SLURC/DPU Action-Learning Alliance
Understanding urban risk traps in Freetown

MSc Environment and Sustainable Development

Practice Module 2017-18

POLICY BRIEF No 2. Urban Risk Trap: Fire Dynamics in Freetown's Informal Settlements

Key points

- The cycle of poverty and urban risk traps are interconnected: the combined result of socio-economic and spatial injustices within the city continuously reproduce risk.
- Despite a lack of quantitative and georeferenced data on fires, using qualitative data also gives an understanding of what drives and exacerbates fire, and do not limit our analysis to fire outbreaks itself.
- Difference in access and distribution of energy sources in Freetown create different levels of participation in society and thus recognition, this results in the cycle of energy poverty of households and therefore the reproducing risks of fires.
- Neo-liberal approaches to housing failed to recognize the need of a growing poor population and forced residents to settle in hazardous zones. Improving housing quality in informal settlements is a necessary step toward risk mitigation.
- Poor infrastructural provision and inadequate, or difficulty in accessing resources limit the ability of various stakeholders to act thereby contributing to perpetuate risks associated with fire disasters within Freetown, particularly its informal settlements.

Susan Bay Fire- Sierra Loaded, 2017

Summary

This policy brief aims to understand the cascading effects that contribute to the production and reproduction of residential fires in the informal parts of the city. By using an environmental justice framework, we will discuss which factors drive and exacerbate fires through examining the underlying causes of maldistribution, recognition and participation. Moreover, we will seek to explain why vulnerability and exposure to fire are higher in informal settlements, in contrast to the rest of the city.

Authors

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Introduction

Devastating fires have been a global trend in urban centers overtime. Nowadays, large fire outbreaks are mostly localised in urban centers in low and middle-income countries, and especially in informal settlements (Johnson 2010). Their causes and impacts are often understudied, despite causing significant loss and affecting livelihoods on a regular basis. According to DesInventar Database, between 2006

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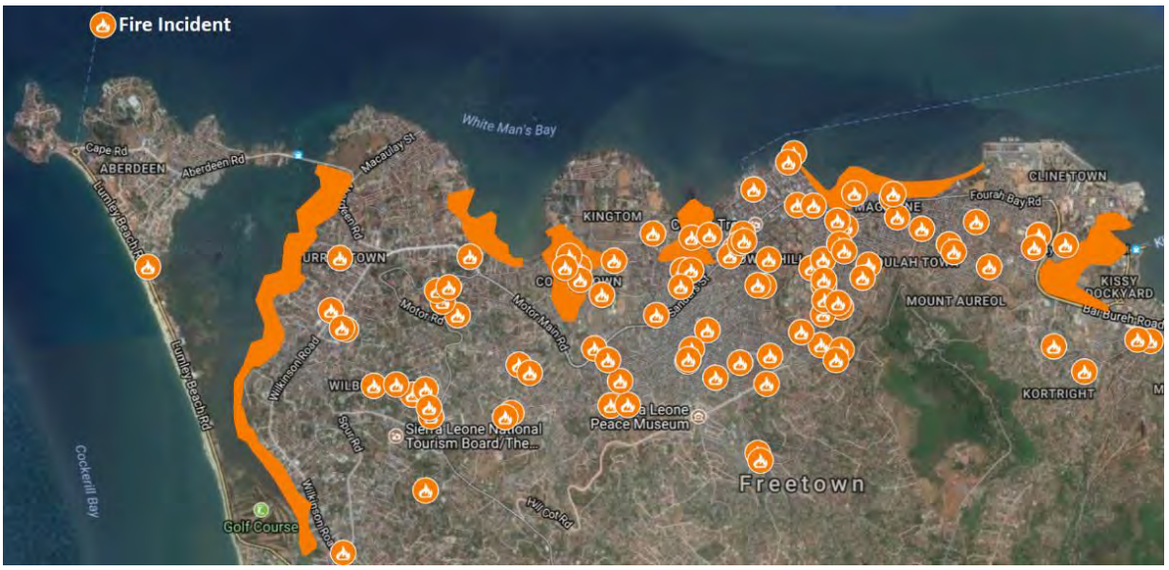
and 2009, in Freetown, fire outbreaks were the cause for the largest material losses, accounting for 65% of houses being destroyed or damaged (Twigg et al. 2017). Although fire can take different forms in Freetown, such as waste disposal fires, wildfires, or politically motivated fires, residential fires are the most prevalent. The Fire Department recorded 547 fires between 2011 and 2015, 476 of them were residential (Osuteye, 2017).

Therefore, this policy brief will focus on residential fires. Sierra Leone's Disaster Risk Management (DRM) approach does not address the full spectrum of risk. Despite their important prevalence, small scale everyday-hazards have often been unreported or not acknowledged by local governments (Allen et al 2017). The common trend in research for fire risks in cities in the Global South illustrates that fires are more prevalent in the informal parts of cities (Twigg et al., 2017; Johnson, 2010). By assessing available data on fires in Freetown, we saw a different representation. By mapping data from DesInventar (UNISDR, 2018) to visualise the spatiality of fires in Freetown, we can see an increase in the number of fires outside the informal parts of the city, contradicting analysis done in different cities (See Map 1). Through discussions and research on the ground in Freetown,



Map 1. Fire Incidents in Freetown

we found that DesInventar only represents a proportion of the fire events reported. Drawing from academic and non-academic research we found that fires in the informal parts of the city seem to be more severe in term of damage and devastation. Therefore we have concentrated our research on qualitative material, to assess why this is the case. This policy brief will therefore firstly analyse the well documented residential fire events in Freetown and highlight commonalities. By looking at the case of Susan's Bay in depth, we will reflect on underlying causes of fire. Three particular underlying causes will be identified: energy poverty, housing and inadequate infrastructure. Each of them will be discussed in order to explain how the development of these issues has led to the creation of an urban risk trap, where the risk of fire keeps being reproduced overtime. The time frame used for the analysis of these factors varies, as do the determinants for when hazards became threats. But the civil war seems to be a pivotal moment for all three factors.

Section 1- Fire Events in Freetown

We have analysed the well documented residential fire events in Freetown to understand the common factors that influence fire events in the informal parts of the city. Fires in Freetown are mainly small-scale, but through assessing the large-scale fire events, it makes it easier to unveil and assess the vulnerabilities and hazards, as the consequences are amplified. Table 1 illustrates four different cases and addresses facts such as the cause of the fire, the number of people who were affected, the number of buildings that were destroyed, the building materials, the distance from infrastructure and the date when these events happened. Observing the table, lack of information in some indicators in the cases of Falcon Bridge and Bismark Johnson informal settlement in Congo Town are evident. These two outbreaks happened in 2012 and 2013 respectively, and no records could be found. Besides that, we notice that in all cases the outbreaks happened in informal settlements where the housing materials are corrugated iron or metal sheets (CODOHSAPA and FEDURP, 2011). In Susan's Bay and Angola Town the cause of fire was related to energy related issues, and quickly spread to neighboring houses. In Angola Town, 1,500 were affected, among them 225 children and 85 mothers relocated temporarily in Don Bosco Fambul (ANS, 2016). Moreover, it is noticeable that in all cases the distance from the infrastructure (i.e. hydrants), is 0-5 km which indicates that the outbreaks happened in areas which are close to hydrants (EuropeanAid 2014). Nevertheless, many of them were out of order (Awoko.org, 2017). We will focus on the fire in Susan's Bay, as this settlement also shares similar factors of concern related to fires as other informal settlements in the city.

Susan's Bay

We have decided to assess the case on the informal settlement of Susan Bay to examine in depth the factors that had contributed to the devastating fire of

Name of the area / Informal Settlement	Cause of fire	Number of people affected	Number of buildings destroyed	Building Materials	Distance from closest infrastructure (km)	When the outbreak happened
Susan's Bay	Cooking fire	2048	200	Corrugated iron sheet	0-5	03/04/2017
Angola Town	Electrical fault or unattended fire	1500	40	Corrugated iron sheet	0-5	01/12/2016
Falcon Bridge	-	257	31	Corrugated metal sheets	0-5	13/02/2012
Bismark Johnson, Congo Town	-	56	5	-	0-5	07/05/2013

Table 1. Fire outbreaks in Freetown

2017. This will reflect an overall better understanding for the other informal settlements in Freetown and highlight the deeper causes of fire events. Susan's Bay (SB) is an informal settlement located on the seashore in Freetown. It was established in the 1800s. In March 2017, one quarter of Susan's Bay population, 2048 people, were affected by a large fire. The cause of the fire was reported to be a cooking fire triggered by someone who was cooking with a locally made stove on their veranda (Jabby, 2018).

Susan's Bay housing conditions share common characteristics with other informal settlements across Freetown as can be seen in Table 2. There are low rates of housing ownership, with 73% of tenants renting from 'slumlords'. Lack of ownership, results in poor quality housing materials being used that require minimum investment by the landlords and poor to no maintenance at all. The housing materials helped propagate the recent large fire during which bricked houses were broken down and unroofed to prevent further fire escalation. Even with secured tenancy the people of SB claim that they cannot invest in their homes due to their restricted income. They also claim that they cannot pay more rent irrespective of the dwellings being upgraded. However, with change in ownership, if the dweller owns the unit, the ability for credit increases that can then be used for improvement. (CODOHSAPA and FEDURP, 2011) The majority of tenants rate their housing conditions very poor. Regardless, more than 50% of residents chose SB as their home because they have family or friends that they can stay with. This way they pay reduced rent and overcome the unaffordability of the housing market. SB is unique among other informal settlements in Freetown regarding demographics as it is a traditional Temen Muslim community (93% of tenants) (CODOHSAPA and FEDURP, 2011). This increased the capacity of the residents to cope after the fire, with most of the seeking accommodation within SB and support from their local social network and religious institutions. (Emmanuel, 2017). Susan's Bay energy use patterns reflect the usage in other informal settlements in Freetown, with 15.6% of households using an electricity connection for lighting but 70% using flammable kerosene. The majority 93% of households use charcoal and firewood for cooking and heating up water. The population density in SB is 962 peoples per hectare. According to a survey approximately 50% of SB residents claimed that internal and external congestion is the main housing problem they face. Most dwellings only have one room where all activities take place so the fire affected all aspects of their lives. External congestion and the lack of roads with vehicular access did not allow emergency services to act and limit damages. (CODOHSAPA and FEDURP, 2011)

Different socio-economic factors play a role in the ability to reduce or exacerbate the risk of fire. From this case study,

Susan's Bay- Similarities to informal settlements in Freetown	Susan's Bay- Differences from other informal settlement in Freetown
The majority of residents in informal settlements are poor, thus unable to afford good quality housing. The poor quality housing is not protective against many hazards such as bad weather. Informal settlements have inadequate basic service provision, water and sanitation, infrastructure etc. The structures' proximity and number create congestion and dwellings are overcrowded. The land it occupies is a hazardous location i.e. the seashore. Residents are commonly stigmatised, misrecognized and unable to participate in formal processes. Livelihoods are dependant on the informal economy. Most residents work in the informal sector. Informal settlements have strong social groups and alternative organisation structures.	Other settlements have a more diverse social demographic, unlike Susan's Bay (majority of residents are Temenes and muslims). Residents' needs differ, as do the organisational and religious structures. Other settlements are located in different hazardous areas such as hills and river basins in Freetown. Settlements in Freetown vary regarding layout, access to basic services, building materials and congestion. Greybush has higher quality housing, with walls made of cement and concrete floors. Susan's Bay residents mostly own informal small-scale businesses, however in other settlements the residents work in other economic sectors and/or activities.

Source: Table 2. Susan's Bay similarities and differences with other informal settlements

energy poverty, low-quality housing, and problematic access to infrastructure seems to be important factors explaining the prevalence of fire. An analysis of how these factors affect the production and reproduction of risk at the city-level, follows.

Section 2- Why are the Factors Housing and Urbanization, Energy Poverty, and Infrastructures Driving and Exacerbating Fires?

This section will explain why the drivers of energy poverty, housing and inadequate infrastructure produce and reproduce the risk of fires in the informal parts of the city, who are most affected, how they have evolved through time and potential mitigations.

Energy poverty

Why Energy Poverty Increases the Risk of fires.

Fire risks in informal settlements are primarily generated by socio-economic conditions, while triggers mainly stem from energy poverty, such as the reliance of low-income residences on cheap but hazardous sources of energy, particularly candles, kerosene stoves, hearth fires and illegal and dangerous electricity connections (Earthscan, 2009). The use of these fuels results in an increased risk of fires due to their combustibility, inefficiencies, unsafe practices and technologies (Earthscan, 2009). For example with electricity, due to the cost and lack of formal electricity supply, residents illegally connect to the electricity network resulting in live and often exposed wiring. When this wiring comes into contact with metal it can create sparks resulting in the combustible buildings material catching fire and rapidly spreading due to the density of buildings (Twigg et al., 2017). There are also hazards such as households using inadequate electricity equipment and too many items plugged into one power supply, where it warms up until it reaches the ignition temperature of the material and resulting in fires (Gooding, 2017). Another example is the use of kerosene for lighting with unsafe stoves and practices. A study by the University of Johannesburg researching into the effects of energy poverty and fires in informal settlements, found that fires mostly originate from knocked over candles and/or paraffin stoves and spread quickly due to the high density of dwellings (Kimemia, 2012), research also suggests that fires from these fuels in informal settlements are often linked to factors such as alcohol abuse and domestic violence (Earthscan, 2009).

Charcoal and wood for cooking are also fire hazards mainly due to the quality of wood stoves, space constraints in a shack dwelling, and lack of awareness on the safe use of modern fuels (Kimemia, 2012).

Energy Sources Used in Freetown and Why These Sources are Used.

Traditional uses of biomass, mainly in the form of charcoal and firewood dominate the energy mix for household cooking needs in Freetown, with 72.7% using charcoal and 26% using firewood. Kerosene, LPG and electricity account for less than 1% each for cooking needs (RECP, 2018). The wood energy situation has transformed dramatically over the past decade. Since the end of the civil war, there has been a significant increase in charcoal production nationally and in charcoal consumption in Freetown (RECP, 2018). Wood stoves are rare in Freetown; the three stone fires predominates with firewood using households (RECP, 2018). The fire chief in Freetown states the dangers of using the three boulder fires as sparks often fly off and if they get in contact with combustible material result in severe fires (Gooding, 2017). Charcoal stoves are more commonly used with all charcoal consumers, with the traditional all-metal stoves being most commonly used and more recently the increased use of "wonder stoves" which are much safer and efficient (RECP, 2018). It has been difficult to find current data on households energy needs for lighting, but the consensus seems to be that most people rely on kerosene lamps, candles or cheaply made battery powered plastic lights with batteries (Gooding, 2017). A study in 2004 found that the percentage of households who used any source of energy for lighting would mainly use kerosene equating to around 61% (GOVERNMENT OF SIERRA LEONE, 2007).

The electricity sector in Sierra Leone and Freetown are severely challenged across all generation, transmission and distribution systems. The systems include vast inefficiencies, severe lack of generation and distribution capacity and a long history of volatile prices (UNDP, 2012) and Freetown was once dubbed "the world's darkest city" (ReliefWeb, 2014).

The high installation cost, tariffs and poor access to electricity make it unaffordable and inaccessible to low-income members of the city unless through illegal connections (Gooding, 2017). Many industries, as well as commercial and wealthy residential customers, have to rely on private imported diesel generators (UNDP, 2012). Those who cannot afford generators have to rely on kerosene, charcoal, wood and liquefied petroleum gas (LPG) among other energy sources. In 2011, 9.2% of Freetown's population had access to grid-connected electricity (UNDP, 2012), therefore consequently resulting in the large percentage of Freetown's low-income population having to rely on the hazardous and inefficient fuels mentioned.

The reason for the failure of the electrical grid system is largely due to the failures of the transmission and distribution networks which are more than 50 years old and which have been poorly maintained. Also, during the civil war, a large amount of the distribution lines were destroyed (UNDP, 2012). The generation capacity also dramatically fell during the civil war, and the generation capacity is still far below potential demand today. Activities in recent years have concentrated on bringing the existing network back to operation (UNDP, 2012). There have been attempts to improve the existing electricity grid system and improve access through institutional changes such as the unbundling of the National Power Authority into two separate private entities (EDSA, 2018). Progress has been made since this period, but the Ebola crisis in 2015 reduced progress in the energy sector as funding was diverted. The unbundling process has also recently resulted in extensive tariff issues in Freetown (Climatescope, 2017). In recent years Sierra Leone has attempted to embark on something of a solar revolution, at least for lighting and mobile phone charging (ReliefWeb, 2014). With these achievements and challenges, the percentage of households connected to the electricity grid had risen from 9% to 11% since 2011. Therefore there is a long way to go to electrify all of Freetown's residents (USAID, 2016). To reduce the risk of fires from reproducing in the informal parts of the city, it therefore seems more effective to concentrate on the replacement of hazardous technologies for household energy needs and where possible replacing the use of hazardous fuels. The use of solar lamps instead of kerosene for lighting if one of the most effective stop-gap solutions for energy poverty in informal settlements, as the solar lamps cost around the same as

kerosene lamps and do not require the continued cost of running (Solar Aid, 2017). By replacing the use of kerosene, it reduces the risk of fires from the combustible fuel source, reduces the negative impacts on health, increases productivity and can offset around 370kg of CO2 per year (Sylvester-Bradley, 2018). An increased use of safer and more efficient wood/charcoal cooking stoves are also another extremely effective stop-gap solution for Freetown. There isn't currently a market or easy potential for the growth of LPG fuel stoves (Natural Capital Partners, 2018) and as discussed electric stoves, therefore the use of more efficient and safe wood/charcoal stoves seems the current best solution for energy poverty and its consequences, as cooking stoves such as the Jiko stove can cost as little as 3 USD and save households around 50 USD per annum (Riley, 2014).

How the Differentiation in Access to Energy Sources has Allowed for Different Levels of Participation and Recognition and Different Levels of Fire Risk in Freetown.

Through examining the risk of fires due to energy poverty with an environmental justice lens it can allow us to uncover the differentiating realities of residents. The differning access and distribution to energy sources in Freetown creates different levels of recognition in society and thus participation as well as resulting in an unfair distribution of the burdens of fire risks.

"Access to modern forms of energy is essential to overcome poverty, promote economic growth and employment opportunities, support the provision of social services, and, in general, promote sustainable human development." (Karekezi et al., 2012).

The disparities in access to energy in Freetown results in segments of the population being able to participate more than others, for example, residents who have the capacity to use stable grid electricity or private generators can continue income generating activities whilst for households that don't, it significantly impacts there household time budgets, labour productivity and income (Bouzarovski and Petrova, 2015). This means that households ability to improve their living conditions is reduced while at the same time using significant amounts of their very limited income on expensive and unhealthy forms of energy that provide poor and/or unsafe services, therefore these factors contribute to the cycle of poverty and energy poverty of households and thus the reproducing risk of fires (Karekezi et al., 2012).

Foday Conteh, a 27-year-old student in Freetown, mentioned in a BBC interview the burden of having to study with candles and how it makes his course more difficult and expensive, as he always has to buy more candles. Foday also mentioned the increased risk of fires starting, as he once fell asleep studying and awoke suddenly in fright to find his calculator and books completely burnt (BBC NEWS, 2005). Mohamed Bah, a trader at Edwards Street, mentioned his area goes days without electricity supply and that this causes issues for his business such as maintaining refrigerators. He mentioned that his business cannot go without electricity supply and if there is no electricity he cannot make any profit (Margai, 2016).

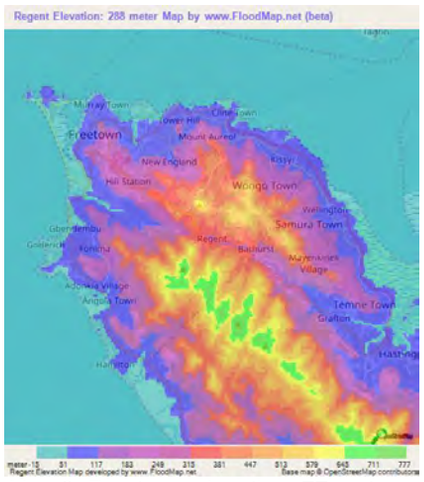
Energy poverty has other extensive health impacts for residents due to indoor air pollution such as respiratory, heart and other diseases (Bouzarovski and Petrova, 2015). It is also a highly gendered problem, with women and children bearing the brunt of the consequences of inadequate energy access. Time-pattern activities make women more vulnerable because on the whole they spent more time in the home and engaged in cooking activities (Benerjee, 1985). The poor-quality fuels women may use contribute to their time poverty, ill health, increased risk of fires and level of drudgery, all of which are indicators that economic and social development is passing women by (Benerjee, 1985). Children are the most physiologically susceptible because their lungs are growing and developing (which air pollution can stunt) and time-pattern activities. Children spend longer in the home, especially young children and children from less advantaged backgrounds whose families can't afford to send them to school (WHO, 2005).

Housing Crisis and Inadequate Planning

This part will discuss how the rapid urbanisation of Freetown and the lack of planning and institutional actors in the development of informal settlements has led to the settlements expanding in an haphazard and hazardous manner. This informality and the unplanned growth of these settlements are key factors that dramatically increase the risk of fire outbreaks due to the high density of buildings, materials and methods for constructing buildings and poor accessibility increase the dangers.

Urban Growth in Freetown

The urbanisation process is not merely explanatory of the ongoing housing crisis, but also of capital importance in understanding how fires in informal settlements, despite being often overlooked, causes such important loss. The history of Freetown differs from the rest of the country. Only Freetown was a British colony, the rest was merely a protectorate. This normative dichotomy is the primary reason why Freetown's land laws are a unicum within the country. Legally speaking, the western area is the only possible place for a freehold title (Johnson 2009). The rest of the state is communally or under leasehold. Freetown was built and planned by the British for 200,000 inhabitants and should not come at surprise that now that the population is five times bigger, the land is running scarce (Shack / Slum Dwellers International, 2010).



Map 2. Freetown elevation: 77 meter (www.FloodMap.net)

The city has grown at alarming rates in term of population and surface area. Originally, around 1893 the city was only 12.4sq Km, however it already expanded to 68 sq Km in 1973 when the Greater Freetown Metropolitan Area was created (Gleave, 1997). Today the boundary has expanded to 81.48 Km2 (CityPopulation, 2018). Table 3 demonstrates population growth in the Western Urban Area has been rapid. The most recent census estimates the population at 1,055,964, while it was only of 469,776 in 1985 and 772,873 in 2004 (Sierra Leone Statistics). Currently about 15% of the national population lives in Freetown. The actual number is probably higher as many residents live in the informal settlements and thus remain unrecorded. In a country in which more than 60% of the population makes under 1.25$/day (UNDP 2015), many move to Freetown looking for employment. (Shack / Slum Dwellers International, 2010)

Failures of the Housing Market: From state-intervention to neo-liberal policies

Shortly after independence, in the 1960s, the national government adopted a state-interventionist and redistributionist agenda. Social-housing was made a priority and a "slum clearance" program was put in place, targeting low-income segments of the population. The state charged itself as the main provider for housing, to reduce housing inequalities (Johnson 2009). This social-project got further implemented with the foundation of the Housing Corporation. The Housing Corporation was founded in 1982 to build new houses and loan money to low income families for houses and construction materials. These policies recognised that housing required important investment and thus required state-intervention to break out of poverty (Rogers 2016). However, in the 1970s reports from international organisation such as UNDP and World Bank, emerged, pushing for restrictions in public spending, and the need to provide incentives for market-led housing. Thus, a shift in policy making happened in the second half of the 1980s. The state moved away from interventionist policies and started providing subsidies for private housing projects (Rogers 2016). These different housing policies have been insufficient to provide quality housing to the poor. Even in 1991, Freetown was highly congested, and housing was of low quality. The eleven year civil war put even more pressure on the housing situation. The amount of houses destroyed exacerbated the existing housing shortage worsening the situation. The city has since been experiencing a constant influx of new residents due to many people fleeing from the countryside to seek employment and refuge in the countries primary city. Homelessness and displacement have been chronic problems for the city. According to Kemoh Tarawallie (SALHOC), the city would need to build 500,000 houses to reach the pre-war level's housing stock. (Shack / Slum Dwellers International, 2010). Thus, government's effort to build 240 social-houses between the 1960s and 2000s, has been extremely insufficient (UN-Habitat 2006).

The housing shortage and increasing poverty caused by the civil war could have provided incentives for stronger state-intervention. However, the housing market followed a neo-liberal strategy.

% Growth of Population of Freetown Over Time

	19 63	1974	1985	2004	2015
population	127, 917	276,247	469,776	772,873	1,050301
Percentage of total population of S/L	5.9%	10.1%	13.$%	15.5%	14.8%

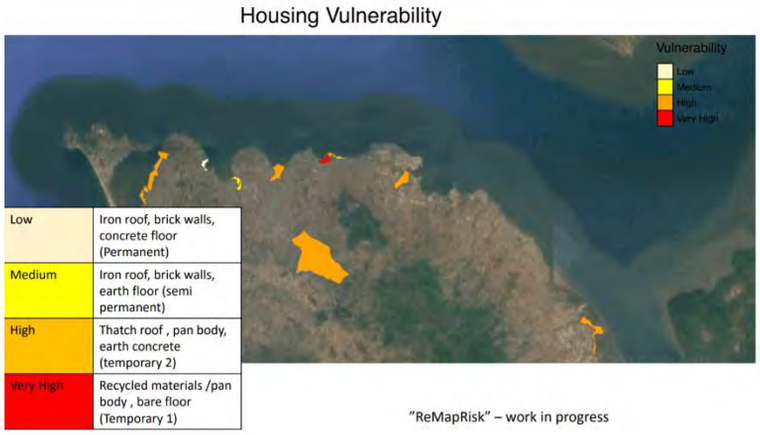
Table 3
Source: Osuteye, E. (2017) The role of urban planning in addressing disaster risks. BENVGBU6 Disaster Risk Reduction in Cities

Picture 1. BBC News, 2013

The Home Mortgage Finance Act of 2009 explicitly defined the role of the state as the main "*facilitator ... providing inputs and incentives for effective participation of the private market*" (Rogers 2016, 583). Private sector investment have resulted in unaffordable housing projects. Rents were set at $100/month, while 60% of the population lives on under $1.25/day (UNDP, ND), Also, it is common for landlords to ask for rent two years in advance (Bradlow 2010). Quality housing options in Freetown require important investment from the renters' part, which is problematic as most residents have limited financial resources. Such practices limit the ability of the poor to participate in the formal housing market, and reproduce conditions of maldistribution. As the formal market became unaffordable, large segments of the population moved to informal settlements. The constant mismatch between offer and demand exacerbated by a stagnant economy explains why an increasing number of new residents locate themselves in the informal settlements. The number of these settlement is currently 61 but the situation is in continuous evolution (Slum/Shack Dwellers international). As a matter of fact, market-led housing resulted in increasing rate in homelessness, even from the middle-class (Roger 2016). Construction projects were not only unaffordable, but also insufficient in numbers. Indeed, Freetown has a housing deficit of 166,000, which could grow to 280,000 within a 15 year period (Hitchen, 2015).

How Informality Reproduce Fire Risk and Poverty

As a result of the housing crisis, informal settlements are characterised by high-density and low-quality housing, making them highly prone to fire risks. Congestion aggravates the rapid propagation of fire as shacks are nearby (See Picture 1 (BBC News, 2013)), making it easy for fire to spread and delaying evacuation (CODHOSAPA and FEDRUP, 2011). Building materials used also exacerbates the destruction caused by fire; "60% of the shacks have currently highly flammable materials such as CI sheets (zinc), plastic and cardboards" (BBC News, 2013). Poverty and the lack of tenure limit capacity to invest in better quality and safer housing options. Most of the residents of informal settlements in Freetown do not have contracts, and can be evicted at any time (UN-Habitat 2006). The lack of financial resources pushes residents to build their shack with what is available, including disposable materials, regardless of their flammability or sustainability. Despite the general trends in housing material, the different availability implies a certain degree of differentiation among the settlements, as shown by the map 3.



Map 3. Source: Osuteye, E. (2017) The role of urban planning in addressing disaster risks. BENVGBU6 Disaster Risk Reduction in

Map 3 only represents fifteen settlements, but can however provide clues to how vulnerability due to building materials is spatially distributed.

Fire leads to important material loss, especially with flammable materials. Most small-scale events result in entire houses being destroyed (UNISDR, 2018). Many hide their savings in their houses, as they do not have access to banking services. Other assets such as electronics and clothes are also stored in houses (Sloane 2012). As these assets will be destroyed, fire outbreaks highly limit their ability to cope and recover. After fire events the structures of the houses maintain the same heterogeneity as many materials are salvaged post-fire and used to rebuild.

Fire hazard has to be ascribed inside the burden of this social disadvantage discussed where the vicious circle of poverty reproduce the condition for the tragedy to repeat itself. Nancy Fraser, Allen and Frediani (2013) request a deeper look that overcomes the mere concept of environmental justice to understand the multidimensional complexities in which maldistribution and misrecognition reproduce each other (Khalil et al 2015). Fire reproduces issues of maldistribution, as poverty increases risk, risk produces loss, and loss creates further inequalities.

The Federation of Rural and Urban Poor (FEDURP) has been an important actor advocating for affordable housing, habitable housing, and accessible housing (NCUSIS, 2011). The Federation recognises the importance of improving housing quality as a necessary step toward risk mitigation. Such initiatives are necessary to increase participation in the housing agenda and to push for policies recognising the different needs created by maldistribution.

Issues of Infrastructures

Since it's colonization, Freetown's political and economic activities have been centered around Tower Hill. As a result, the majority of infrastructures have been located in this area, at the expense of the rest of the city (Georg 1998). It resulted in an uneven distribution of resources, which were exacerbated by the civil war. The destruction caused by the civil war also greatly diminished the country's infrastructure. With the declaration of peace, infrastructure development was prioritized, with an annual investment of $134 million. However, approximately $66 million is inefficiently allocated. Despite worldwide economic and technical support, Sierra Leone is still far from its posited infrastructure standard due to serious economic hardship (Pushak et al., 2011). Due to the lack of public resources, reconstruction has mostly focused on the city centre excluding the rest of the city.

The inadequacy and lack of access to available infrastructure and resources, limit the capacity of various stakeholders to act. They cannot respond quickly in the event of a fire to reduce the damage or the spreading of the fire. The inability to act thereby contributes to perpetuate the risk associated with fire disasters within Freetown.

The National Fire Force (NFF) in Freetown, lacks financial and material resources to effectively respond to fire disasters within the city. The decision for the allocation of funding is centralised, which means that each city cannot choose where the funding is most needed. Indeed, the NFF is the most under-funded and under-resourced force in Sierra Leone's security department (Sierra Leone government, Agenda for Prosperity).

It is noteworthy that there are only three fire stations in Freetown, in Central, Aberdeen and Kissy areas. This number is highly insufficient to deal with the frequent small and large scale disasters. Faced with an inordinate resource constraint, the fire force is unable to decrease the risk of material losses and the loss of human lives through quick response to fire events.

There is an increased occurrence of fires during the dry Harmattan season in Freetown between November to March. The observation made by Freetowns Fire Chief for the seasonal increase in fires, is that people engage in lots of food preparation and increase the use of fires to cook during the festive seasons of November, December, January and February (Gooding, 2017). In 2013, Sierra Leone experienced an intensive Harmattan wind season which resulted in major bushfires in January, in rural Sierra Leone, engulfing villages (ReliefWeb, 2013). We assessed the data on fire outbreaks in Freetown from the DesInventar database (UNISDR, 2018) to see if there was an increase in fire outbreaks in Freetown during the 2013 Harmattan. This was to discover if there is a correlation between an increased risk of fires in Freetown and climate variables. The data can be seen in the graph below and there is a sharp increase in fires during the January 2013 Harmattan period (Blue line), thus illustrating that climate as well as the festive events throughout the year have a significant effect on the risk of fires.

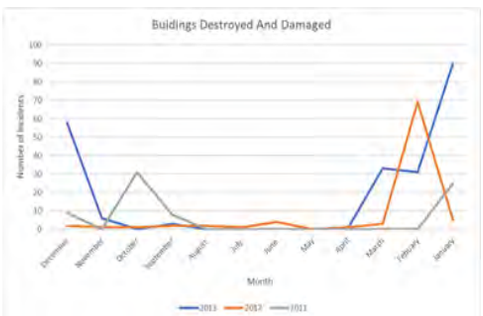
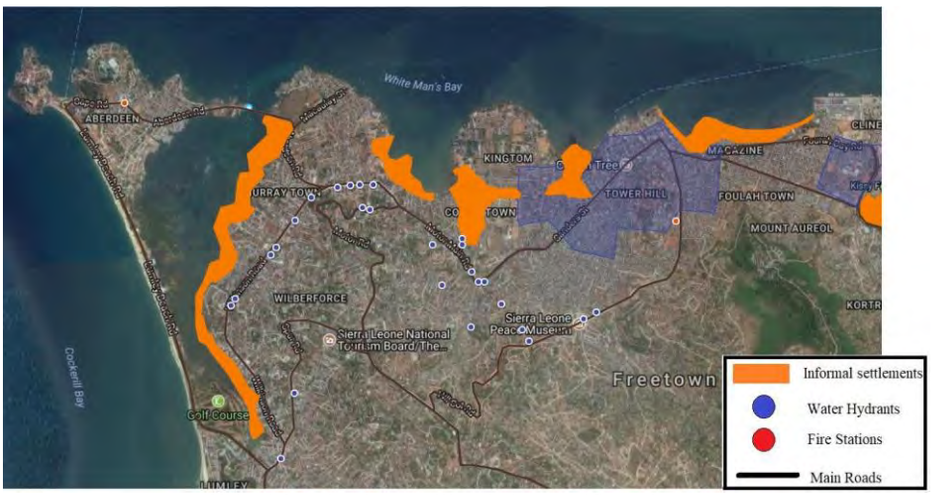


Figure 1

The reasons for the increased risk of fires during the Harmattan season are due to the low relative humidity as fine fuels become drier and thus fire incidents increase. Wind is also a major controlling factor that determines rate and direction of spread, and shape of fires. Wind can also influence the likelihood of spotting (LearnLine, 2018). There is also further reduced water accessibility during the dry season to reduce the severity of fires (IMC Worldwide, 2017). Also, limited access to water and in some cases its unavailability limits the capacity of not only the Fire Force but also of Community Groups,



Map 4. Informal settlements, Water hydrants and fire stations

community based Disaster Management Committees, community members and other concerned parties who may be on the ground to help fight fires in the event of an outbreak. The Guma Valley Water Dam which is the main source of piped water (potable) for the entire city was constructed in 1961 to serve a population of 500,000 (Concord Times, 2016). With the current population of Freetown, estimated to be about 1,500,000, the Guma Dam cannot sufficiently cater for its water needs. Issues of water scarcity are prevalent as a result, especially in the dry season, posing firefighting problems.

Even where water is available, it is difficult for it to be accessed especially in emergency situations. Out of all the fire hydrants shown on the map 4 only two are functional (Awoko.org, 2017). This presents a great challenge to fire fighters who have to drive miles away from the emergency scene to refill fire engines, which usually only last a few minutes in intense fires. The navigation of unmapped dirt roads poses another challenge for time-poor firefighters. These roads are congested during peak traffic hours, blocked or sometimes not wide enough to fit a fire engine. Informal settlements present particular geo-referencing challenges due to factors such as the lack of formal street addresses, repeated changes to neighbourhood boundaries, structural alterations etc. With the challenges mentioned above, firefighters have to spend critical time away from the disaster area. Thus, the scale of most disasters could be smaller, with fewer people affected and fewer material losses.

Informal settlements within the city tend to be the most affected. Their inhabitants are trapped living everyday life with the risk of fire outbreaks. These settlements are congested and have limited road accessibility, lack basic infrastructure and services including most importantly water. Also, the houses are constructed with materials which are combustible. These characteristics coupled with the lack of capacity to provide quick response due to the scantiness of available infrastructure and resources or difficulty in accessing them, explain why fire disasters in informal settlements are more severe. They result in significantly more damage and losses than in other parts of the city, where fire disasters are more manageable due to the spatial distribution of fire retarding resources.
Consequentially, the poverty cycle suffered by the urban poor, is perpetuated by living in disaster prone areas which lack basic infrastructure and services. Even though all inhabitants are vulnerable, the disabled, children and the elderly are especially vulnerable, as their mobility is limited. In the context of Sierra Leone disability needs to be considered in emergency plans, as the civil war left the country with one of the highest global rates of disabled (UNDP 2014).

Conclusion

This policy brief has used an environmental justice lens to provide an analytical perspective to uncover why there are differentiating realities for the risk of fires for residents. The differing access and distribution of resources in Freetown create different levels of recognition in the society and thus participation, therefore, resulting in an unfair distribution of the burdens of fire risks. We have analysed all of the well documented residential fire events in Freetown to examine the common triggers, the extent of damages, the structure of settlements and the date. By focusing on the devastating fire of Susan's Bay in 2017, we found that energy poverty, poor housing, and inadequate infrastructures, had an important impact on risk.
Each of the factors discussed, impact fire dynamics by exacerbating the frequency and intensity of fire risk. In most cases risk is produced and reproduced from maldistribution, misrecognition and the lack of participation of the poor in local development issues. Because of the extent of energy poverty, the low-quality of housing and the inadequacy of infrastructure, loss caused by fire is significantly more prevalent in informal settlements. Loss of resources further limits the ability to recover, leads to the amplification of poverty and reproduces risky practices. More precisely:

- The failure of the grid electricity systems resulted in extensive energy poverty in Freetown. Difference in access and distribution of energy sources in Freetown also create different levels of participation in society and recognition, therefore resulting in the cycle of energy poverty of households and thus the reproducing risk of fires.
- In the case of housing, the market approach failed to recognize the need of a growing poor population, and forced residents to settle under conditions creating fire risks. These conditions produce fire risk, and fire exacerbate these conditions as it causes the loss of all assets.
- Poor infrastructural provision or difficulty in accessing resources limit the ability of various stakeholders to act thereby contributing to perpetuate risks associated with fire disasters within Freetown, particularly its informal settlements. Lesser access to roads and water, combined with limited emergency response services intensify the negative consequences of fire.

As a result, mitigation of fire risk in informal settlements do not only depend on managing fire events but also on underlying socio-economic conditions. Adopting an environmental justice framework highlights the need recognition, distribution and participation. Such an approach provides incentives for DRM plans to be established in coordination with the broader development agenda as both issues are linked.

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