaster. "Starting from Cyclone of 1970, 1991, 2007 and floods of 1998, schools were interrupted due to structural collapse and proximity to the hazards-prone location" (ECHO, 2010:2).

In a research carried out in Zimbabwe by Mudavanhu (2014), factors that contributed to school vulnerability to flood disasters in the study area were identified to include terrain, poor structures, geographical location, climate change, non-adherence to building standards, poverty and lack of resources. His findings also revealed that children dropped out of school as a result of flood disasters. Of the 5730 children in Chadareka ward aged 5-14 years, only 4715 (82.3%) were enrolled in school in 2012, meaning that some 1015 (17.7%) children were out of school.

Natural disasters impact the educational sector in several ways. These, according to UNESCO (2010: 33) include;

- disruption of the school calendar, as school buildings are usually used as temporary shelters;
- the return of teachers to their affected home communities;
- lack of access to schools due to disruptions in transportation systems, destroyed bridges, damage to school structures and equipment;
- psycho-social trauma leading to attention deficit problems and lack of focus in the classroom;

- children removed from school by parents because their services are needed to clean homes, replant crops, and engage in other livelihood practices, and
- homeless families relocated to temporary shelters.

2.3.2 Disasters and Its Impact on Schools: Nigeria Perspective

In 2001, fire gutted Girls' Secondary School, Gindiri, Plateau State in northern Nigeria, killing 23 and injuring 14 children. Students were trapped in the dormitory because it was locked and fortified with iron bars. Local residents managed to save some of them by opening a bathroom door. The fire was caused by overturned kerosene lantern (*The Independent,* March 2001). Also, in December 2013, School of Science, Pade in Ibadan was gutted by fire. Although the inferno did not claim lives, property worth of several millions of naira was destroyed (Lemuel, 2013). A case of poisonous gas at Ogba Junior School, Lagos State on March 6, 2014 left 13 pupils unconscious after inhaling an unidentified poisonous fume discharged from a photo laboratory located within the premises of Ogba Shopping Mall behind the school. A year earlier, 22 pupils of the same school reportedly fainted after inhaling an unidentified gaseous substance (Oseghale, 2014).

The study carried out by Amadi (2013) examined the impact of flooding on secondary school students in Ogba/Egbema/Ndoni Local Government Area of Rivers State, Nigeria. The study revealed that 93.3 per cent of the schools had their building foundation affected by the flood. "The effect was so devastating that most secondary schools in Omoku town were closed down for almost one full term" (Amadi, 2013: 15).

In Zaria urban area, Nigeria, between 2007 and 2008, 18 disaster events affected schools: 6 occurred in 2007 and 12 in 2008 (Ibrahim and Musa, 2011). In 2008, floods affected 8.3 per cent of schools, fire disaster affected 25 per cent, while a majority of the schools (66.7 per cent) were affected by windstorm. Olatunya, Oseni, Ogundele and Oyelami (2014) found that, of all the 64 primary schools in Ilesa East LGA of Osun State, Nigeria, 6.3 per cent had safety patrol team, 29.7 per cent had school fence, 1.6 per cent had fire extinguisher, while most of the schools (62.5 per cent) had no safety measures in place.

The report prepared by the Office of the Vice Chancellor, University of Ibadan (OVC-UI) on the impact of the August 2011 flood in Ibadan revealed that some building roofs were blown off, fish ponds and four poultry pens were washed away, part of perimeter

fence collapsed, animal cages were flooded at the zoo, while some underground electric cables were destroyed (OVC-UI, 2011).

3.0 The Study Area

Ibadan is located in south western Nigeria, with geographical coordinates 7° 25' North and 3° 5' East of the equator. It is the capital of Oyo State, and is reputed to be the largest indigenous city in Africa, South of the Sahara. The Oyo State's landmass is 28,451 square kilometres, representing 3.0 % of Nigeria's territorial landmass, out of which Ibadan has an estimated landmass of 3,123 square kilometres. The main city covers 463.33 square kilometers with eleven local government areas grouped together to constitute what is called the Ibadan metropolitan area of Ibadan region (Figs. 1 and 2).

The city is naturally drained by four rivers, with many tributaries: Ona River, in the North and West; Ogbere River, towards the East; Ogunpa River, flowing through the city; and Kudeti River, in the central part of the metropolis (Adegbola and Jolayemi, 2012). The city ranges in elevation from 180 metres in the valley area to 210 metres above sea (Faniran, 1994). The mean total rainfall for Ibadan is 1420.06 mm, falling in approximately 109 days. There are two peak rainfall periods: June and September. The mean maximum temperature is 26.46°, the minimum is 21.42°, and the relative humidity is 74.55%. Average temperatures are relatively high, between 24°C and 25°C (Ajayi *et al.*, 2012). The Ibadan population is estimated to be about 2,550,593, according to the 2006 estimates by the National Population Commission. Its projected population by 2010, using 3.2% growth rate is about 2,893,137 (Ajayi *et al.*, 2012)

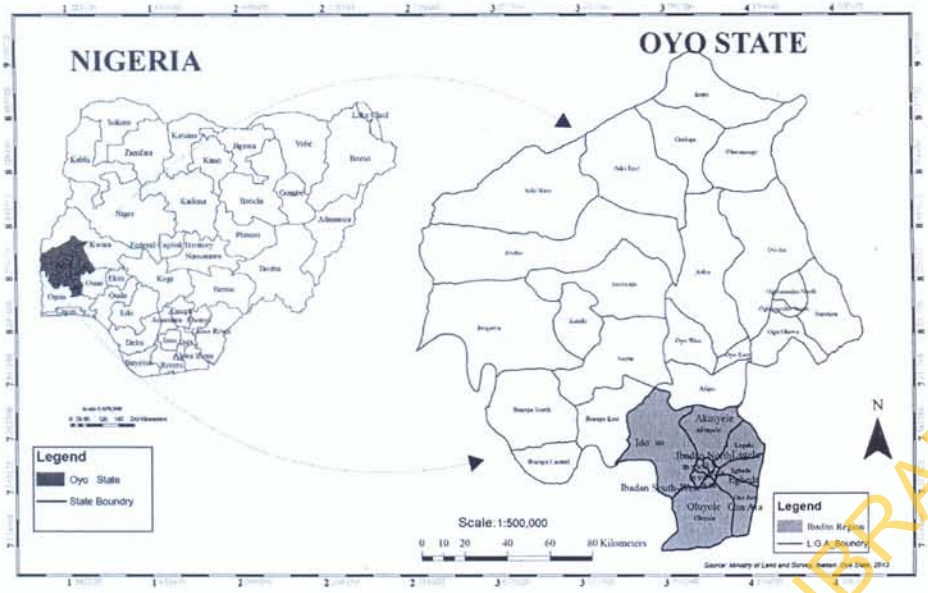


Figure 1: Oyo State in the Context of Nigeria; Ibadan in the Context of Oyo State
Source: Ministry of Lands and Survey, Ibadan, Oyo State, 2013

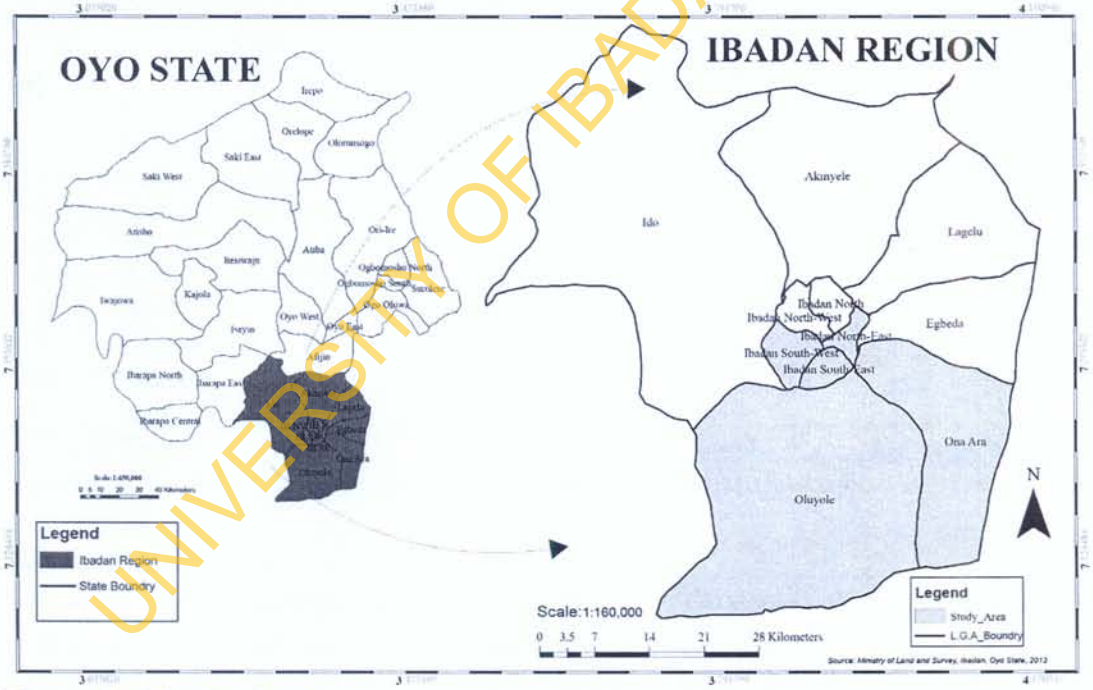


Figure 2: The Study Area.
Source: Ministry of Lands and Survey, Ibadan, Oyo State, 2013

In 2014, the Ibadan region had 913 and 281 public primary and secondary schools, respectively. The total enrolment of pupils for both primary and secondary schools was 657685 (Table 2).

Table 2: Pupils' Enrolment in Public Primary and Secondary Schools in Ibadan in 2014

S/N	LGA	Primary		Sub Total	Secondary		Sub Total	Total
		Girls	Boys		Girls	Boys		
1.	Akinyele	16,463	15,695	32,158	10,029	9,814	19,843	52,001
2.	Egbeda	16,219	15,134	31,353	10,416	9,972	20,388	51,741
3.	Ibadan North	23,767	21,713	45,480	18,939	18,160	37,099	82,579
4.	Ibadan North East	21,479	20,092	41,571	11,992	16,331	28,323	69,894
5.	Ibadan North West	20,910	17,144	38,054	5,351	4,297	9,648	47,702
6.	Ibadan South East	21,511	20,592	42,103	22,142	19,205	41,347	83,450
71.	Ibadan South West	22,667	20,471	43,138	17,149	16,348	33,497	76,635
8.	Ido	13,431	12,221	25,652	4,737	5,294	10,031	35,683
9.	Lagelu	15,293	14,488	29,781	7,781	9,034	16,815	46,596
10.	Oluyole	16,615	15,551	32,166	9,999	10,190	20,189	52,355
11.	Ona-Ara	17,779	16,546	34,325	12,904	11,820	24,724	59,049
	Total	**206,134**	**189,647**	**395,781**	**131,439**	**130,465**	**261,904**	**657,685**

Source: Oyo State Ministry of Education and Oyo SUBEB, 2014

Table 3: Number of Teachers in Public Primary and Secondary Schools in Ibadan in 2014

S/N	LGA	Primary	Secondary	Total
1.	Akinyele	1,015	426	1,441
2.	Egbeda	1,073	809	1,882
3.	Ibadan North	1,375	1,176	2,551
4.	Ibadan North East	1,324	1,054	2,378
5.	Ibadan North West	828	176	1,004
6.	Ibadan South East	1,333	949	2,282
7.	Ibadan South West	1,366	1,221	2,587
8.	Ido	628	229	857
9.	Lagelu	972	628	1,600
10.	Oluyole	779	454	1,233
11.	Ona-Ara	889	520	1,409
	Total	**11,582**	**7,642**	**19,224**

Source: Oyo State Ministry of Education and Oyo SUBEB, 2014

4.0 Methodology

The study made use of data from primary and secondary sources. The primary source of data relied on the use of questionnaire administration, checklist, in-depth interviews with key informants, and Global Positioning System (GPS) device, employed to record the coordinates of disaster-affected public schools during the field survey. Secondary data were from materials reviewed, like government official documents, journals, research articles,

textbooks, newspapers, past theses, as well as seminar and conference papers. A total of 61 disaster events which occurred between 2009 and 2014 in Ibadan affected 57 public schools, as shown in Tables 4 and 5. A breakdown of the LGAs showed that only four of the five urban and four of the six rural LGAs had 57 of their public schools affected by the 61 disaster events (Table 5). Table 5 further shows that 13 primary and 44 secondary schools were affected in the eight LGAs. Using the stratified random sampling technique, three urban out of four and two rural out of four local government areas (LGAs) with the highest number of affected schools were selected for the survey. Thus, all the 50 affected public schools in the selected three urban and two rural LGAs (see Table 6), representing 87.7% of the total number of public schools affected by disasters in Ibadan, were selected for questionnaire survey. The 50 public schools affected by disasters were geo-referenced to evaluate their spatial patterns.

Table 4: Profile of Type and Number of Disasters Reported (2009-2014)

Type of Disaster	Year						Total
	2009 N (%)	2010 N (%)	2011 N (%)	2012 N (%)	2013 N (%)	2014 N (%)	(%)
Rainstorm	9 (81.8)	4 (66.6)	16 (76.2)	11 (91.7)	6 (85.7)	4 (100.0)	50 (82.0)
Fire	-	-	1 (4.8)	-	1 (14.3)	-	2 (3.3)
Flood	-	1 (16.7)	2 (9.5)	-	-	-	3 (4.9)
Windstorm	2 (18.2)	1 (16.7)	2 (9.5)	-	-	-	5 (8.2)
School Violence	-	-	-	1 (8.3)	-	-	1 (1.6)
Total	**11 (100.0)**	**6 (100.0)**	**21 (100.0)**	**12 (100.0)**	**7 (100.0)**	**4 (100.0)**	**61 (100.0)**

Source: Compiled from OYSEMA, SUBEB, and Oyo State Ministry of Education Data, 2014

Table 5: Number of Public Schools affected by Disaster in Ibadan from 2009 to 2014

S/N	LGA	LOCALITY		NUMBER OF SCHOOLS		TOTAL NUMBER OF SCHOOLS
		RURAL	URBAN	PRIMARY	SECONDARY	
1.	Akinyele	*		-	1	1
2.	Egbeda	*		-	-	-
3.	Ibadan North		*	-	5	5
4.	Ibadan Northeast		*	1	4	5
5.	Ibadan Northwest		*	-	-	-
6.	Ibadan Southeast		*	7	16	23
7.	Ibadan Southwest		*	-	13	13
8.	Ido	*		-	1	1
9.	Lagelu	*		-	-	-
10.	Ona-Ara	*		1	3	4
11.	Oluyole	*		4	1	5
	TOTAL			**13**	**44**	**57**

Source: Compiled from OYSEMA, SUBEB, and Oyo State Ministry of Education Data, 2014

Table 6: Sampled Public Schools affected by Disaster in Selected Urban and Rural Local Government Areas of Ibadan

S/N	LGA	NUMBER OF SCHOOLS		TOTAL NUMBER OF SCHOOLS
		PRIMARY	SECONDARY	
1.	Ibadan Northeast	1	4	5
2.	Ibadan Southeast	7	16	23
3.	Ibadan Southwest	-	13	13
4.	Oluyole	1	3	4
5.	Ona-Ara	4	1	5
	TOTAL	**13**	**37**	**50**

Source: Compiled from OYSEMA, SUBEB, and Oyo State Ministry of Education Data, 2014

In each of the 50 public schools surveyed, the head teachers were purposively selected and three of the teaching staff were randomly selected for interview. In all, a total of 200 persons were sampled with the aid of a set of pre-tested structured questionnaire. In-depth interviews were held with the staffs of Oyo State Ministry of Education, Oyo State Emergency Management Agency, Oyo State Chapter of the Nigerian Red Cross, and Oyo State Universal Basic Education Board. Informal interviews were held with female and male school prefects in the selected schools.

5.0 Findings and Discussions

5.1 Socio-demographic Characteristics of Respondents

About 63.9% of the respondents were female and 36.1% male. Also, 60.0% were secondary and 40.0% were primary school teachers, respectively. Years of teaching of the respondents in their present schools revealed that 20.4% had taught for 2 years, 37.1% for 3-5 years, 32.3% for 6-10 years, 5.4% for 11-20 years, and 4.8% for 21-34 years.

In terms of age of the respondents, the modal class of the respondents was the age group 41-55 years, with 59.9 per cent. Not less than 40.1 per cent of the respondents fell below the modal class. The majority (50.9%) of the respondents had Bachelor's degree; 28.1% had NCE; 16.8% had postgraduate degrees; while 3.6% and 0.4% had HND and OND educational qualifications, respectively.

5.2 Vulnerability of Public Schools to Disasters

Findings from the heads of schools and the teachers interviewed also confirmed the information obtained from OYSEMA, SUBEB and Oyo State Ministry of Education, that

from 2009 to 2014, rainstorm was the most frequent disaster event, which occurred each year and affected most schools, followed by windstorm. The vulnerability of buildings to windstorm hazards is high in the core areas of Ibadan (Adelekan, 2012). As depicted in Table 7, rainstorm affected nine schools each in 2009 and 2012, twelve schools in 2011, and 4, 6 and 3 schools in 2010, 2013 and 2014, respectively. Flood affected one school in 2010 and two in 2011. Windstorm affected one school each in 2009 and 2010, and two schools in 2011; while fire affected one school in 2011. There was a reported case of school violence in one school in 2012. Also, Table 7 depicts year 2011 as the year with the highest number of disasters and highest number of public schools affected. The 187.5 mm rainfall of 26, August 2011, accompanied by wind speed of 65 km/hr. devastated the whole of Ibadan (Agbola *et al*., 2012).

It should, however, be noted that, while the number of reported cases of schools affected in urban LGAs decreased from 15 in 2011 to 3 in 2013, the number of reported disaster-affected schools in rural LGAs rose from 2 in 2011 to 3 in 2013 (Table 8).

Table 7: Profile of Type and Number of Disasters Reported (2009 – 2014)

Type of Disaster	Year						Total Schools Affected (%)
	2009 N (%)	2010 N (%)	2011 N (%)	2012 N (%)	2013 N (%)	2014 N (%)	
Rainstorm	9 (90.0)	4 (66.6)	12 (70.5)	9 (90.0)	6 (100.0)	3 (100.0)	43 (82.7)
Fire	-	-	1 (5.9)	-	-	-	1 (1.9)
Flood	-	1 (16.7)	2 (11.8)	-	-	-	3 (5.8)
Windstorm	1 (10.0)	1 (16.7)	2 (11.8)	-	-	-	4 (7.7)
School Violence	-	-	-	1 (10.0)	-	-	1 (1.9)
Total	**10 (100.0)**	**6 (100.0)**	**17 (100.0)**	**10 (100.0)**	**6 (100.0)**	**3 (100.0)**	**52* (100.0)**

* Total was 52 because two schools were affected by more than one type of disaster
Source: Authors' Survey, 2014

Table 8: Number of Disaster Events Experienced by Urban and Rural Schools (2009-2014)

Locality	Year						Total
	2009 N	2010 N	2011 N	2012 N	2013 N	2014 N	
Urban	9	5	15	9	3	2	43
Rural	1	1	2	1	3	1	9
Total	**10**	**6**	**17**	**10**	**6**	**3**	**52***

* Total was 52 because two schools were affected by more than one type of disaster
Source: Authors' Survey, 2014

5.3 The Effects of Disasters in Public Schools (2009-2014)

The results presented in Table 9 showed that, from 2009 to 2014, 52 disaster events, which affected the 50 sampled public schools, involved 68 school buildings and claimed one life. In 2011, the number of reported disaster rose to seventeen (17) from six (6) in 2010. In 2011, the number of affected school buildings also rose to twenty-four (24) from ten (10) in 2010. In 2012, ten (10) disasters were registered, eleven (11) school buildings were affected, and the only fatality recorded was as a result of school violence. In 2013, six (6) disaster events were recorded and eight (8) school buildings were affected; while, in 2014, three (3) disasters were recorded and seven (7) buildings were affected. Many of the school buildings affected had their roofs blown off, while walls were also damaged (Plates 1 and 2). The school buildings were vulnerable to disasters mostly owing to poor construction and lack of maintenance culture in public schools.

Table 9: Profile of Occurrences of Disasters and their Destructions in Public Schools in Ibadan (2009 – 2014)

Occurrence of Disasters and Destruction	Year						Total
	2009	2010	2011	2012	2013	2014	
Number of Disaster	10	6	17	10	6	3	52
Number of Buildings Affected	8	10	24	11	8	7	68
Number of Fatality	-	-	-	1	-	-	1

Source: Authors' Survey, 2014

Plate 1: Part of the roof of a building blown off by rainstorm at IMG Primary School, Eleta, in Ibadan Southeast Local Government

Source: Authors' Survey, 2014

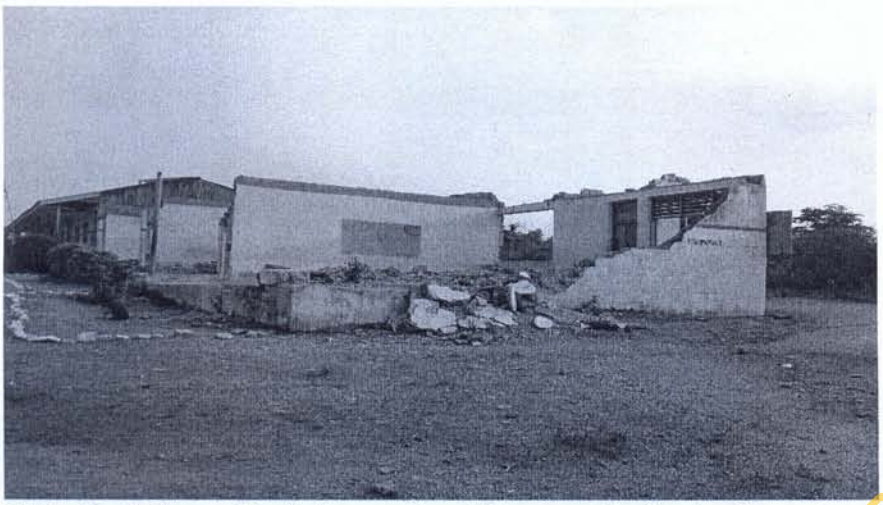


Plate 2: Collapsed building walls at Community Senior Secondary School, Olomi, Oluyole Local Government
Source: Authors' Survey, 2014

5.4 Location of Schools

Location of schools is shown in Table 10. The table shows that 38.0% of the schools were located on steep terrain, 4.0% in or near a floodplain, 2.0% near a communication mast, 10.0% adjacent to an interstate highway, 10.0% near a market, and 28.0% on a busy residential road. All the schools sited on steep terrain experienced gully erosion (Plate 3). Morgan (2005) observes that steep lands are more vulnerable to erosion by water than flat lands because of the higher rates and speed of run-off.

Table 10: Location of School

Location	Locality		Total
	Urban N (%)	Rural N (%)	(%)
Adjacent to an interstate highway	4(9.8)	1(11.1)	5(10.0)
On a busy residential road	12(29.3)	2(22.2)	14(28.0)
Steep terrain	15(36.5)	4(44.4)	19(38.0)
Near a market	4(9.8)	1(11.1)	5(10.0)
Off a major (4-lane) road	4(9.8)	0(0.0)	4(8.0)
In or near a floodplain	1(2.4)	1(11.1)	2(4.0)
Near a communication mast	1(2.4)	0(0.0)	1(2.0)
Total	**41(100.0%)**	**9(100.0%)**	**50(100.0%)**

Source: Authors' Survey, 2014

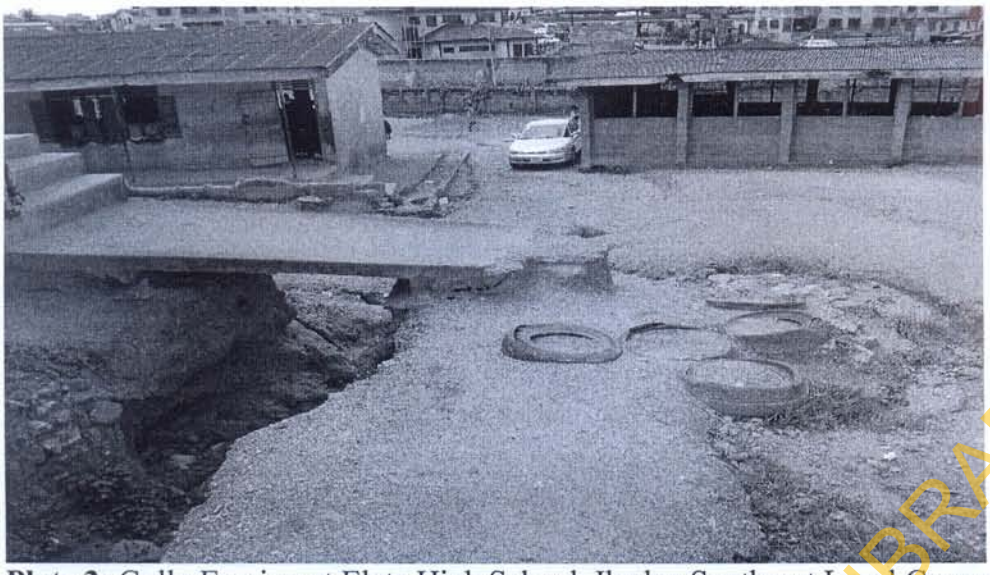
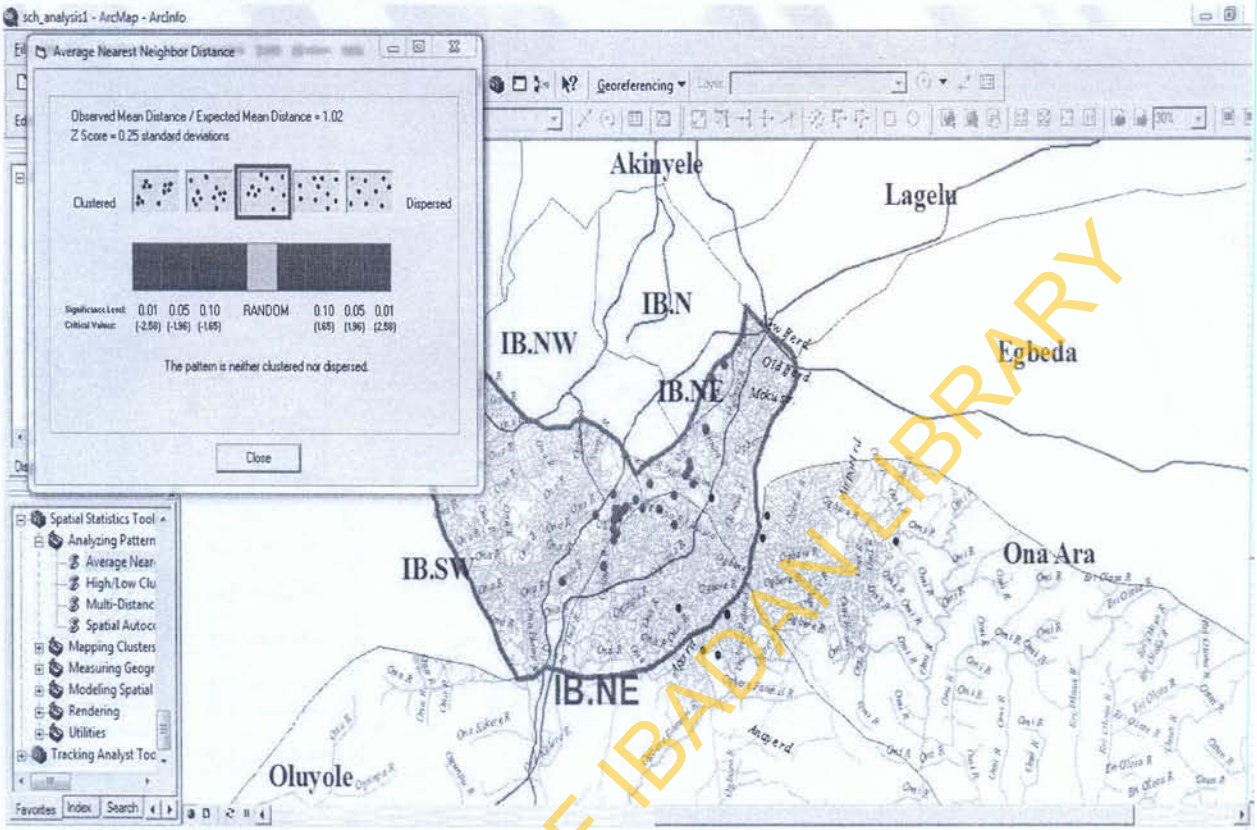


Plate 3: Gully Erosion at Eleta High School, Ibadan Southeast Local Government
Source: Authors' Survey, 2014

5.5 Schools with Emergency Equipment

An insignificant 4.7% of the schools had fire extinguishers while the majority (95.3%) did not have. Only 5.9% of the schools in urban had fire extinguishers, while all the rural schools did not have. Generally 60.5% of the schools had first-aid kits, while 39.5% had none. A total of 64.7% of the urban schools had first-aid kits, while 44.4% of the rural schools also had.

5.6 Pattern Analysis

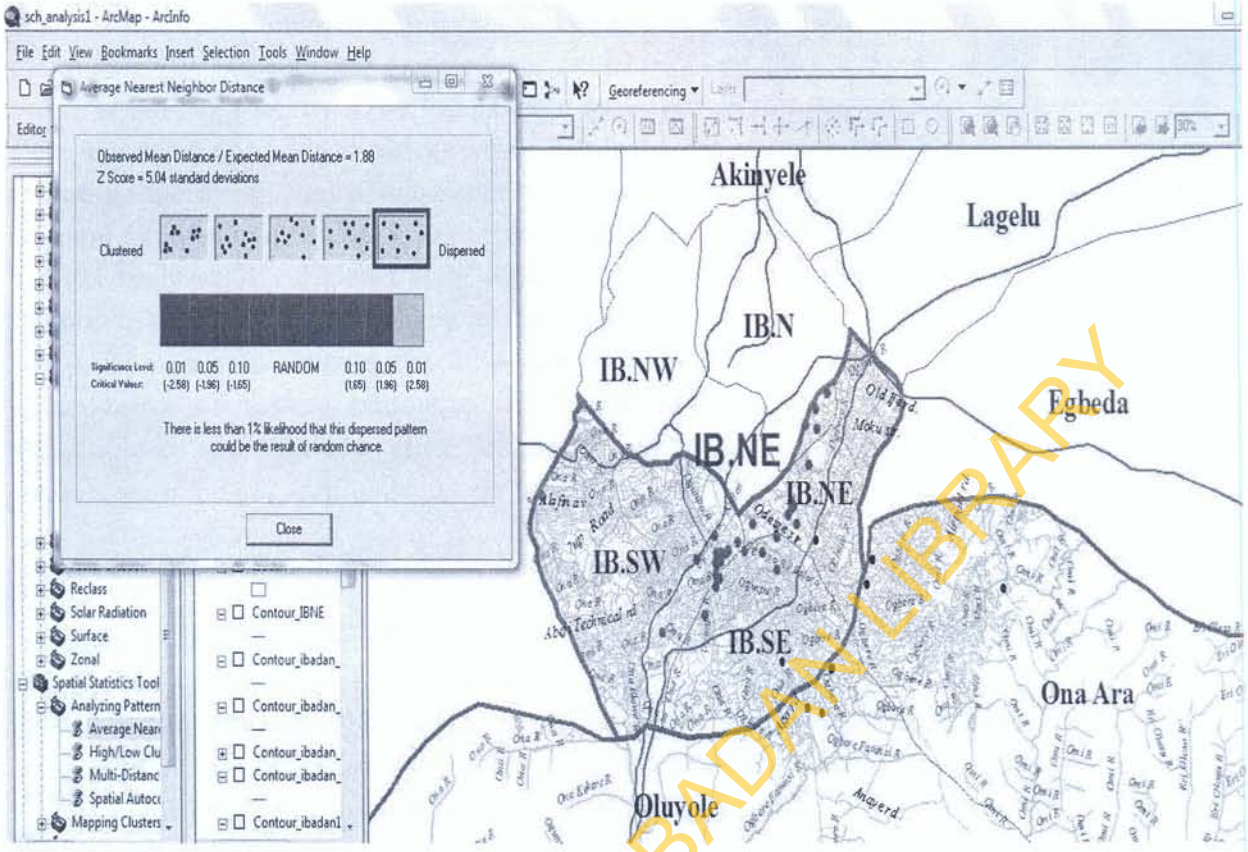


- Urban Schools
- Rural Schools

Figure 3: Nearest Neighbour Analysis of Disaster Affected Public Schools in the three (3) Urban Local Government Areas.

Source: Authors' Field Work, 2014

The distribution of public schools affected by disasters in the urban local government areas (Figure 3) depicted a random pattern, while the Z score showed 0.25 standard deviation. The pattern was neither clustered nor dispersed. This means that the public schools in the area have an equal chance of being affected by disaster. Several factors could account for the randomness, such as increased rate of urbanization, high rate of deforestation and absence of a regular topography.



- Urban Schools
- Rural Schools

Figure 4: Nearest Neighbour Analysis of Disaster Affected Public Schools in two (2) Rural Local Government Areas.
Source: Authors' Field Work, 2014

The distribution of public schools affected by disasters in the rural local government areas (Figure 4) showed a dispersed pattern with a significant level of 0.01 and a critical value of 2.58, while the Z score showed 5.04 standard deviation. There is less than 1% likelihood that this dispersed pattern could be the result of random chance. It could be concluded that the public schools affected in the area showed a dispersed pattern simply because there were large farm and forest lands separating the schools. Also, the degree of deforestation was not much felt like that experienced in the urban centres.

During the informal interviews held with school prefects, they all confirmed that their schools had experienced disasters like rainstorm, fire and flood in the last six years. All the students also claimed that they had no knowledge of the use of fire extinguishers, and

many of them also claimed that it was not even available in their schools. On the impact of the disaster on schools, all the students confirmed that they were all affected negatively owing to the fact that, when buildings were destroyed, pupils were moved to classrooms that were not affected by the disaster, which resulted into overcrowding, and over-stretching of classroom facilities. They also claimed that enrolment dropped each time a disaster occurred as some of their mates were absent from school. Based on the effects of disasters that they had experienced, the students were willing to learn basic things about natural disasters and share with their families what they learnt at school.

The key informants revealed that there was no guideline for the assessment of vulnerability of school buildings. They also claimed that urban schools were more vulnerable to disasters than rural schools simply because most of the buildings in urban schools were too old and inadequately maintained.

6.0 Conclusion and Recommendations

As a result of rapid urbanization, unplanned growth, and over-population in urban areas, schools are growing in number to accommodate more students in the education system. Owing to limited land space, some school buildings are sited on flood-prone land. School infrastructure are vulnerable during the occurrence of disasters owing to poor construction, siting on steep terrains, construction on floodplains and lack of disaster-management facilities and equipment.

This study revealed that urban and rural public schools in Ibadan were not disaster-compliant, as they were exposed to yearly disaster events, such as rainstorm, flood and windstorm. Teachers and pupils also lacked basic knowledge about disasters. The disaster at public schools, especially those that occurred more than once in the same schools, are an indication of lack of, or inadequate emergency preparedness. As a result of the disaster events, affected rural and urban schools recorded damage to building walls and roofs. Nearest neighbour analysis revealed that the spatial distribution of affected public schools in urban and rural areas showed a random pattern and a dispersed pattern, respectively.

Based on the findings, the following suggestions are offered to reduce the level of exposure to disaster and the damage therefrom:

i. State government should conduct public school disaster Vulnerability and Capacity Analysis (VCA) and allow results to inform decisions regarding rehabilitation programmes to reduce risk to critical infrastructure in the education sector.

ii. The Ministry of Education, in collaboration with Oyo State Emergency Management Agency (OYSEMA), Local Government Emergency Management Committee and other relevant stakeholders in disaster management, need to promote awareness about safe schools. They should develop vulnerability assessment guidelines for the schools, ensure that every school has disaster preparedness plan and operates the plan.

iii. Zoning regulations can be used as a strategy in reducing disaster impacts. The Oyo State Ministry of Physical Planning and Urban Development should carve out zones for schools and strictly enforce related regulations in order to reduce vulnerability level of schools arising from poor siting and substandard/illegal building construction. This will increase resilience of schools.

iv. State and local governments and their agencies alone cannot effectively shoulder the burden of running a safe school programme in view of other sectors competing for attention. Government should, therefore, encourage the participation of parents, old students' associations, community associations operating in the vicinity of schools, philanthropists and the organized private sector in the provision, management and maintenance of disaster-prevention facilities. Cash and in-kind assistance should be encouraged.

v. One of the reasons for the closure of a school is substandard facilities (i.e lack of safe sanitation facilities, weak buildings, and lack of erosion and flood barriers). Therefore, the availability of safe, secure, adequate and satisfactory educational facilities will support the teaching and learning processes and ultimately improve the quality of education.

vi. The Oyo State Ministry of Education and SUBEB as well as relevant educational planners and policy-makers should ensure that enough provision is made in their annual budgets for maintenance and management of educational facilities. Fire extinguishers and first-aid kits should be procured and placed at strategic locations and serviced regularly for efficiency. Teachers and learners must all be taught on how to use the equipment.

vii. Landscaping of school premises should be given the deserved attention. Pupils and their parents and other willing members of the community should be mobilized to plant trees and shrubs all over the school and nurture the plants. This will check erosion and flood, shield structures from windstorm and create beautiful school environments.

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