

# Hazard Profile and Vulnerability Assessment of Informal Waterfront Settlements in Rivers State

\*<sup>1</sup>Victor Bull, <sup>1</sup>Arokoyu S.B, and <sup>2</sup>Ogoro, M

Department of Geography and Environmental Management, University of Port Harcourt, Port Harcourt, Rivers State

**Abstract:** - This study profiles the hazards waterfront informal settlements are exposed to in Rivers State. It was affected by means of literature review and field survey in which perceptions of various households' representatives of waterfront communities within the study area were analysed along with secondary data obtained from relevant institutions in Rivers State. A questionnaire survey was administered and analysed from the data retrieved. From the analysis, varieties of hazards such as air pollution, criminal activities, congestion, flood, fire etc., were found to be the most common hazards in the area of study, thus endangering the lives of people within that area. Similarly, the hazards with the most severe effect on lives and property arranged in their order of severity are the same prevalent identified above. It is therefore recommended that phase redevelopment of waterfront informal settlements should be carryout in the study area; a dedicated disaster response organization at local levels, furnished with state-of-the art emergency response equipment; tackle poverty and create jobs; implement frequent public enlightenment campaign on community safety and security; government should devise an effective feedback system for prompt reporting of hazard and hazardous conditions within the community; provision of local warning and communication systems for predictable hazardous events/disaster; provision basic of infrastructure such as access road, hospitals, electricity, water supply.

**Keywords:** - Hazards, Profile, Informal, Waterfront, Emergencies.

## I. INTRODUCTION

Rivers State, like most states in Nigeria, is undergoing massive growth of its metropolitan areas and Local Government Areas Headquarters. The inability of cities in the country to provide adequate shelter and urban services for the growing populations as well as sufficient opportunities for economic advancement has resulted in burgeoning informal settlements in both inner cities as well as in the urban periphery (Giddings, 2013). The

inability of the city authorities to deal with the housing supply shortages and the low levels of housing affordability, have directly contributed to the development of slums and waterfront informal settlements, such as those found in the southern part of Nigeria (Konadu-Agyemang, 2001).

Waterfront settlement, also called waterside are usually situated within low-lying, environmentally fragile and hazard prone areas. In the Riverine communities, waterfront settlements are the natural habitat of the indigenes, while in the urban centres, Port Harcourt and Obio-Akpor LGAs, waterfront settlements started as small group of houses where farmers and fishermen who brought in food and fish from the hinterland and riverine communities to Port Harcourt to sell, made their temporary homes during their trips. These small settlements have grown over the years to very large settlements with some of these settlements having populations' well over ten thousand persons. Waterfront's settlements are now found all around the coastlines of Port Harcourt. Obafemi and Odubo (2013) put the total number of waterfront settlements in Port Harcourt to be Forty -nine (49) and estimated the population of the waterfronts to account for about 65% of the city's population. Living conditions in these settlements are often horrendous and pose significant risks to the inhabitants (Swanepoel and De Beer, 2014). Additionally, water supply, sewage and drainage, paved roads, lighting and electricity supply, public transport and garbage disposal are often not available, which creates health and safety hazards (Nguluma & Lupala, 2003).

According to Pharoah (2009), informal settlements occupy an ambiguous legal position. They are however home to the poorest and most marginalized urban populations. Due largely to the inadequately managed urbanization processes coupled with lack of effective urban planning measures, poor governance and so forth; urban residents in the south-south cities of Nigeria and other densely populated areas have become vulnerable to a range of disasters like fire outbreaks, diseases, flood, severe weather, crime etc. (Lerise & Kiunsi, 2004). An analysis of disaster impacts in informal settlements shows the greatest loss of life and property. Response to hazards, especially in informal settlements continues to be

a daunting task. This is largely due to the lack of publicly provided management system including the lack of water sources to douse fires, dense building concentrations, flammable building materials (untreated wood, plastic and cardboard), lack of access roads, and haphazard electricity connections. Further, the lack of resources to upgrade preparedness and response skills coupled with poor infrastructural development have resulted in a growing risk of large scale, multiple structure hazards in informal settlements, thus contributing to their vulnerability (Asian Disaster Preparedness Center, 2004; Disaster Relief Emergency Fund, 2014).

The ultimate objective of this paper is to examine the factors that have increased exposure and vulnerability of residents in informal dwellings to hazards. In so doing, it aims to contribute to knowledge on the conceptualization and drivers of risk in urban areas in Africa and draws out lessons for prescriptive risk reduction interventions both in Nigeria and elsewhere. This study therefore aims to profile the the hazards of waterfront informal settlements in Rivers State focusing on the the types of hazards waterfront informal settlements are exposed to and the socio-economic impacts of emergencies experienced in Rivers State.

## II. THE STUDY AREA

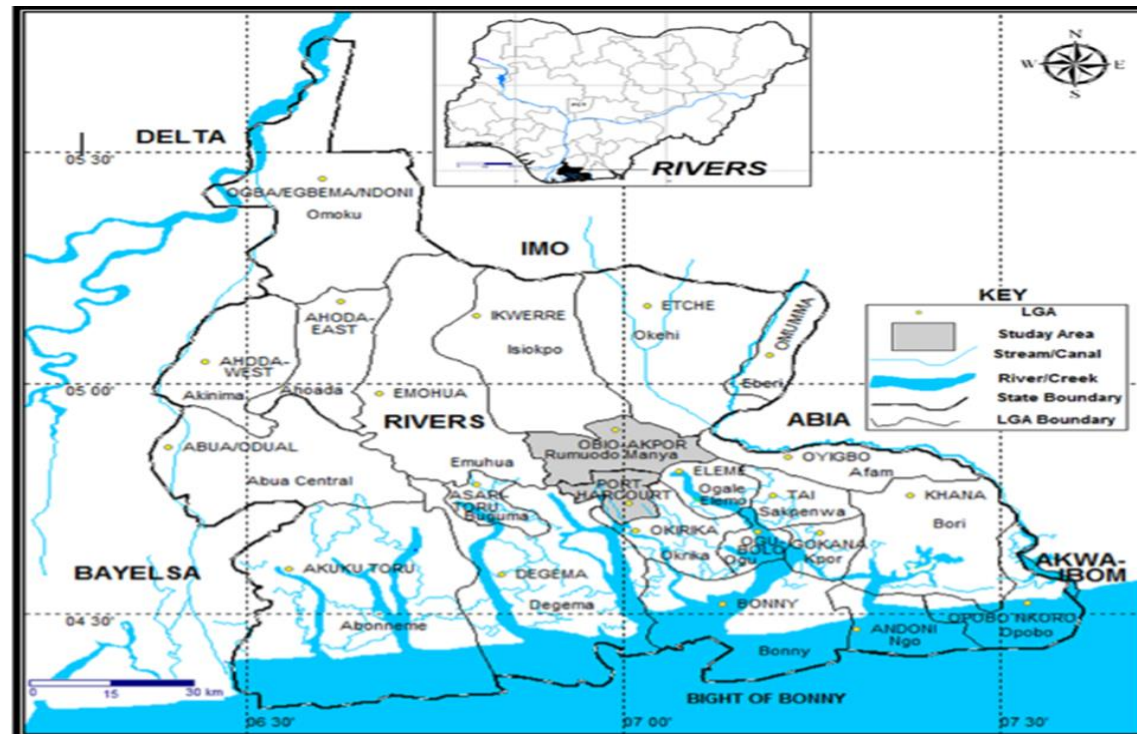


Fig 1: Administrative map of Rivers State

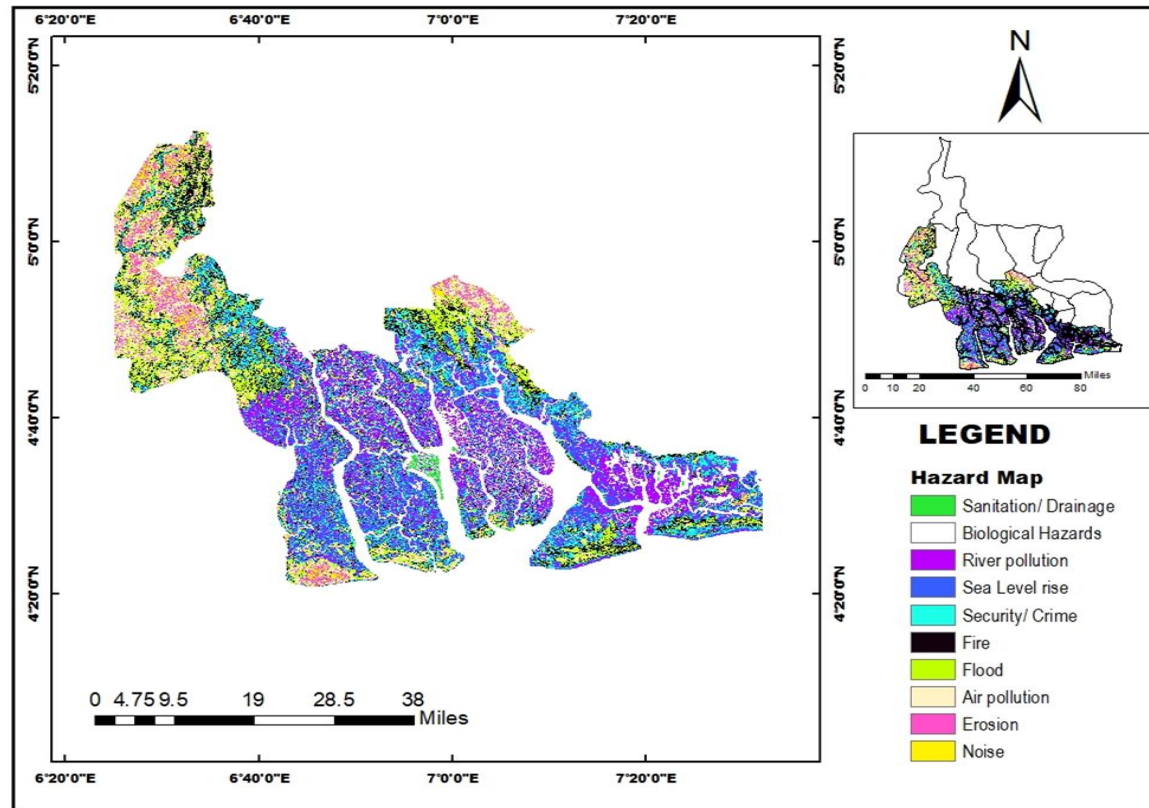


Fig 2: Hazards Map of the study area

Rivers State occupies an area of about 37,000 square kilometers they lie between latitude 4° 40' 38" North and longitude 6° 25' 42" East. It is bounded in the south by the Atlantic Ocean, to the north by Imo and the Abia States, to the east by Akwa Ibom State, and the west by Bayelsa and Delta States. Its shores form part of the West African coastline (Uche, 2016). Over one-third of the State is occupied by water with a low land stretching from Bonny in the South to Ndoni in the north. A network of creeks spans the riverine south, emptying into the Atlantic Ocean through numerous tributaries of Rivers state

### III. MATERIAL AND METHODOLOGY

The study employed a descriptive research design to profile the hazards of waterfront informal settlements in Rivers State. Both primary and secondary data sources were used. Primary data was obtained from household survey, interviews and field observation. Secondary data were obtained from the River State Ministry of housing and Urban Development; 2009 Port Harcourt Waterfront Urban Regeneration Scoping Study, the 1991 Census as published by the National population commission (NPC). The population of study comprised of all the 451572 households representing 496 waterfront settlements in Rivers State. This was determined using 6 persons per household composition figure as stipulated by NDHS report (2013).

Structured questionnaires were designed with open and close ended questions. 400 copies of questionnaires were administered to respondents in the study area. Thus, 10% of the communities were randomly selected from the 496 sampled waterfront informal settlements and 451572 households from the 12 LGAs making a total of 45157 households and 50 communities which represents 10% of the entire population of the waterfront communities in the State as sample size. Furthermore, to determine appropriate sample size based on the number of Households, Taro Yamane method was adopted.

$$n = \frac{451572}{(1 + 451572 (0.0025))}$$

$$n = \frac{451572}{1129.30} \approx 400$$

The data obtained was analyzed using descriptive statistics such as mean and standard deviation and simple percentages distribution tables. The results of the data analyses are presented below.

#### IV. RESULT AND DISCUSSION

Below is the mathematical illustration for the Taro Yamane formula:

$$n = \frac{N}{(1 + N(e^2))}$$

Where:  
 n-signifies the sample size  
 N-signifies the population under study  
 e-signifies the margin error = 0.05

##### ➤ Types of hazards

This section determined the types of hazards that are prevalent in the study areas. This was important because knowing the type of hazards that affect the households in the study area is the first step that must be taken in any effective disaster management efforts. Questionnaire respondents and interview participants’ responses are displayed in this section and compared to what scholars and policy documents say about the prevalence of hazards in Rivers State waterfront settlements.

Table 1 Respondent’s Knowledge Level of Hazards

Knowledge Level of Hazards	Response Categories			
	Yes		No	
	F	%	F	%
Excellent	37	9.3	109	27.3
Good	129	32.3	11	2.8
Average	84	21.0	30	7.5
<b>Total</b>	<b>250</b>	<b>62.5</b>	<b>150</b>	<b>37.5</b>

Source: Researcher’s Fieldwork, 2023

Table 1 indicated percentage level of respondents’ knowledge of hazards which reveals as follows; that the majority 129 (32.3%) of the respondents indicated that their knowledge level of hazards was good, 21% with a frequency of 84 respondents indicated that their knowledge level was average while, 9.3% with a frequency of 37 respondents indicated that their knowledge level of hazards was excellent.

##### ➤ Respondent’s Perception Of Prevalent Hazards And The Likelihood Of Hazardous Events

An evaluation scale adapted from “School Health Practice” by Anderson and Crowell (2008) was used to assess the types of hazards people in waterfront informal settlement are prone to. Items were scored according to their importance or relevance. For instance, the scores for availability of hazards in the study areas were graded from 0-4 points. 4 point was awarded for More often, 3 – Often, 2-Sometimes, 1-Rarely, while 0 point was awarded for Never or the absence of any of the hazards respectively.

Table 2 Respondents' Perception on Types of Hazards Exposed to.

COMMUNITY	HAZARDS												
	FLOODS	SEA LEVEL RISE	EROSION	FIRES	CRIME/ SECURITY	CONGESTION AND OVERCROWDING	SANITATION AND DRAINAGE	AIR POLLUTION	OIL/ CHEMICAL SPILL	RIVER POLLUTION	NOISE	BIOLOGICAL HAZARDS	OTHER HAZARDS (EARTHQUAKE, HURRICANE, TSUNAMIS, ETC)
<b>ABUA/ODUAL</b>													
OKOBOH W/SIDE ABUA	4	1	3	4	3	1	3	3	2	2	1	2	0
AKANI ODUAL	4	1	3	3	3	0	2	3	1	2	2	2	0
<b>AHOADA WEST</b>													
OLOKUMA EKPEYE	4	2	3	4	2	2	2	3	1	2	2	2	0
ODEREKE EKPEYE	3	3	3	3	4	2	3	3	2	1	2	3	0
<b>AKUKU TORU</b>													
KULA	4	3	3	3	4	2	1	4	2	1	2	3	0
OBNOMA	3	2	3	2	3	1	1	3	3	3	3	2	0
ELEM ABISSA	3	3	3	3	3	2	1	4	2	3	3	2	0
<b>ANDONI</b>													0
ASUK-AMA	1	3	2	1	2	0	1	3	2	3	2	3	0
ASUK-OYET	1	3	1	1	3	0	1	3	2	3	1	3	0
OKOROILE	1	3	2	2	3	1	1	3	3	3	2	2	0
DEMA	1	2	2	1	3	0	1	3	2	3	2	3	0
EKEDE	2	3	1	2	3	0	1	3	2	3	1	3	0
IBOTOKPON	1	3	2	1	4	2	1	2	2	3	2	3	0
IKURU	1	3	2	1	3	0	1	3	3	3	2	2	0
OKOROSOILE	1	2	2	2	3	0	1	3	2	3	2	2	0
OYOROKOTO	1	3	1	1	3	0	1	4	2	3	2	3	0
EBUKUMA	1	2	2	1	4	0	1	3	2	3	3	2	0
ASARAMA AMA	1	3	2	1	3	1	1	3	2	3	1	3	0
AMA-EKUT	1	3	1	1	3	0	1	3	2	3	2	2	0
AMA SUNDAY	1	3	2	1	3	0	1	3	3	3	2	3	0
AMAOKE	1	3	2	1	2	0	1	3	2	3	2	3	0
EGBOMU	1	3	2	1	3	0	1	3	2	3	1	3	0
<b>ASARI TORU</b>													
ABALAMA	3	3	2	2	3	1	2	3	3	2	2	2	0
KRAKRAMA	3	2	2	2	3	2	2	3	3	3	1	3	0
OPORO-AMA	3	3	3	3	3	2	1	3	2	3	2	2	0
BENIBO KIRI	3	2	2	2	2	1	2	2	2	3	2	2	0

Table 2: Respondents’ Perception on Types of Hazards Exposed to. (Cont)

COMMUNITY	HAZARDS												
	FLOODS	SEA LEVEL RISE	EROSION	FIRES	CRIME/SECURITY	CONGESTION AND OVERCROWDING	SANITATION AND DRAINAGE	AIR POLLUTION	OIL/CHEMICAL SPILL	RIVER POLLUTION	NOISE	BIOLOGICAL HAZARDS	OTHER HAZARDS (EARTHQUAKE, HURRICANE, TSUNAMIS, ETC)
<b>BONNY</b>													
BUOKIRI	3	3	2	2	2	2	2	3	2	3	3	2	0
GREENS IWOMA	2	3	3	3	2	2	2	3	2	3	2	2	0
OLOMA	3	4	3	2	1	3	1	3	2	3	2	1	0
PETERSIDE	3	3	2	2	2	1	2	3	2	3	2	2	0
DEMA ABBEY	3	3	2	3	2	1	3	3	1	3	3	2	0
OGWEDE	3	3	3	3	2	2	2	3	1	3	2	2	0
<b>DEGEMA</b>													0
BAKANA	4	3	2	3	3	2	2	4	3	3	2	3	0
KE	3	3	3	3	3	1	2	3	3	3	2	2	0
<b>OGU/BOLO</b>													
OGU	2	3	2	3	2	1	1	3	2	3	2	2	0
BELEMA-KIRI	3	4	3	3	3	2	1	4	1	3	1	3	0
<b>OKRIKA</b>													0
KALIO -AMA	3	3	4	2	3	3	2	4	2	3	2	2	0
OGOLOMA	3	3	4	4	3	3	3	3	1	3	3	2	0
OMOBA KIRI	3	3	3	4	3	3	3	4	1	3	3	2	0
OKUMGBA -AMA	3	4	3	3	4	4	3	3	1	3	2	3	0
<b>OBIO-AKPOR</b>													
IWOFE WATERFRONT	3	3	2	3	3	3	3	4	0	3	3	2	0
<b>OPOBO/ NKORO</b>													
EPELEMA	3	3	3	2	3	2	3	3	1	3	2	2	0
MINIMAH	3	3	3	2	3	2	3	2	0	2	2	2	0
QUEENS TOWN	3	3	3	3	3	1	4	3	1	3	2	3	0
<b>PORT HARCOURT</b>													0
ELECHI	3	1	3	4	3	4	3	3	0	2	3	2	0
BUNDU	2	1	3	4	3	4	4	3	0	2	3	2	0
YAM ZONE	3	0	3	4	3	4	4	3	0	2	2	2	0
REX LAWSON	3	1	2	3	3	4	3	3	0	3	3	2	0
ENUGU	3	0	2	3	2	4	3	3	0	2	2	2	0
CEMETARY	3	1	2	4	3	4	2	3	0	1	2	2	0

Source: Researcher’s Fieldwork, 2022

➤ *Legend: Range of Values Verbal Interpretation:*

- 4 - More Often
- 3 - Often
- 2 - Sometimes
- 1 - Rarely
- 0 - Never

The results from table 2 show that, Air pollution, criminal activities, flood, fire and congestion and overcrowding respectively are the most hazards, waterfront informal settlements are vulnerable to.

Table 3 Responses on frequency of hazard occurrence in the sampled communities

Likelihood of Occurrence/Frequency													
COMMUNITY	FLOODS	SEA LEVEL RISE	EROSION	FIRES	CRIME/ SECURITY	CONGESTION AND OVERCROWDING	SANITATION AND DRAINAGE	AIR POLLUTION	OIL/ CHEMICAL SPILL	RIVER POLLUTION	NOISE	BIOLOGICAL HAZARDS	OTHER HAZARDS (EARTHQUAKE, HURRICANE, TSUNAMIS, ETC)
<b>ABUA/ODUAL</b>													
OKOBOH W/SIDE ABUA	2	2	3	4	3	1	3	3	2	2	1	2	1
AKANI ODUAL	3	3	3	3	3	1	2	3	1	2	1	2	1
<b>AHOADA WEST</b>													
OLOKUMA EKPEYE	2	2	3	4	2	1	2	3	1	2	1	2	1
ODEREKE EKPEYE	3	3	3	3	4	1	3	3	3	1	1	3	1
<b>AKUKU TORU</b>													
KULA	4	4	3	3	4	1	2	3	3	1	1	2	1
OBONOMA	3	3	3	2	3	1	2	3	3	3	1	2	1
ELEM ABISSA	3	3	3	3	3	2	2	3	3	3	1	2	1
<b>ANDONI</b>													
ASUK-AMA	1	1	2	2	2	1	2	3	2	3	1	2	1
ASUK-OYET	1	1	1	2	3	2	2	3	2	3	1	2	1
OKOROILE	1	1	2	2	3	1	2	3	2	3	1	2	1
DEMA	1	1	2	2	3	1	2	3	2	3	1	3	1
EKEDE	2	2	1	2	3	1	2	3	2	3	1	2	1
IBOTOKPON	1	1	2	2	4	2	2	3	2	3	1	3	1
IKURU	1	1	2	2	3	1	2	3	3	3	1	2	1
OKOROSOILE	1	1	2	2	3	2	2	3	2	3	1	2	1
OYOROKOTO	1	1	1	2	3	1	2	4	2	3	1	3	1
EBUKUMA	1	1	2	2	4	2	2	3	2	3	1	2	1
ASARAMA AMA	1	1	2	2	3	1	2	3	2	3	1	3	1
AMA-EKUT	1	1	1	2	3	1	2	3	2	3	1	2	1
AMA SUNDAY	1	1	2	2	3	1	2	3	2	3	1	3	1
AMAOKE	1	1	2	2	2	1	2	3	2	3	1	3	1
EGBOMU	1	1	2	2	3	2	2	3	2	3	1	2	1
<b>ASARI TORU</b>													
ABALAMA	3	3	2	2	3	1	2	3	3	2	1	2	1
KRAKRAMA	3	3	2	2	3	1	2	3	3	3	1	3	1
OPORO-AMA	3	3	3	3	3	1	2	3	3	3	1	2	1
BENIBO KIRI	3	3	2	2	2	1	2	3	3	3	1	2	1
<b>BONNY</b>													
BUROKIRI	3	3	2	2	2	1	2	3	2	3	1	2	1
GREENS IWOMA	3	3	3	2	2	1	2	3	3	3	1	2	1
OLOMA	3	3	3	2	2	1	2	3	2	3	1	2	1
PETERSIDE	3	3	2	2	2	1	2	3	2	3	1	2	1



DEMA ABBEY	3	3	2	3	2	1	3	3	2	3	1	2	1
OGWEDE	3	3	3	3	2	1	2	3	2	3	1	2	1
<b>DEGEMA</b>													
BAKANA	3	3	2	3	3	1	2	3	3	3	1	2	1
KE	3	3	3	3	3	1	2	3	3	3	1	2	1
<b>OGU/BOLO</b>													
OGU	3	3	2	3	2	1	2	3	3	3	1	2	1
BELEMA-KIRI	3	3	3	3	3	1	2	4	3	3	1	2	1
OKRIKA													
KALIO -AMA	3	3	4	2	3	1	2	4	2	3	1	2	1
OGOLOMA	3	3	4	3	3	1	3	3	3	3	1	2	1
OMOBA KIRI	3	3	3	3	3	1	3	4	2	3	1	2	1
OKUMGBA -AMA	3	3	3	3	3	1	3	3	3	3	1	2	1
<b>OBIO-AKPOR</b>													
IWOFE WATERFRONT	3	3	2	3	4	3	3	4	2	3	3	2	1
<b>OPOBO/NKORO</b>													
EPELEMA	3	3	3	2	3	1	3	3	2	3	1	2	1
MINIMAH	3	3	3	2	3	1	3	3	1	2	1	2	1
QUEENS TOWN	3	3	3	3	3	1	2	3	1	3	1	3	1
<b>PORT HARCOURT</b>													
ELECHI	3	3	3	4	4	4	3	4	1	2	3	2	1
BUNDU	2	2	3	4	4	4	3	4	1	2	3	2	1
YAM ZONE	3	3	3	4	4	4	3	4	1	2	3	2	1
REX LAWSON	3	3	2	3	4	4	3	4	1	3	3	2	1
ENUGU	3	3	2	3	4	4	3	4	1	2	3	2	1
CEMETARY	3	3	2	4	4	4	3	4	1	1	3	2	1

Source: Researcher’s Fieldwork, 2020

➤ Legend: Range of Values Verbal Interpretation:

- 4 - Highly likely
- 3 - Possible
- 2 - Likely
- 1 - Unlikely

The results from table 3 show that, Air pollution, criminal activities, flood, fire and congestion and overcrowding respectively are the most frequent hazard experienced by the waterfront informal settlements, but over-all, the frequency of experience of the natural hazard occurrences is generally rare.

Table 4 Respondents Perception on The Severity of The Impacts of The Hazards

SEVERITY													
COMMUNITY	FLOODS	SEA LEVEL RISE	EROSION	FIRES	CRIME/ SECURITY	CONGESTION AND OVERCROWDING	SANITATION AND DRAINAGE	AIR POLLUTION	OIL/ CHEMICAL SPILL	RIVER POLLUTION	NOISE	BIOLOGICAL HAZARDS	OTHER HAZARDS (EARTHQUAKE, HURRICANE, TSUNAMIS, ETC
ABUA/ODUAL													
OKOBOH W/SIDE ABUA	3	3	3	4	3	2	3	3	3	2	2	3	4
AKANI ODUAL	3	3	3	3	3	2	3	3	3	2	2	2	4
AHOADA WEST													
OLOKUMA EKPEYE	3	3	3	4	3	2	3	3	3	2	2	3	4
ODEREKE EKPEYE	3	3	3	3	4	2	3	3	3	1	2	3	4
AKUKU TORU													
KULA	4	4	3	3	4	2	3	3	3	1	2	3	4
OBONOMA	3	3	3	3	3	2	3	3	3	3	2	3	4
ELEM ABISSA	3	3	3	3	3	2	3	3	3	3	2	2	4
ANDONI													
ASUK-AMA	3	3	2	3	3	2	3	3	3	3	2	3	4

ASUK-OYET	3	3	1	3	3	2	3	3	3	3	2	3	4
OKOROILE	3	3	2	3	3	2	3	3	3	3	2	2	4
DEMA	3	3	2	3	3	2	3	3	3	3	2	3	4
EKEDE	3	3	1	3	3	1	3	3	3	3	2	3	4
IBOTOKPON	3	3	2	3	4	2	3	3	3	3	2	3	4
IKURU	3	3	2	3	3	2	3	3	3	3	2	2	4
OKOROSOILE	3	3	2	3	3	2	3	3	3	3	2	3	4
OYOROKOTO	3	3	1	3	3	2	3	3	3	3	2	3	4
EBUKUMA	3	3	2	3	4	2	3	3	3	3	2	2	4
ASARAMA AMA	3	3	2	3	3	2	3	3	3	3	2	3	4
AMA-EKUT	3	3	1	3	3	2	3	3	3	3	2	3	4
AMA SUNDAY	3	3	2	3	3	1	3	3	3	3	2	3	4
AMAOKE	3	3	2	3	3	2	3	3	3	3	2	3	4
EGBOMU	3	3	2	3	3	2	3	3	3	3	2	3	4
<b>ASARI TORU</b>													
ABALAMA	3	3	2	3	3	2	3	3	3	3	2	2	4
KRAKRAMA	3	3	2	3	3	2	3	3	3	3	2	3	4
OPORO-AMA	3	3	3	3	3	2	3	3	3	3	2	2	4
BENIBO KIRI	3	3	2	3	3	2	3	3	3	3	2	3	4

<b>BONNY</b>													
BUOKIRI	3	3	2	3	3	2	3	3	3	3	2	2	4
GREENS IWOMA	3	3	3	3	3	2	3	3	3	3	2	3	4
OLOMA	3	3	3	3	3	2	3	3	3	3	2	2	4
PETERSIDE	3	3	2	3	2	2	3	3	3	3	2	2	4
DEMA ABBEY	3	3	2	3	2	2	3	3	3	3	2	3	4
OGWEDE	3	3	3	3	2	2	3	3	3	3	2	2	4
<b>DEGEMA</b>													
BAKANA	3	3	2	3	3	2	3	3	3	3	2	3	4
KE	3	3	3	3	3	2	3	3	3	3	2	2	4
<b>OGU/BOLO</b>													
OGU	3	3	2	3	3	2	3	3	3	3	2	3	4
BELEMA-KIRI	3	3	3	3	3	2	3	3	3	3	2	3	4
OKRIKA													
KALIO -AMA	3	3	4	3	3	3	3	3	3	3	2	2	4
OGOLOMA	3	3	4	3	3	3	3	3	3	3	2	3	4
OMOBA KIRI	3	3	3	3	3	3	3	3	3	3	2	3	4
OKUMGBA -AMA	3	3	3	3	3	3	3	3	3	3	2	3	4
<b>OBIO-AKPOR</b>													

IWOFE WATERFRONT	3	3	2	3	3	3	3	3	3	3	2	3	4
<b>OPOBO/ NKORO</b>													
EPELEMA	3	3	3	3	3	2	3	3	3	3	2	3	4
MINIMAH	3	3	3	3	3	2	3	3	3	3	2	2	4
QUEENS TOWN	3	3	3	3	3	2	3	3	3	3	2	3	4
<b>PORT HARCOURT</b>													
ELECHI	3	3	3	4	3	3	3	3	3	3	2	3	4
BUNDU	3	3	3	4	3	3	3	3	3	3	2	2	4
YAM ZONE	3	3	3	4	3	3	3	3	3	3	2	3	4
REX LAWSON	3	3	2	4	3	3	3	3	3	3	2	2	4
ENUGU	3	3	2	4	3	3	3	3	3	3	2	3	4
CEMETARY	3	3	2	4	3	3	3	3	3	3	2	2	4

Source: Researcher’s Fieldwork, 2020

Legend: Range of Values Verbal Interpretation:

- 4 - Catastrophic
- 3 - Critical
- 2 - Moderate
- 1 - Negligible

The findings from table 4 reveal that hazards impact to the waterfront communities is generally not critical. Only flood, fire and air pollution are cited with a moderate severity of impact which suggests that their vulnerability factors have to be addressed accordingly to reduce their impact. Preparedness measures on flood, fire and air pollution can be given more attention and priority by the community authorities without compromising the disaster preparedness efforts of other hazards.

Table 5 Evaluation of Risk

EVALUATION OF RISK																																								
RISK (R) = FREQUENCY (F) X SEVERITY (S)																																								
WATERFRONT COMMUNITIES/ SETTLEMENTS		FLOODS			SEA LEVEL RISE			EROSION			FIRES			SECURITY/ CRIME			CONGESTION AND OVERCROWDING			SANITATION AND DRAINAGE			AIR POLLUTION			OIL/ CHEMICAL SPILL			RIVER POLLUTION			NOISE			BIOLOGICAL HAZARDS			OTHER HAZARDS (EARTHQUAKE, HURRICANE, TSUNAMIS, ETC)		
		F	S	R	F	S	R	F	S	R	F	S	R	F	S	R	F	S	R	F	S	R	F	S	R	F	S	R	F	S	R	F	S	R	F	S	R			
ABUA/ ODUAL	OKOBOH W/SIDE ABUA	2	3	6	2	3	6	3	3	9	4	4	16	3	3	9	1	2	2	3	3	9	3	3	9	2	3	6	2	2	4	1	2	2	2	2	4	1	4	4
	AKANI ODUAL	3	3	9	3	3	9	3	3	9	3	3	9	3	3	9	1	2	2	2	3	6	3	3	9	1	3	3	2	2	4	1	2	2	2	2	4	1	4	4
AHOADA WEST	OLOKUMA EKPEYE	2	3	6	2	3	6	3	3	9	4	4	16	2	3	6	1	2	2	2	3	6	3	3	9	1	3	3	2	2	4	1	2	2	2	3	6	1	4	4
	ODEREKE EKPEYE	3	3	9	3	3	9	3	3	9	3	3	9	4	4	16	1	2	2	R 3	3	9	3	3	9	3	3	9	1	1	1	1	2	2	3	3	9	1	4	4
AKUKU TORU	KULA	4	4	16	4	4	16	3	3	9	3	3	9	4	4	16	1	2	2	2	3	6	3	3	9	3	3	9	1	1	1	1	2	2	2	3	6	1	4	4
	OBONOMA	3	3	9	3	3	9	3	3	9	2	3	6	3	3	9	1	2	2	2	3	6	3	3	9	3	3	9	3	3	9	1	2	2	2	3	6	1	4	4
	ELEM ABISSA	3	3	9	3	3	9	3	3	9	3	3	9	3	3	9	2	2	4	2	3	6	3	3	9	3	3	9	3	3	9	1	2	2	2	2	4	1	4	4
ANDONI	ASUK-AMA	1	3	3	1	3	3	2	2	4	2	3	6	2	3	6	1	2	2	2	3	6	3	3	9	2	3	6	3	3	9	1	2	2	2	3	6	1	4	4
	ASUK-OYET	1	3	3	1	3	3	1	1	1	2	3	6	3	3	9	2	2	4	2	3	6	3	3	9	2	3	6	3	3	9	1	2	2	2	3	6	1	4	4
	OKOROILE	1	3	3	1	3	3	2	2	4	2	3	6	3	3	9	1	2	2	2	3	6	3	3	9	2	3	6	3	3	9	1	2	2	2	2	4	1	4	4
	DEMA	1	3	3	1	3	3	2	2	4	2	3	6	3	3	9	1	2	2	2	3	6	3	3	9	2	3	6	3	3	9	1	2	2	3	3	9	1	4	4
	EKEDE	2	3	6	2	3	6	1	1	1	2	3	6	3	3	9	1	1	1	2	3	6	3	3	9	2	3	6	3	3	9	1	2	2	2	3	6	1	4	4
	IBOTOKPON	1	3	3	1	3	3	2	2	4	2	3	6	4	4	16	2	2	4	2	3	6	3	3	9	2	3	6	3	3	9	1	2	2	3	3	9	1	4	4
	IKURU	1	3	3	1	3	3	2	2	4	2	3	6	3	3	9	1	2	2	2	3	6	3	3	9	3	3	9	3	3	9	1	2	2	2	2	4	1	4	4

	OKOROSOILE	1	3	3	1	3	3	2	2	4	2	3	6	3	3	9	2	2	4	2	3	6	3	3	9	2	3	6	3	3	9	1	2	2	2	3	6	1	4	4	
	OYOROKOTO	1	3	3	1	3	3	1	1	1	2	3	6	3	3	9	1	2	2	2	3	6	4	3	12	2	3	6	3	3	9	1	2	2	3	3	9	1	4	4	
	EBUKUMA	1	3	3	1	3	3	2	2	4	2	3	6	4	4	16	2	2	4	2	3	6	3	3	9	2	3	6	3	3	9	1	2	2	2	2	4	1	4	4	
	ASARAMA AMA	1	3	3	1	3	3	2	2	4	2	3	6	3	3	9	1	2	2	2	3	6	3	3	9	2	3	6	3	3	9	1	2	2	3	3	9	1	4	4	
	AMA-EKUT	1	3	3	1	3	3	1	1	1	2	3	6	3	3	9	1	2	2	2	3	6	3	3	9	2	3	6	3	3	9	1	2	2	2	3	6	1	4	4	
	AMA SUNDAY	1	3	3	1	3	3	2	2	4	2	3	6	3	3	9	1	1	1	2	3	6	3	3	9	2	3	6	3	3	9	1	2	2	3	3	9	1	4	4	
	AMAOKE	1	3	3	1	3	3	2	2	4	2	3	6	2	3	6	1	2	2	2	3	6	3	3	9	2	3	6	3	3	9	1	2	2	3	3	9	1	4	4	
	EGBOMU	1	3	3	1	3	3	2	2	4	2	3	6	3	3	9	2	2	4	2	3	6	3	3	9	2	3	6	3	3	9	1	2	2	2	3	6	1	4	4	
ASARI TORU	ABALAMA	3	3	9	3	3	9	2	2	4	2	3	6	3	3	9	1	2	2	2	3	6	3	3	9	3	3	9	2	3	6	1	2	2	2	2	4	1	4	4	
	KRAKRAMA	3	3	9	3	3	9	2	2	4	2	3	6	3	3	9	1	2	2	2	3	6	3	3	9	3	3	9	3	3	9	1	2	2	3	3	9	1	4	4	
	OORO-AMA	3	3	9	3	3	9	3	3	9	3	3	9	3	3	9	1	2	2	2	3	6	3	3	9	3	3	9	3	3	9	1	2	2	2	2	4	1	4	4	
	BENIBO KIRI	3	3	9	3	3	9	2	2	4	2	3	6	2	3	6	1	2	2	2	3	6	3	3	9	3	3	9	3	3	9	1	2	2	2	3	6	1	4	4	
BONNY	BUROKIRI	3	3	9	3	3	9	2	2	4	2	3	6	2	3	6	1	2	2	2	3	6	3	3	9	2	3	6	3	3	9	1	2	2	2	2	4	1	4	4	
	GREENS IWOMA	3	3	9	3	3	9	3	3	9	2	3	6	2	3	6	1	2	2	2	3	6	3	3	9	3	3	9	3	3	9	1	2	2	2	3	6	1	4	4	
	OLOMA	3	3	9	3	3	9	3	3	9	2	3	6	2	3	6	1	2	2	2	3	6	3	3	9	2	3	6	3	3	9	1	2	2	2	2	4	1	4	4	
	PETERSIDE	3	3	9	3	3	9	2	2	4	2	3	6	2	2	4	1	2	2	2	3	6	3	3	9	2	3	6	3	3	9	1	2	2	2	2	4	1	4	4	
	DEMA ABBEY	3	3	9	3	3	9	2	2	4	3	3	9	2	2	4	1	2	2	2	3	3	9	3	3	9	2	3	6	3	3	9	1	2	2	2	3	6	1	4	4
	OGWEDE	3	3	9	3	3	9	3	3	9	3	3	9	2	2	4	1	2	2	2	3	6	3	3	9	2	3	6	3	3	9	1	2	2	2	2	4	1	4	4	
DEGEMA	BAKANA	3	3	9	3	3	9	2	2	4	3	3	9	3	3	9	1	2	2	2	3	6	3	3	9	3	3	9	3	3	9	1	2	2	2	3	6	1	4	4	
	KE	3	3	9	3	3	9	3	3	9	3	3	9	3	3	9	1	2	2	2	3	6	3	3	9	3	3	9	3	3	9	1	2	2	2	2	4	1	4	4	
OGU	OGU	3	3	9	3	3	9	2	2	4	3	3	9	2	3	6	1	2	2	2	3	6	3	3	9	3	3	9	3	3	9	1	2	2	2	3	6	1	4	4	

	BELEMA-KIRI	3	3	9	3	3	9	3	3	9	3	3	9	3	3	9	1	2	2	2	3	6	4	3	12	3	3	9	3	3	9	1	2	2	2	3	6	1	4	4
OKRIKA	KALIO -AMA	3	3	9	3	3	9	4	4	16	2	3	6	3	3	9	1	3	3	2	3	6	4	3	12	2	3	6	3	3	9	1	2	2	2	2	4	1	4	4
	OGOLOMA	3	3	9	3	3	9	4	4	16	3	3	9	3	3	9	1	3	3	3	3	9	3	3	9	3	3	9	3	3	9	1	2	2	2	3	6	1	4	4
	OMOBA KIRI	3	3	9	3	3	9	3	3	9	3	3	9	3	3	9	1	3	3	3	3	9	4	3	12	2	3	6	3	3	9	1	2	2	2	3	6	1	4	4
	OKUMGBA -AMA	3	3	9	3	3	9	3	3	9	3	3	9	3	3	9	1	3	3	3	3	9	3	3	9	3	3	9	3	3	9	1	2	2	2	3	6	1	4	4
OBO- AKPOR	IWOFE WATERFRONT	3	3	9	3	3	9	2	2	4	3	3	9	4	3	12	3	3	9	3	3	9	4	3	12	2	3	6	3	3	9	3	2	6	2	3	6	1	4	4
OPOBO/ NKORO	EPELEMA	3	3	9	3	3	9	3	3	9	2	3	6	3	3	9	1	2	2	3	3	9	3	3	9	2	3	6	3	3	9	1	2	2	2	3	6	1	4	4
	MINIMAH	3	3	9	3	3	9	3	3	9	2	3	6	3	3	9	1	2	2	3	3	9	3	3	9	1	3	3	2	3	6	1	2	2	2	2	4	1	4	4
	QUEENS TOWN	3	3	9	3	3	9	3	3	9	3	3	9	3	3	9	1	2	2	3	3	6	3	3	9	1	3	3	3	9	1	2	2	3	3	9	1	4	4	
PORT HARCOURT	ELECHI	3	3	9	3	3	9	3	3	9	4	4	16	4	3	12	4	3	12	3	3	9	4	3	12	1	3	3	2	3	6	3	2	6	2	3	6	1	4	4
	BUNDU	2	3	6	2	3	6	3	3	9	4	4	16	4	3	12	4	3	12	3	3	9	4	3	12	1	3	3	2	3	6	3	2	6	2	2	4	1	4	4
	YAM ZONE	3	3	9	3	3	9	3	3	9	4	4	16	4	3	12	4	3	12	3	3	9	4	3	12	1	3	3	2	3	6	3	2	6	2	3	6	1	4	4
	REX LAWSON	3	3	9	3	3	9	2	2	4	3	4	12	4	3	12	4	3	12	3	3	9	4	3	12	1	3	3	3	3	9	3	2	6	2	2	4	1	4	4
	ENUGU	3	3	9	3	3	9	2	2	4	3	4	12	4	3	12	4	3	12	3	3	9	4	3	12	1	3	3	2	3	6	3	2	6	2	3	6	1	4	4
	CEMETARY	3	3	9	3	3	9	2	2	4	4	4	16	4	3	12	4	3	12	3	3	9	4	3	12	1	3	3	1	3	3	3	2	6	2	2	4	1	4	4



Table 6 Risk Matrix (Risk = Frequency X Severity)

FREQUENCY OF OCCURRENCE	SEVERITY OF CONSEQUENCE			
	Negligible 1	Limited 2	Critical 3	Catastrophic 4
Unlikely 1	1 LOW	2 LOW	3 MEDIUM	4 MEDIUM
Possible 2	2 LOW	4 MEDIUM	6 MEDIUM HIGH	8 MEDIUM HIGH
Likely 3	3 MEDIUM	6 MEDIUM HIGH	9 MEDIUM HIGH	12 HIGH
4 Highly likely	4 MEDIUM	8 MEDIUM HIGH	12 HIGH	16 HIGH

Source: Introduction to international Disaster, 2015

➤ *Frequency of Occurrence*

*Legend: Range of Values Verbal Interpretation:*

- 4 - Highly likely
- 3 - Possible
- 2 - Likely
- 1 - Unlikely

➤ *Severity of Consequence.*

*Legend: Range of Values Verbal Interpretation:*

- 4 - Catastrophic
- 3 - Critical
- 2 - Moderate
- 1 - Negligible

Table 7 Risk Categorization

Risk Level Rating
Low Risk
Medium Risk
Medium High Risk
High Risk

## V. HAZARD PROFILE BASED ON SAMPLED LGAS

The finding of this research analysis revealed an increase in exposure to various hazards in all the communities studied. The analysis of hazard profile over the study area reveals that the area level of exposure to hazards is high. Port Harcourt have fire, flood, security and congestion/overcrowding as mostly exposed to (Figure 1) during the period studied. In Bonny, the common hazards are flood, sea level rise, river pollution, air pollution and security problem (Figure 2), Opobo are vulnerable to flood, sea level rise, security problem, air pollution and river pollution etc. (Figure 3). There is also an upward exposure Obio Akpor communities to flood, air pollution, insecurity, fire and erosion etc. (Figure 4), Okrika are vulnerable to congestion/ overcrowding, flood, sea level rise, security problem, air pollution and river pollution etc. (Figure 5). In Andoni, Ogu Bolo, Asari Toru, Akuku Toru, Abua Odual, Degema and Ahoada, the common hazards are flood, sea level rise, river pollution, air pollution and security problem etc. (Figure 6,7, 8, 9, 10, 11 and 12) respectively. This implies that the study LGAs are exposed to numerous hazards.

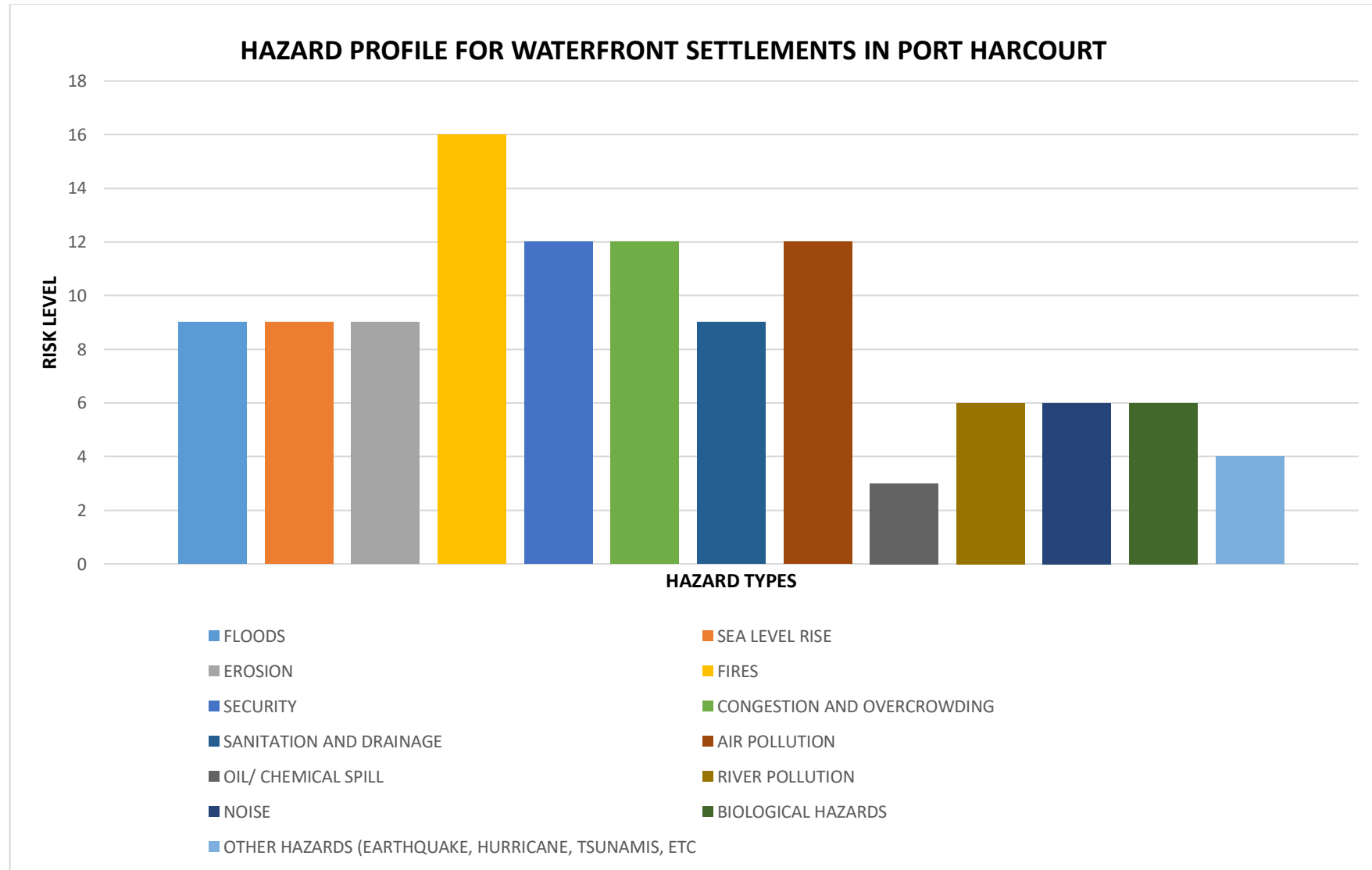


Fig 3 Hazard Profile for Waterfront Settlements in Port Harcourt

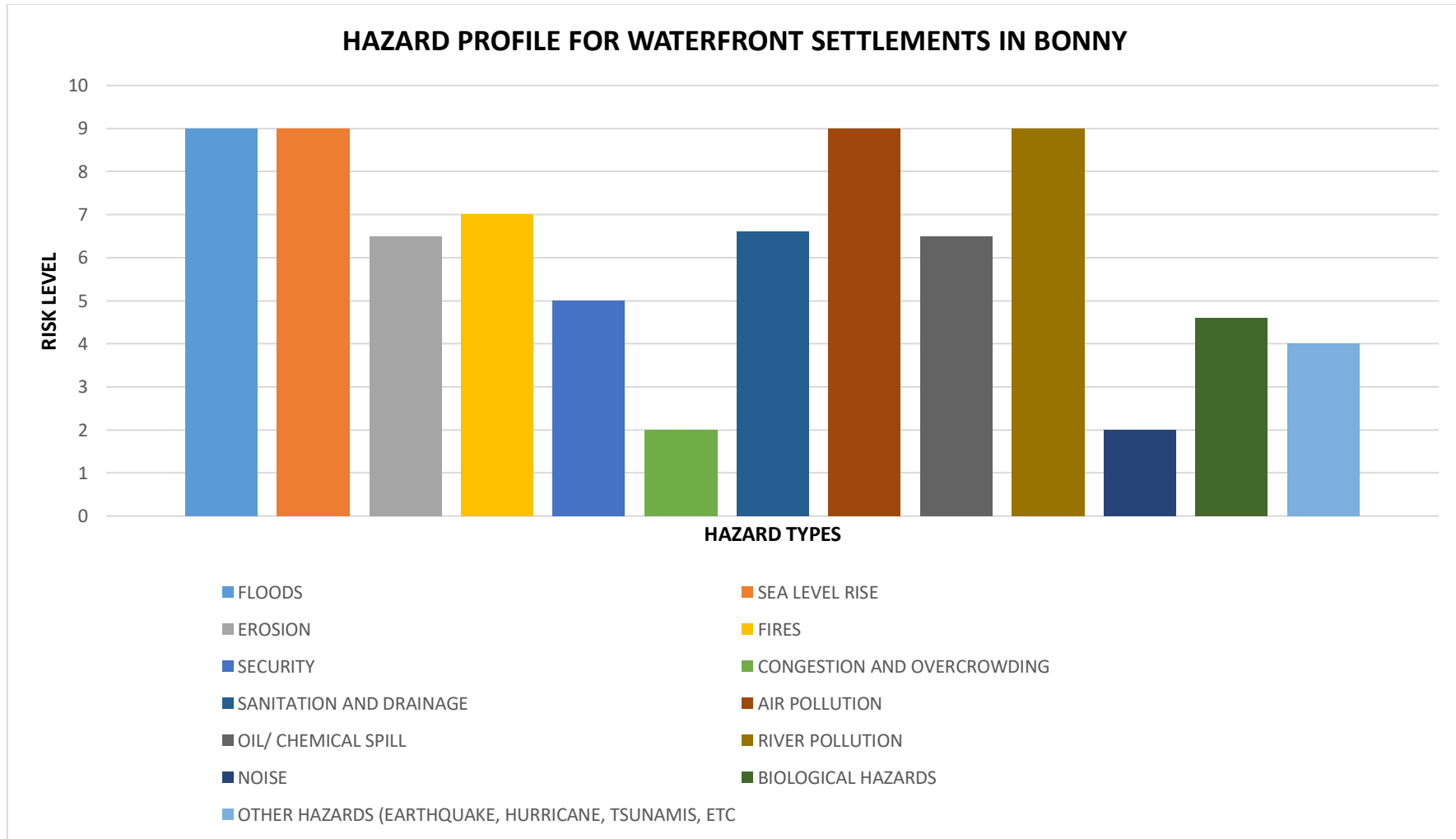


Fig 4 Hazard Profile for Waterfront Settlements in Bonny

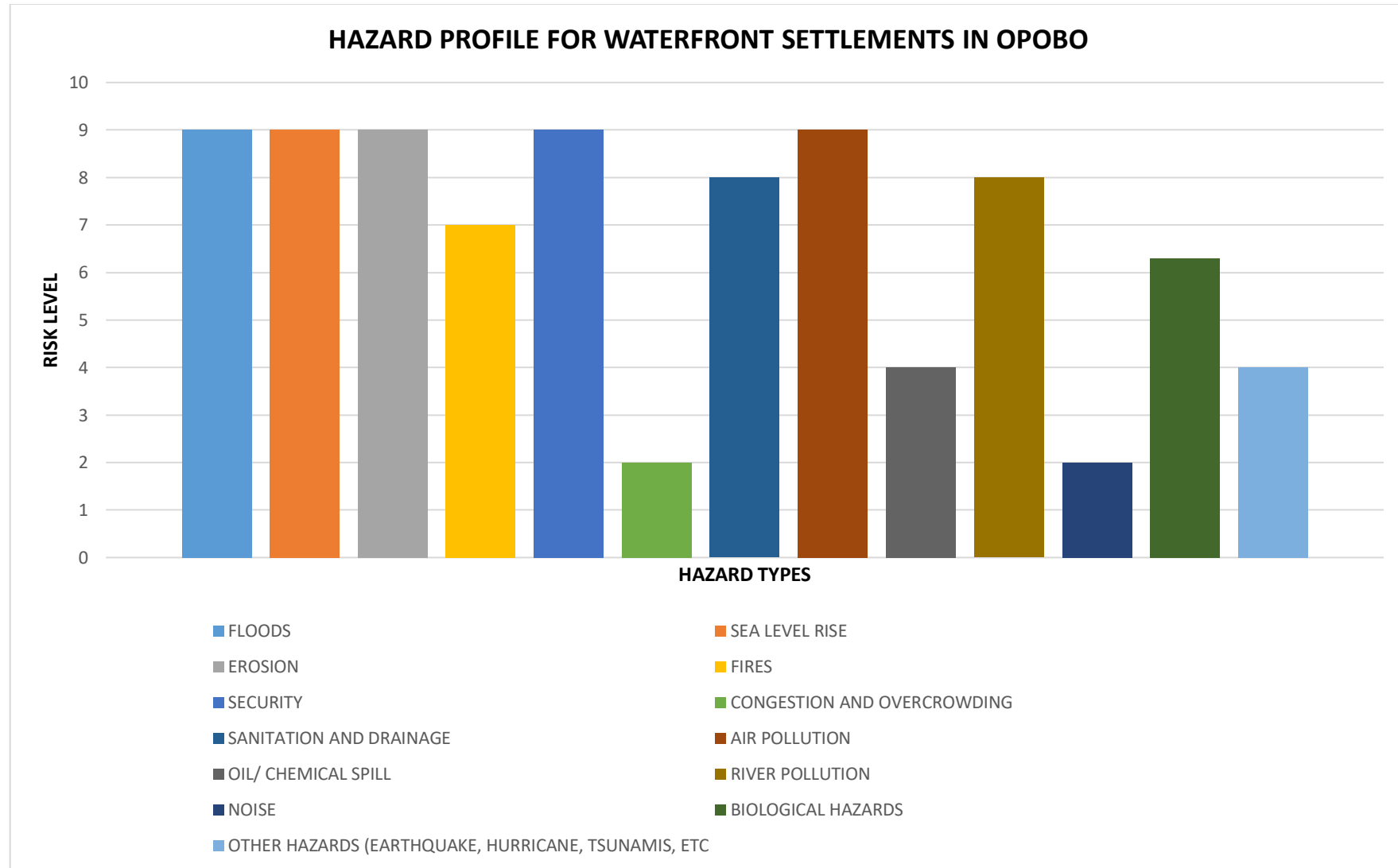


Fig 5 Hazard Profile for Waterfront Settlements in Opo

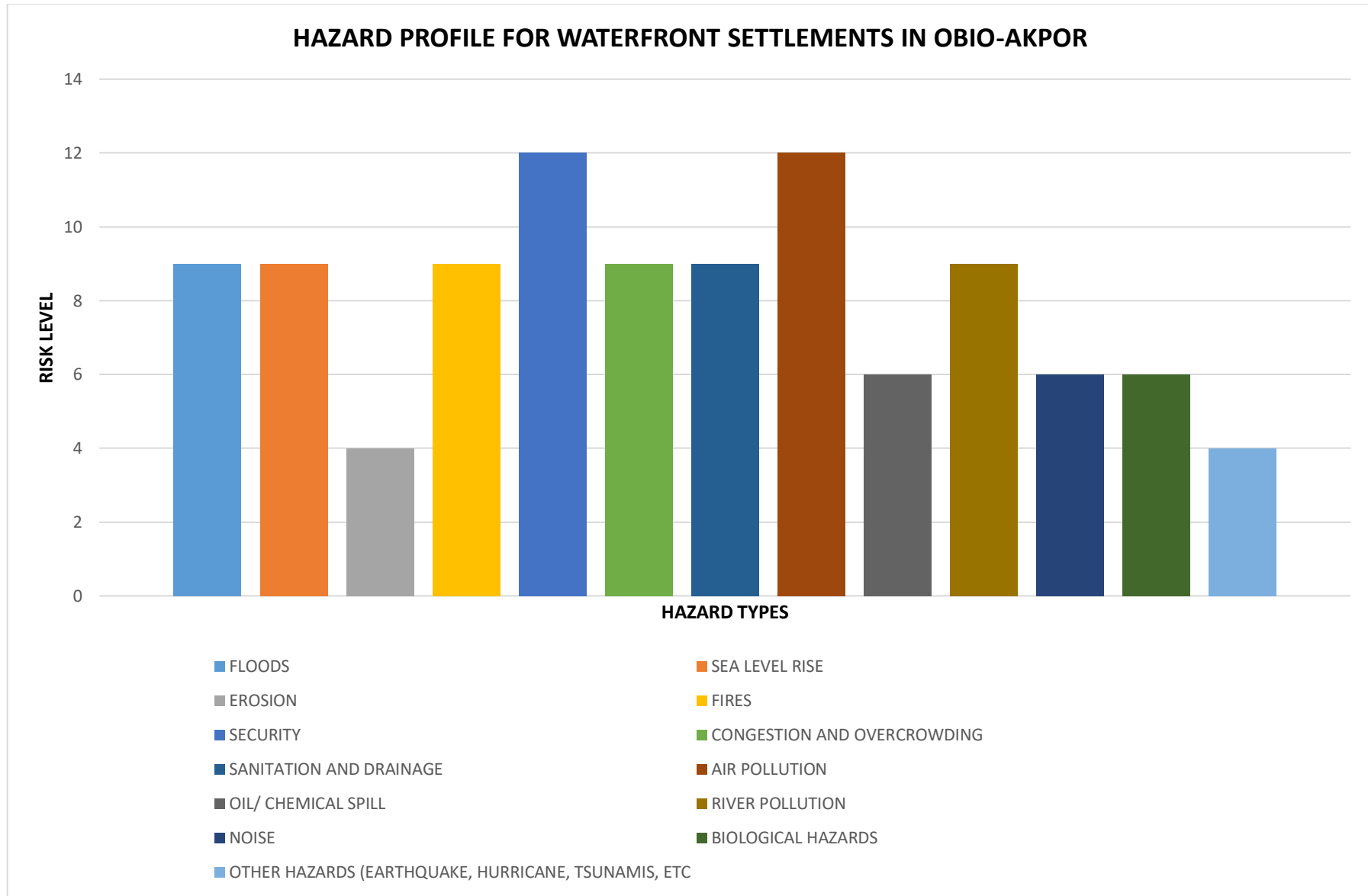


Fig 6 Hazard Profile for Waterfront Settlements in Obio Akpor

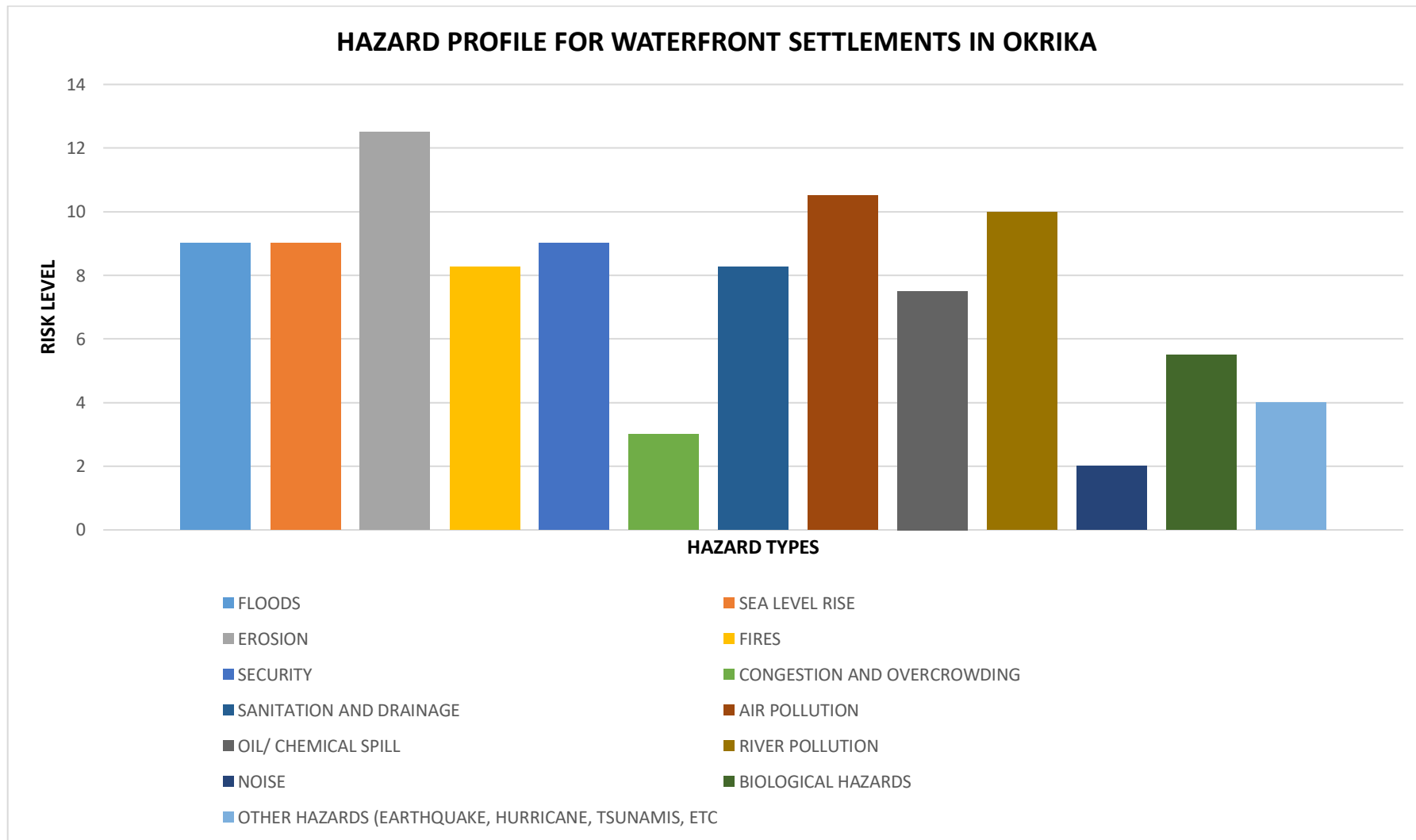


Fig 7 Hazard Profile for Waterfront Settlements in Okrika

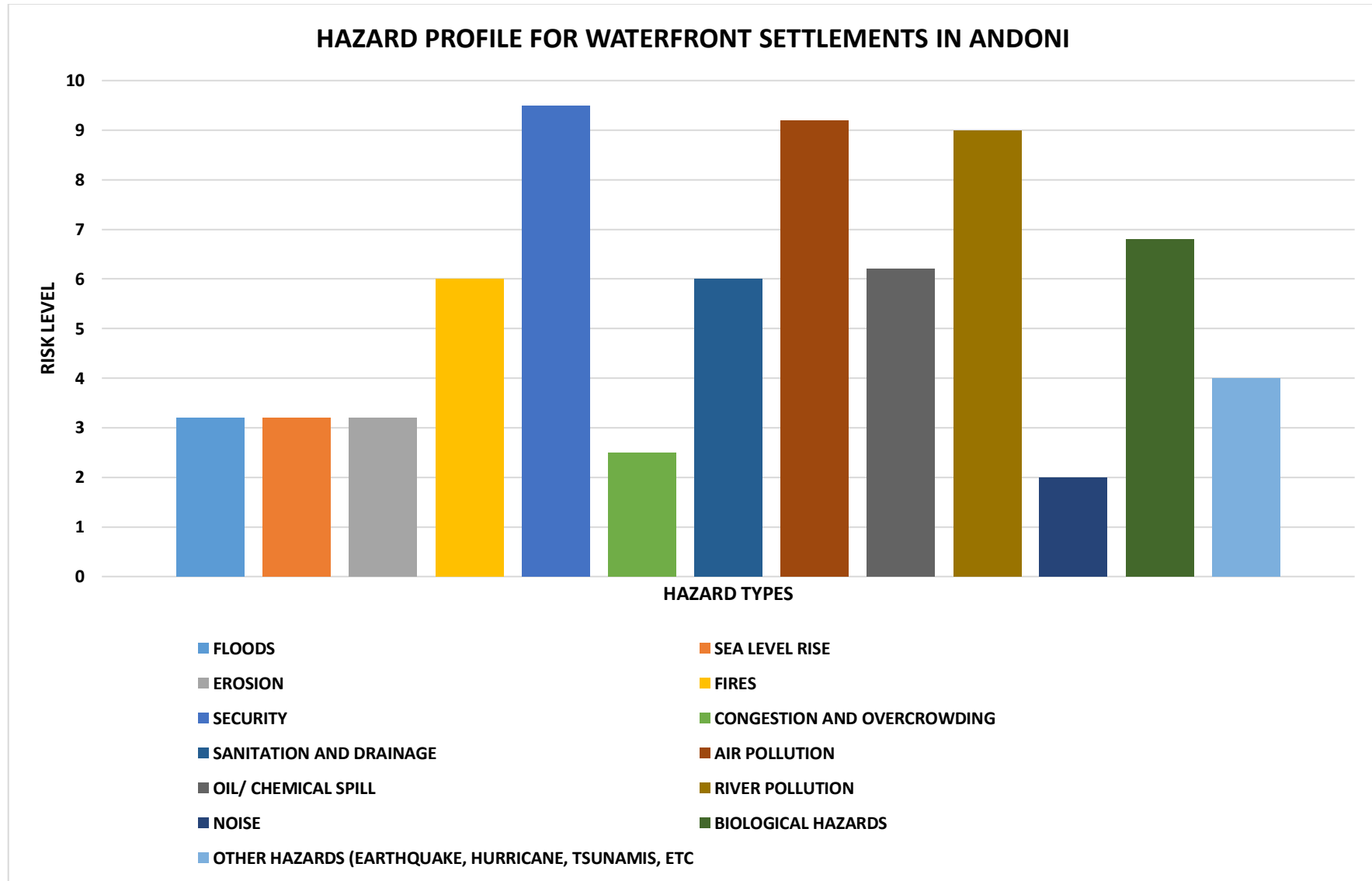


Fig 8 Hazard Profile for Waterfront Settlements in Andoni



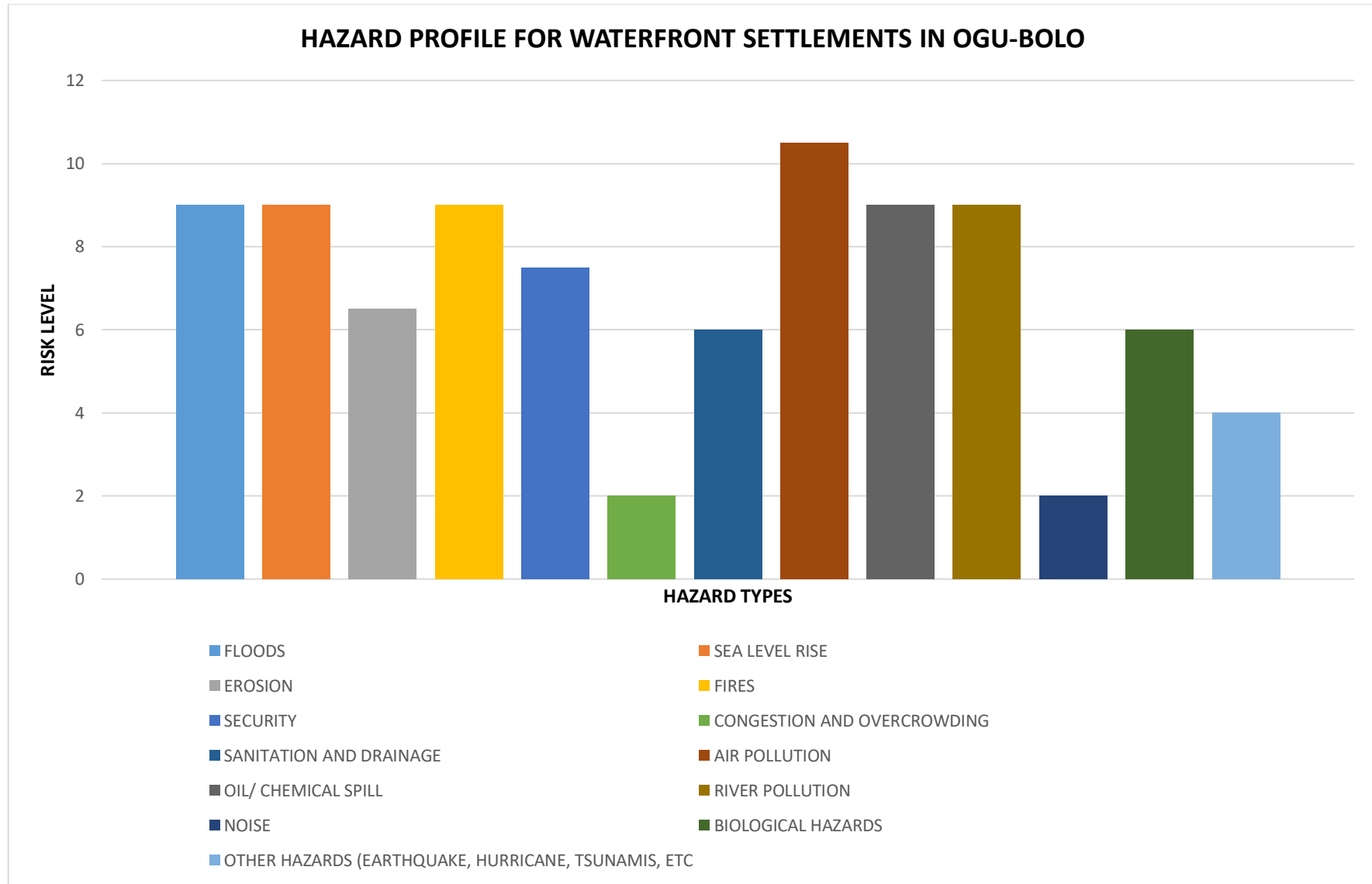


Fig 9 Hazard Profile for Waterfront Settlements in Ogu Bolo

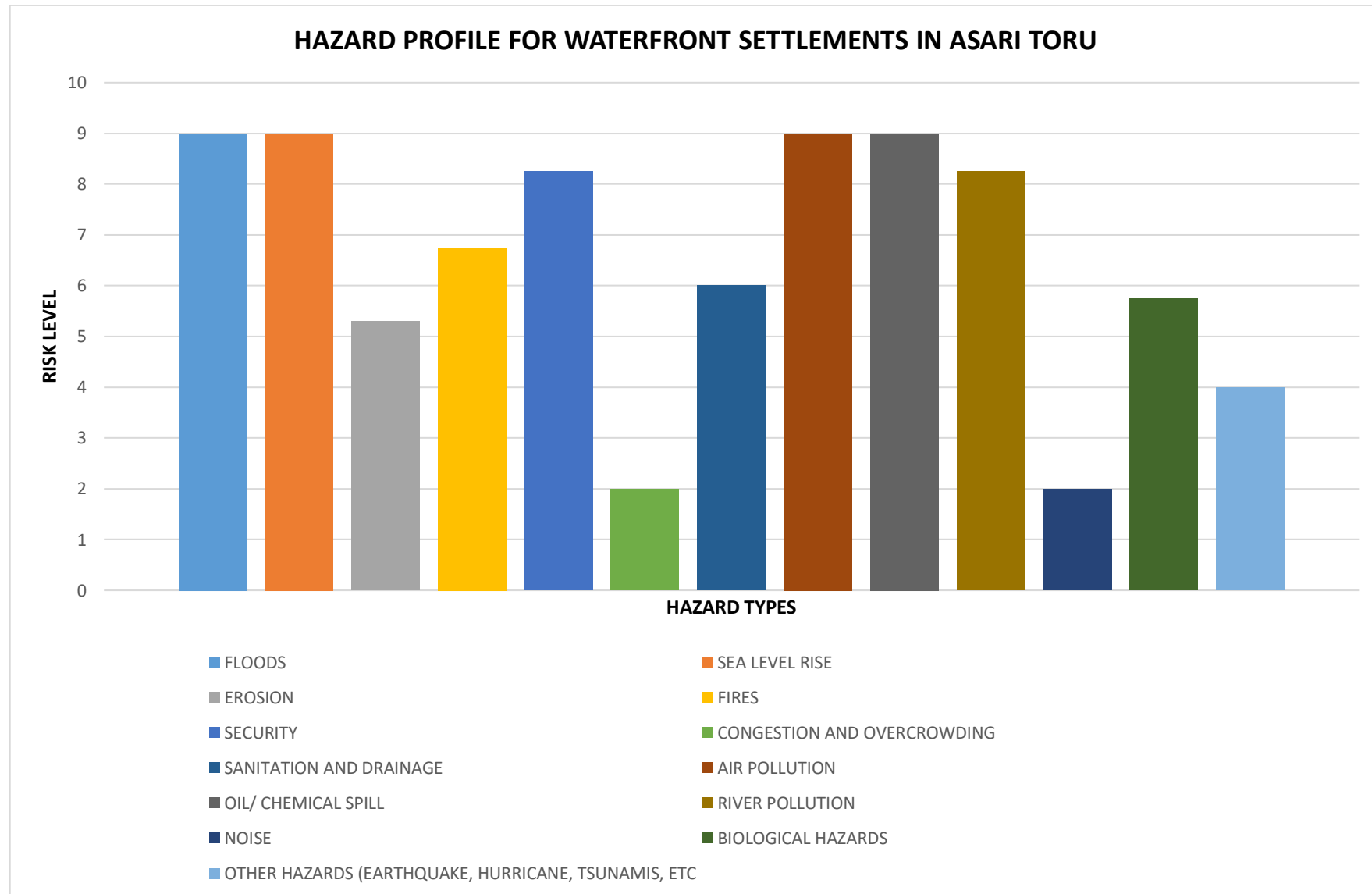


Fig 10 Hazard Profile for Waterfront Settlements in Asari Toru

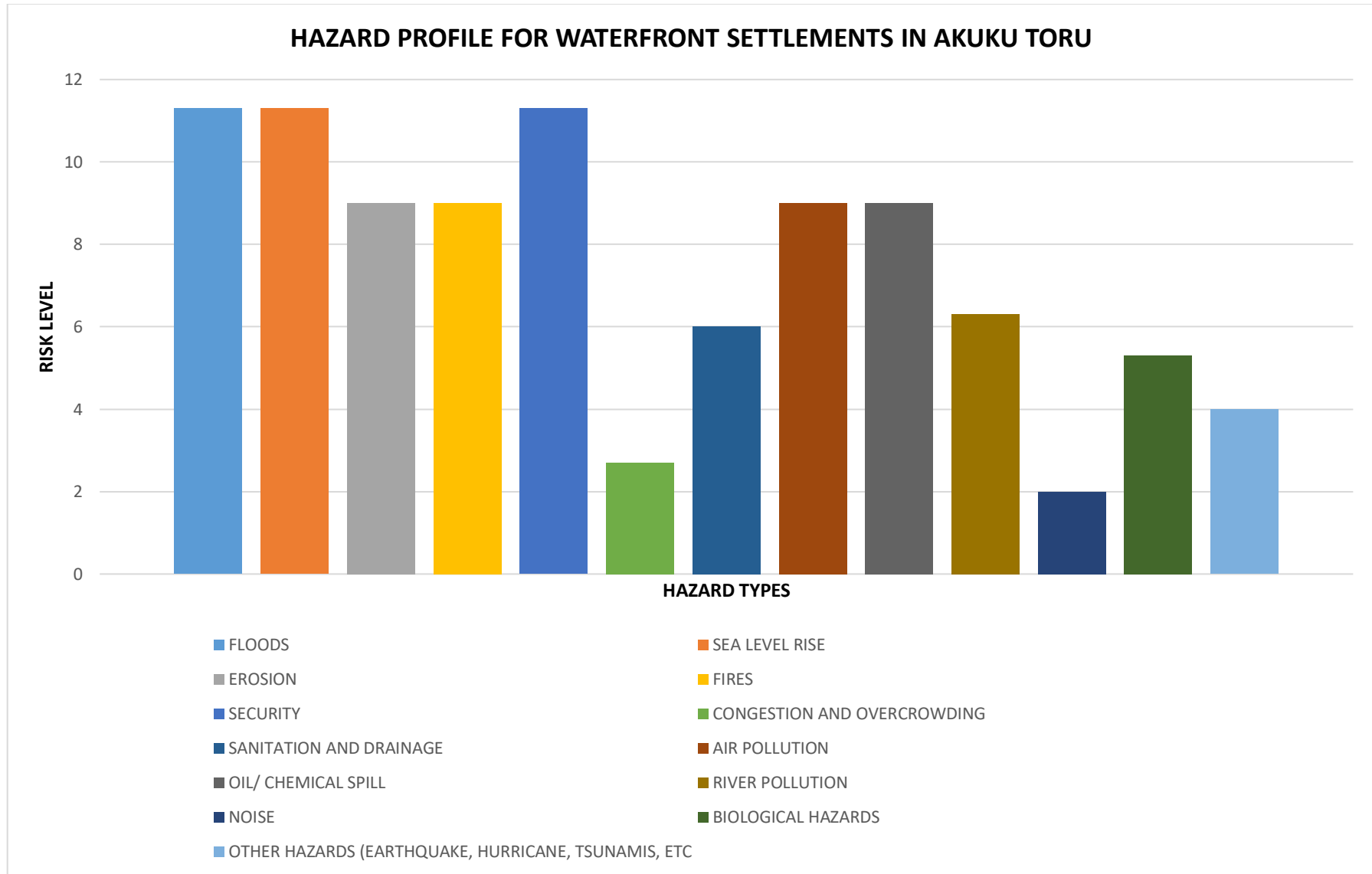


Fig 11 Hazard Profile for Waterfront Settlements in Akuku Toru

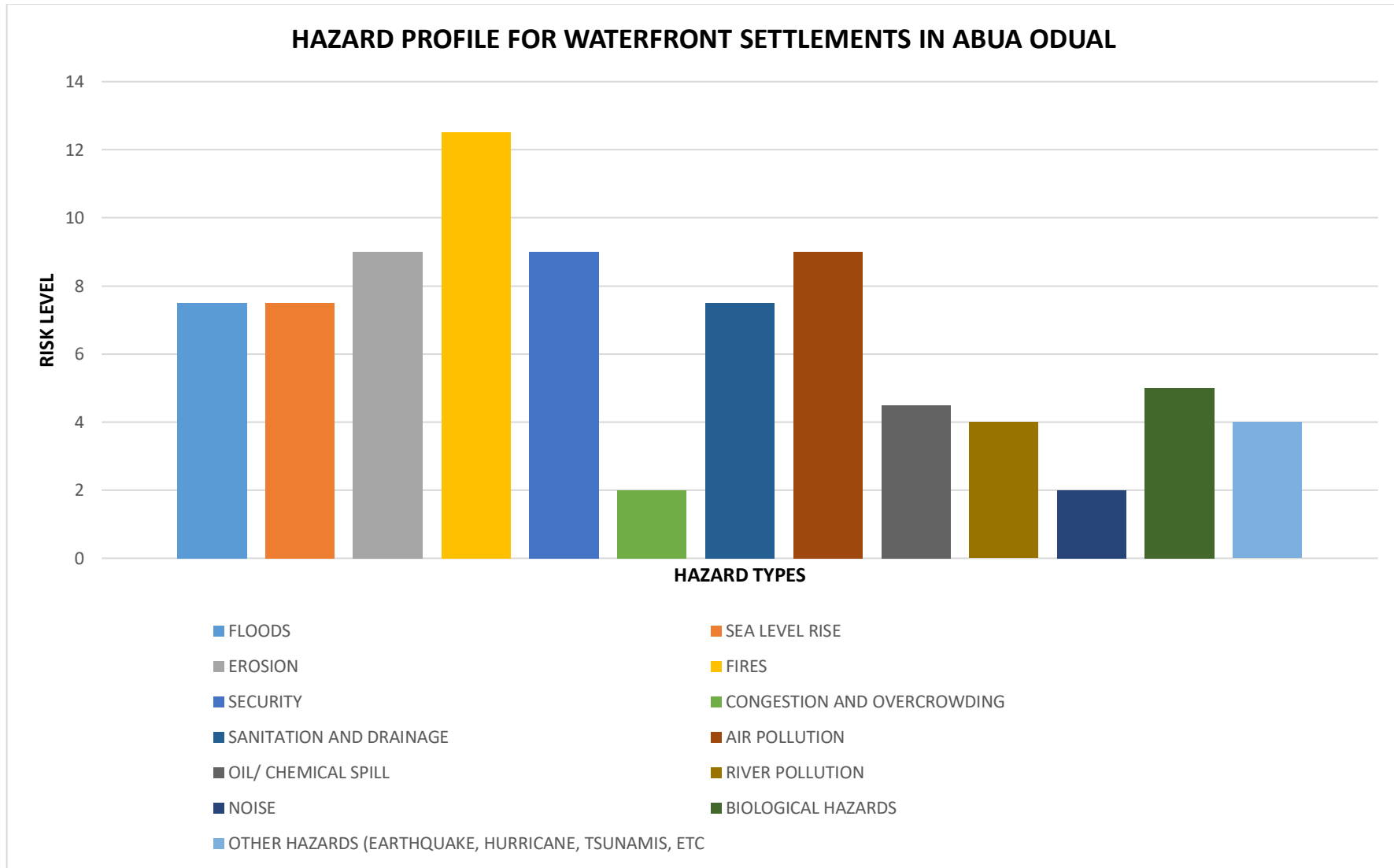


Fig 12 Hazard Profile for Waterfront Settlements in Abua Odual

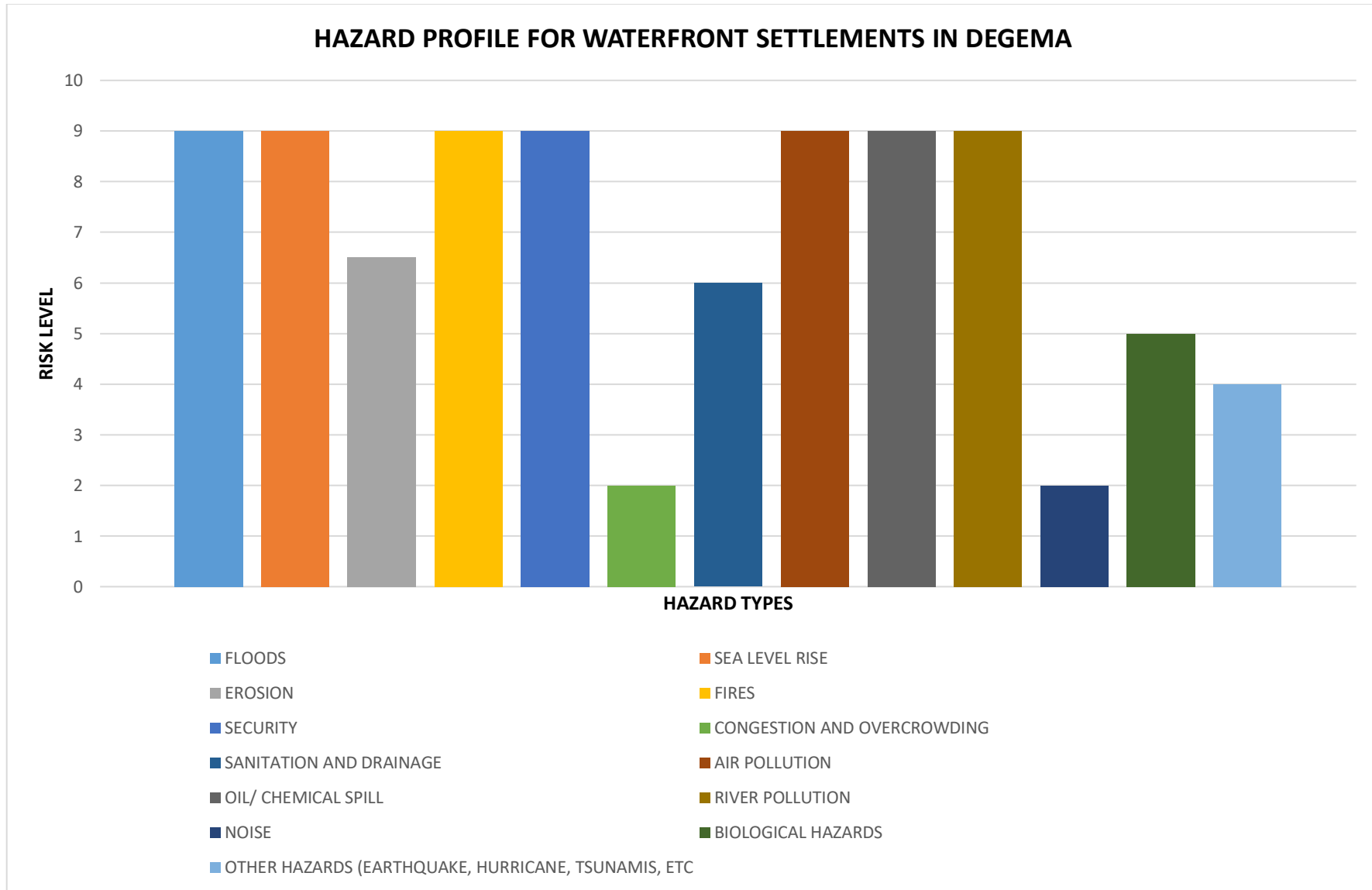


Fig 13 Hazard Profile for Waterfront Settlements in Degema

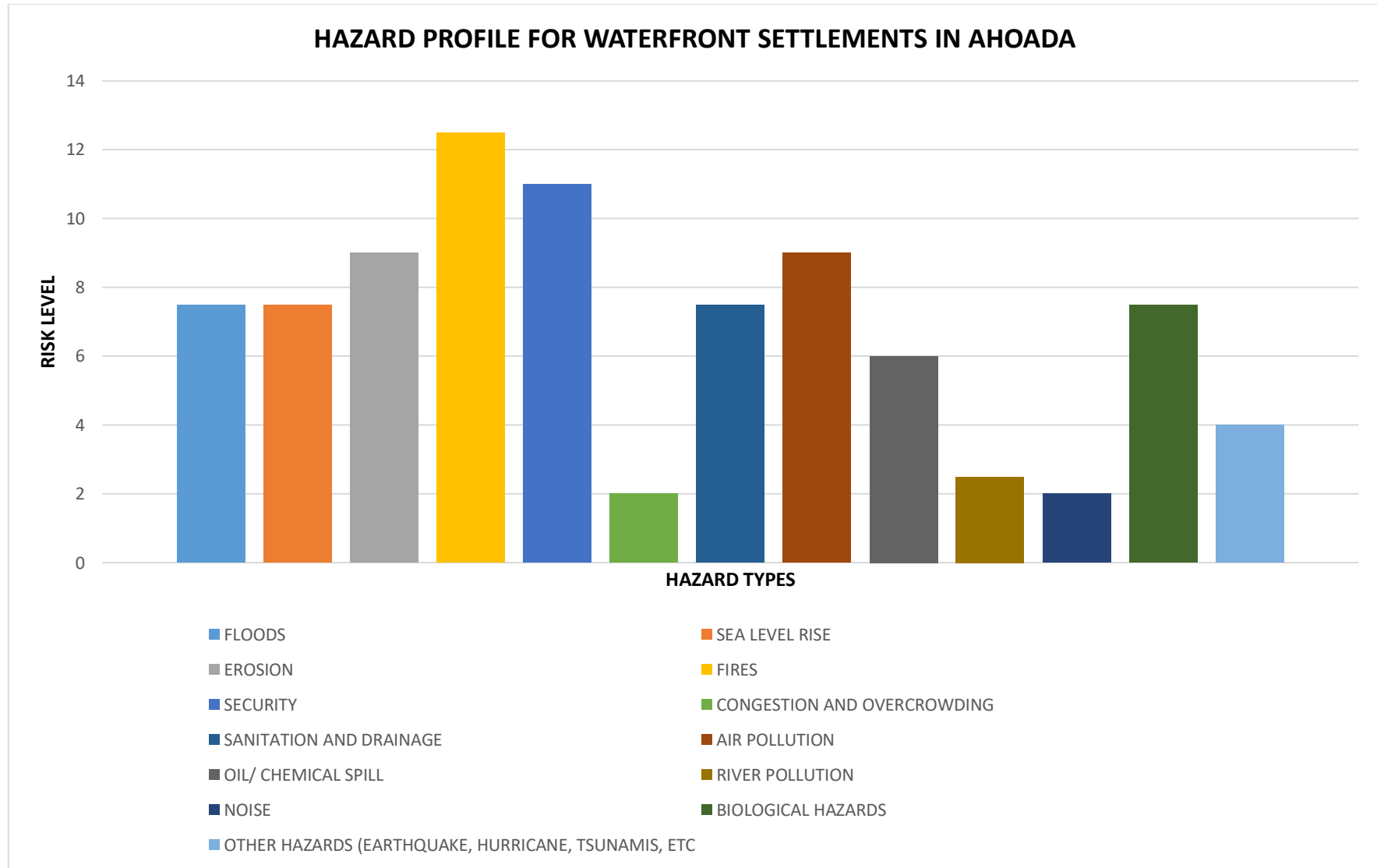


Fig 14 Hazard Profile for Waterfront Settlements in Ahoada

## VI. CONCLUSION AND RECOMMENDATIONS

The findings on the respondents' knowledge of hazards reveals that the majority of the respondents indicated that their knowledge level of hazards was good. In addition, Air pollution, criminal activities, flood, fire and congestion and overcrowding were reported as the major hazards, waterfront informal settlements are exposed to.

The finding of this research analysis also revealed an increase in exposure to various hazards in all the communities studied. The analysis of hazard profile over the study area reveals that the area level of exposure to hazards is high.

Based on the findings of the study, it can be concluded that: Most waterfronts informal communities in Rivers State had experienced hazardous events and therefore the awareness level in the region was high. Air pollution, criminal activities, flood, fire, congestion and overcrowding respectively are the most hazards, waterfront informal settlements are vulnerable to.

➤ *Based on the findings of this research, the following recommendations were made:*

- Based on the identified hazards, the relevant Government and Community agencies should develop and implement effective hazard-risk-disaster management plan that is more encompassing, stating and taking into cognizance the various hazards informal waterfront settlements are prone to. This plan should be cascaded to all stakeholders including vulnerable residents and should be regularly updated.
- To reduce pathetic and life-threatening situation in the extremely vulnerable slums and waterfront informal settlements, government should frantically seek ways of tackling poverty; create jobs, adopt educational policies that is not only theoretical but informal, semiformal and practical.

## REFERENCES

- [1]. Asian Disaster Preparedness Centre, (2004). *Reducing fire threat to homes: Piloting community-based fire risk assessment in Ban Hatsady Village*: Asian author.
- [2]. Giddings, W. S. (2013). Proposal for a New USAID approach to programming for the urban poor
- [3]. Konadu-Agyemang, K. (2001). A survey of housing conditions and characteristics in Accra. *Habitat international*, 25, 15, (34) 15-34.
- [4]. Lerise, F., Meshack, J., & Kiunsi, R. (2004). *Community initiatives in managing urbanization and risk accumulation processes: Lessons from Dar es Salaam*. Tanzania.
- [5]. National Disaster Management Organization, (2013). *Reports: Technical advisory committee reports for 2013, relief and reconstruction*. Unpublished report 2013, NADMO Accra
- [6]. National Population Census (NPC) (1991): The 1991 Census report
- [7]. Nguluma, M. H. (2003). *Housing themselves: Transformations, modernization and spatial qualities in informal settlements in Dar es Salaam, Tanzania*. Built environment analysis, Stockholm.
- [8]. Niger Delta Development Commission (NDDC) Act (2000).
- [9]. Obafemi A. & Odubo, T. (2013) Waterfront Redevelopments in Port Harcourt Metropolis: issues and socio-economic implications for urban environmental management. *The International Journal of Engineering and sciences*, (2) 01-14.
- [10]. Pharoah, P. (2009). High-Frequency Low-Penetrance Alleles. In: Welsch, P. (eds) *The Role of Genetics in Breast and Reproductive Cancers*. Cancer Genetics. Springer, New York, NY. [https://doi.org/10.1007/978-1-4419-0477-5\\_11](https://doi.org/10.1007/978-1-4419-0477-5_11)
- [11]. Swanepoel, H. and De Beer, F. (2014). *Community development: Breaking the cycle of poverty*. Lansdowne, Caep Town, South Africa.