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Global Facility for Disaster Reduction and Recovery

Disaster Risk Management Diagnostic Note

Sierra Leone

This note was prepared by a team led by Oscar A. Ishizawa and composed of Luc Bonnafous, Maria Gaspari, Alex Giron Gordillo, Joaquín Muñoz Díaz, Antonios Pomonis, and Nathalie Wandel.

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Contents

1. Country Disaster and Climate Risk Profile

1.1. Historical Disasters

1.1.1. Current Climate and Hazard Context

Sierra Leone is prone to natural hazards such as floods, landslides, tropical storms, coastal erosion, and droughts that cause severe economic damage and loss of lives with disproportionate effects on the poorest and most vulnerable.[1] Climate change and underlying socioeconomic factors—such as the increase in urban population exposed to disasters, poverty, and low levels of economic development—will most likely aggravate the impact of adverse natural events in the future (World Bank, 2017). These further strains the coping capacity of Sierra Leone as a country which is still recovering from the Ebola outbreak of 2014–2016 and the current COVID-19 pandemic. Epidemics and other health-related risks—including cholera and dengue fever outbreaks in the aftermath of floods—are another key concern, as evidenced by the fact that between 1980 and 2010, epidemics were the deadliest hazard in Sierra Leone, responsible for 83% of the total number of deaths due to disasters (HARPIS-SL, n.d.).

Sierra Leone has a tropical monsoon climate (Am) with a unimodal wet season generally occurring from April/May to October/November (Beck et al, 2018; Kamara, 2016; Blinker, 2006). This climate is largely a product of the West African Monsoon (WAM), a pattern consisting of low-level southwesterly winds carrying moisture from the Atlantic Ocean inland during the wet season, and northeastern winds during the dry season (Harmattan), in concordance with the ITCZ migration (CLIVAR; Sylla et al., 2012; Raj et al., 2019). It is a highly complex phenomena: cumulus-scale to planetary-scale processes influence its timing, extent, and intensity. It comprises three phases: the onset (March to May), during which the rain belt expands north from the coast, the high rain period (June-August) initiated by the monsoon jump, an abrupt shift of the rain belt northward bringing higher rainfall over the Sahel and ending the heavy rain period over the Guinean coast, and the southward retreat, which starts in September.

A few figures suffice to highlight Sierra Leone's very hot and wet climate. Average yearly temperature is around 26–27°C, monthly temperatures oscillate between 24°C and 29°C, diurnal temperatures often reach 40°C, and very rarely go below 20°C (Kamara, 2016; CLIVAR; Levert 2007; World Bank, n.d.). Both the rare station data and gridded datasets lead to estimates of precipitation higher than 1,500 mm per year almost everywhere in the country, with a large part receiving 2,500–3,500 mm (Kamara 2016; World Bank, n.d.).

This extreme climate leads to risks specific to Sierra Leone's society. On the one hand, the combination of such high temperatures and humidity leads to high heat index values, which can cause adverse health effects and have a detrimental impact on some areas of the economy such as the energy sector.[2] On the other hand, extreme rainfall events can lead to flash floods in urban areas, riverine flooding, and landslides. In the context of a changing climate, further elements to consider include sea level rise, which

[1] For more information on Sierra Leone's Hazard Profile and Risk Assessments, see HARPIS-SL (Hazard and Risk Profile Information System – Sierra Leone, by INTEGEMS and UNDP): http://www.harpis-sl.website/index.php/hazard-profiles/sierra-leone-hazard-profile.

[2] High temperatures can affect solar panel efficiency, although some cell types do better than others in tropical regions (Osarumen et al., 2017; Peters et al., 2018), an aspect to consider as there exists a push for Sierra Leone to rely largely on mini solar grids and standalone solar panel for the electrification of some communities (see for instance PAD3995). Further temperature increases likely under climate change could lead to load shedding and impact the country's energy policy.

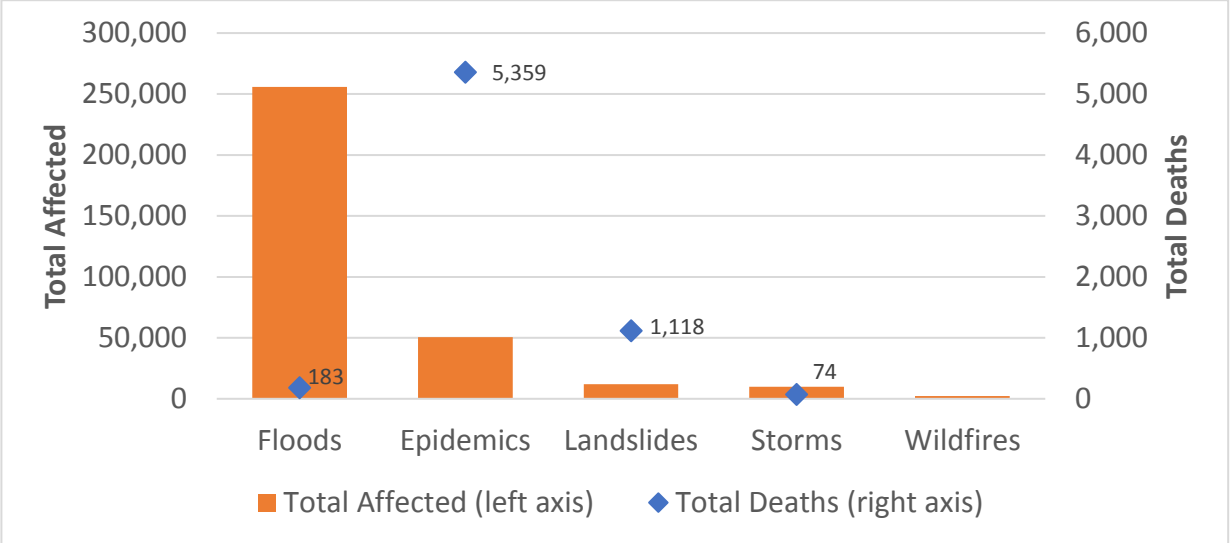
can increase the potential for coastal erosion, and changes in the WAM timing that could impact agriculture systems.

1.1.2. Statistics on Historical Disasters

Hazard profiles and experience from past events show that floods, storms, and fires are rather frequent in Sierra Leone, though often have a limited impact (in other words, partial damages and losses, a reduced number of people and buildings affected, localized in geographical extent, and event effects limited in time). On the other hand, landslides, droughts, and epidemics are less frequent but can cause moderate to large impacts (that is, localized in geographical extent but devastating damages in the case of landslides; and limited asset damages but a large number of people affected and long-lasting economic disruption in the case of droughts and epidemics). Thus, different types of events have unique impact characteristics and require differentiated response approaches with respect to the management of physical assets, and support to affected households, individuals, and businesses.

Sierra Leone's historic disaster records are limited (see Figure 1 for summary statistics), but they suggest that the 2017 mudslide near Freetown was the worst adverse natural event experienced in recent decades, while the Ebola Virus Disease (EVD) outbreak in 2014–16 represents the most adverse health-related crisis in the country until 2019. As a result of heavy monsoon rainfall in August 2017, part of the Sugar Loaf Mountain in the Western Area near Freetown collapsed, triggering a massive landslide. The landslide and floods affected more than 6,000 people and claimed about 1,141 lives. The total economic impact of the mudslide and floods was estimated at around $31.7 million, approximately 0.8% of the 2016 GDP (World Bank, 2017). While the effects of the landslide were limited in time and geographical scope, Ebola affected the entire country and its effects lasted longer than the epidemic's crisis. About 14,000 Sierra Leoneans were infected by EVD, of whom almost 4,000 died (CDC, n.d.). The total impact of the EVD crisis in Sierra Leone accounted for $1.9 billion and included adverse fiscal effects through increased EVD-related spending in a time with falling revenues (World Bank, 2016).

Figure 1. Summary Statistics of Historical Disasters in Sierra Leone (1975–2020)



Source: Authors with data from CRED (2021).

1.2. Disaster Risk Profile

Multiple disaster, climate-related, and epidemics risk estimates exist for Sierra Leone at national and city-levels. They include UNDRR's Global Assessment Report (GAR) 2017, the Multicity Hazard and Risk Assessment developed by the World Bank and carried out by ARUP, and an historical approach developed as part of the *Sierra Leone Crisis and Disaster Risk Finance Diagnostic* conducted by FCI. Examining these results allows for an understanding of the magnitude of the disaster risk, but caution must be exerted as the different estimates are not directly comparable. This subsection presents risk estimates to building and infrastructure for floods and landslide. The cost of response to disaster events is discussed in subsection 1.3.

1.2.1. Flood Risk

The multicity hazard and risk assessment (World Bank, 2018b) provides information on the probable damages to buildings and infrastructure from flood events.[3] The assessment focuses on fluvial and pluvial flood, landslide, and coastal flood and sea level rise risk in the cities of Freetown (which accounts for 15.5% of the national population), Makeni (1.7% of the national population), and Bo (2.4% of the national population). Estimates from a different building stock dataset (METEOR) suggests that these three cities account for about 59% of the country's building exposure.

The combined fluvial and pluvial flood Annual Average Loss (AAL) to buildings for these three cities is $2.8 million (0.03% of the modelled exposure). Although data at the national level was not provided, a back-of-the-envelope extrapolation under different assumptions yields that the national AAL from fluvial and pluvial floods could be between $3.6 and 6.0 million.[4] The exceedance probability curve is presented in Figure 2, suggesting that flood risk is largely concentrated in the capital Freetown where a flood causing at least $32 million in losses has a 5% probability of happening any given year. A simple overlay of fluvial and pluvial flood hazard maps and high-resolution building footprints suggests that about 0.8% of the buildings in the country are exposed to fluvial flood risk, whereas 4.5% are exposed to pluvial flood risk.[5]

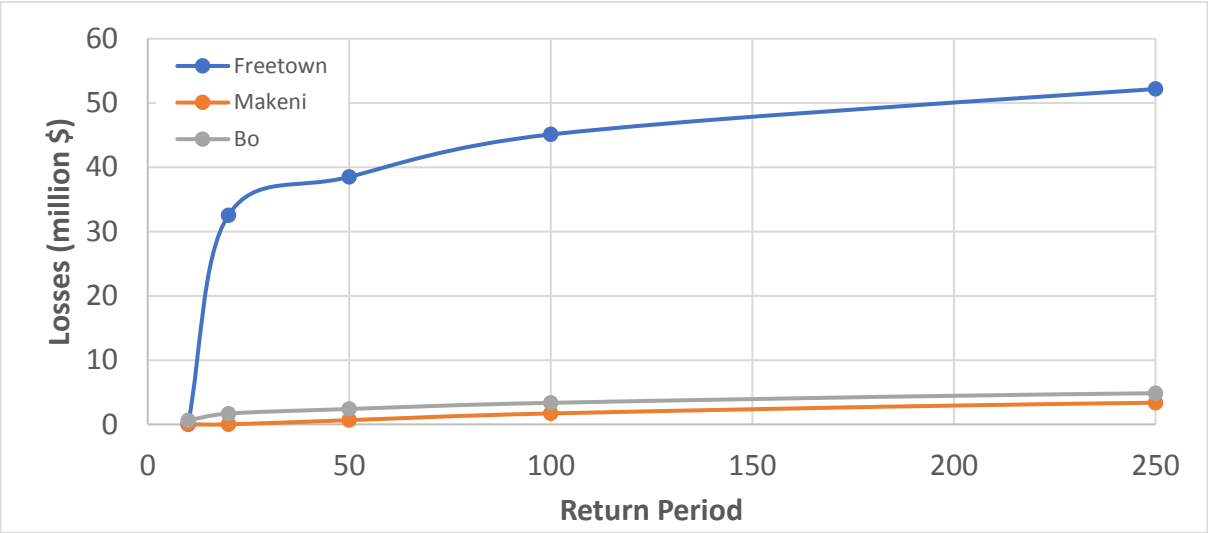
A second source of information on riverine flood risk at the national level is the Global Assessment Report (GAR) 2017. The GAR—based on a global approach—estimates an AAL of $7.7 million (0.3% of GAR's estimated capital stock). Examining the exceedance probability curve (Figure 3) reveals a saturation of losses starting from a 50-year return period at $123.6 million (4.1% of the capital stock). However, there is an important caveat to these estimations: they only consider fluvial flood risk and not pluvial, and therefore do not account for an important share of the exposure in many urban areas including Freetown (Figure 4), as characterized by the multicity hazard and risk assessment. Historical records do not quite match GAR's spatial distribution of flood risk in the country.

[3] Model accounts for educational, government, healthcare, utility and industrial facilities, formal and informal residential buildings, and road infrastructure.

[4] This extrapolation was based on exposure estimates from the METEOR project and the Digitize Africa building exposure dataset, and the FATHOM Global Flood Hazard Dataset. Different assumptions of the distribution of flood risks were applied. The sole purpose of this extrapolation is to get an order of magnitude of the AAL at the national level. Considering that it is not based on a probabilistic or historical risk calculation approach, it corresponds to a rough estimate and should be treated with caution.

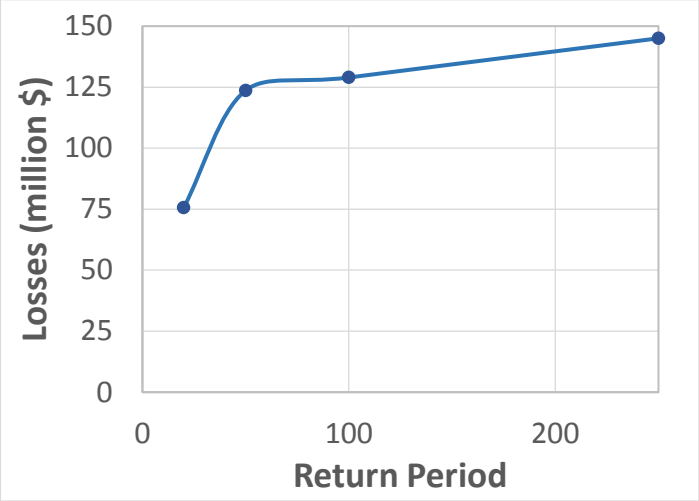
[5] The Digitize Africa building exposure dataset and the FATHOM Global Flood Hazard Dataset were used to carry out this exercise. A building was considered to be exposed to fluvial (pluvial) flood risk if it is located in an area that would be flooded by more than 30cm under a 100-year return period fluvial (pluvial) flood.

Figure 2. Exceedance Probability Curve of Flood Risk for Freetown, Makeni, and Bo



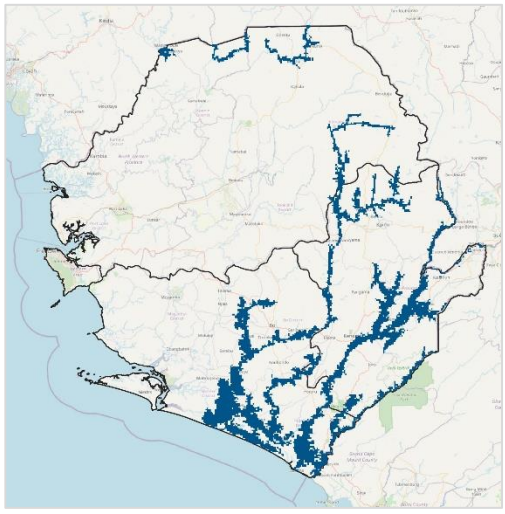
Source: ARUP. Reproduced from World Bank (2018b).

Figure 3. Exceedance Probability Curve of Flood Risk for Sierra Leone (national level)



Source: UNDRR (2017).

Figure 4. GAR's 100-Year Return Period Riverine Flood Hazard Map



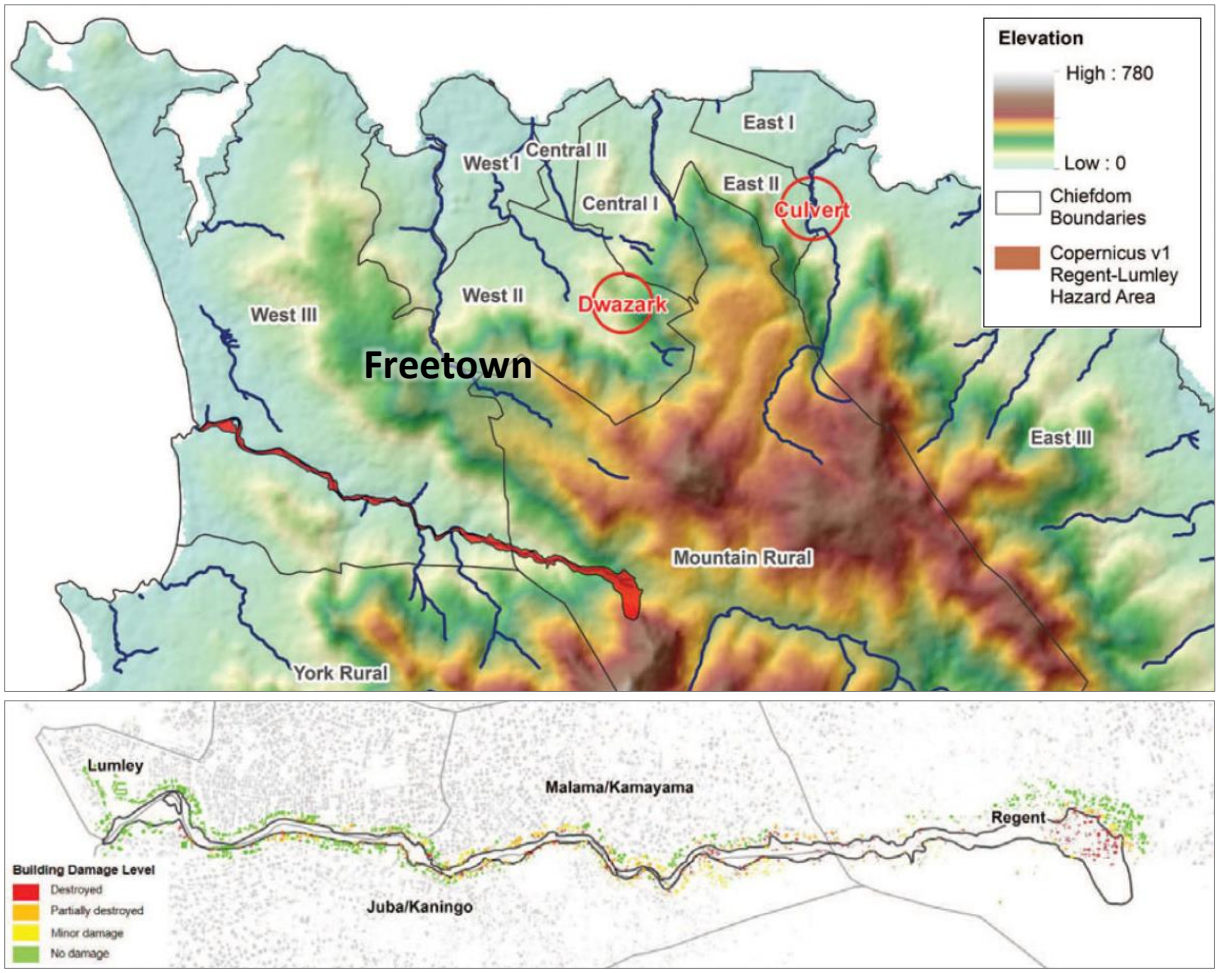
Source: UNDRR (2017).

1.2.2. Landslide Risk

Quantifying landslide risk is a complex endeavor, as landslides are generally localized events that depend on a combination of the susceptibility of the terrain to be displaced, and the action of a trigger of hydrometeorological or geophysical nature such as sustained heavy precipitation or an earthquake. An assessment of landslide risk in Freetown (World Bank, 2018b) estimates the average annual direct losses to all buildings at $0.4 million (upper bound of $0.7 million). Results of the assessment indicate that the highest landslide hazard takes place in the valleys directly beneath the high relief mountainous areas. The area of Hamilton is particularly exposed to landslide hazard. Other wards with significant landslide hazard are Regent, Goderich, York, Charlotte, and Bathurst. As expected, landslide hazard is lower in the flatter coastal regions.

A large recent landslide event took place in 2017 in the Western Area Rural District. A rapid Damage and Loss Assessment (World Bank, 2017) was conducted following the events, assessing the total cost of the event at $31.7 million, of which 53% correspond to damages (mainly suffered by the housing sector) and 47% correspond to losses (primarily experienced by the social protection and health sectors). Figure 5 shows the spatial extent of the disaster. Although the Regent landslide was unprecedent in size and magnitude, the large damages and losses suffered reveal the potential for large-magnitude landslide events in the region, with costs well above the above-presented AAL.

Figure 5. Location of the Regent Landslide (shown in red) and Affected Buildings, and the Flooded Areas in Dwazark and Culvert (circled in red)



Source: World Bank (2017, 2018b).

1.3. Cost of Disaster Response and Recovery

Instead of focusing on damages to the building and infrastructure stock, the cost of responding to a disaster reflects the amount that needs to be mobilized by the government, civil society, and development partners to cope with the direct and indirect impacts of the event. An historical approach was undertaken to shed light on the costs of disaster response as part of the *Sierra Leone Crisis and Disaster Risk Finance Diagnostic* conducted by the World Bank, which estimates the response cost of adverse natural events from a humanitarian standpoint based on governmental and humanitarian aid contributions to response.

The analysis is based on a limited historical register of 11 years, and highlights that all historical annual response costs that were available ranged from $4 million to $45 million between 2010 and 2020 (excluding the Ebola response costs in 2014). On average, the historical annual response cost can be estimated at $15.3 million.[6] Although data availability has improved since 2015, records often do not report on disaggregated costs (in other words, costs for the reconstruction or repair of assets, for social assistance, and for other emergency measures). The large events of the Ebola Virus Disease in 2014–2016 and the 2017 landslide are an exception to this, and break down estimated response costs. In both cases, estimated social protection costs accounted for about 10–15% of the overall response costs (World Bank, 2017; GoSL, 2015).

1.4. Estimated Range of Annual Disaster Costs

Based on historical events and available disaster risk information, an approximate value of annual costs of disaster and climate-related shocks in Sierra Leone has been estimated, including asset losses due to natural perils as well as response costs to support communities. Table 1 below presents a range of the estimated cost per peril or item based on risk estimates and information from historical events from various sources. Damages to building and infrastructure assets from perils such as floods, landslides, windstorms, and fires are estimated to be worth about $5.7–10 million per year. On the other hand, the annual costs of responding to disasters and epidemics are estimated to be between $9–16.9 million. Due to limited information and relatively high uncertainty on the available data, the estimates are to be seen as rough values resulting from 'back-of-the-envelope' calculations. The purpose of these estimates is to get an idea on the overall order of magnitude of disaster risk in Sierra Leone and should not be considered as definite values. The estimates correspond to the current risk picture, which could increase in coming years as a result of population growth, urban expansion in disaster-prone areas, and future climate scenarios.

Table 1. Estimated annual aggregate costs of disasters in Sierra Leone (in million $)

Peril or Item	Amount		Comment
	Low	High	
Flood	3.60	6.00	Conservative rough estimates of building and infrastructure losses.
Landslide	0.90	1.50	Rough extrapolation of Freetown/Western Area AAL to country level (Freetown accounts for about 44% of the country's building stock; 24% of the 2.5 million Sierra Leoneans moderately exposed to landslide risk live in the Western Area—according to HARPIS-SL (n.d.) landslide risk assessment).
Windstorm	0.50	1.50	Similar magnitude as landslides.
Fire	0.70	1.00	Similar magnitude as landslides, based on comparison of limited historical events.
Total Natural Perils Asset Losses	**5.70**	**10.00**	

[6] This corresponds to the average of the cost of response excluding epidemics. The report also calculates the annual average cost of response through a Monte Carlo simulation, including the cost of epidemics, at $50 million. However, there are several limitations of this estimation driven by scarce available data on losses from past disasters, including the fact that this estimate applies a once every year return period to the costs associated with the devastating 2017 landslide event. Available data and reports on losses and response costs are fragmented, and historic data might not cover all the relevant costs, thus uncertainties remain. For example, government contributions to a specific disaster response may rather reflect available forthcoming funding, and not the actual scale or impact of the emergency.

Epidemics (Government Response)	—	1.90*	Based on the government's own contribution ($48 million) to fight Ebola and assuming a return period of 25 years for these response costs.
Humanitarian Assistance	9.00	15.00	Low estimate: average cost of years 2010–2019 excluding years of Ebola (2014–2016). High estimate: average cost of years 2010–2019, adjusting a return period for Ebola in 2014 (25y RP).
Total Response Costs	**9.00**	**16.90**	

Note: * = This estimation corresponds to an Ebola-like event only. As shown by the COVID-19 pandemic, these costs can be significantly larger if widespread diseases hit the country in the future. For instance, the Quick Action Economic Response Programme of the Government of Sierra Leone, released on May 2020, estimated potential costs of response at about $380 million under an adverse scenario of the evolution of the COVID pandemic.

Source: Authors' own calculations and estimations based on data from World Bank (2017, 2018b), UNDRR (2017), Government of Sierra Leone (2015), So & Rajput (2020, Ministry of Finance raw data), HARPIS-SL. (n.d.) and OCHA (2020).

2. Assessing Changes on Future Disaster and Climate-Related Risk

2.1. Climate Change and Projected Hazard Patterns

Temperature projections from CMIP5 data, available on the World Bank Climate Change Knowledge Portal, are quite consistent, with all models projecting relatively uniform increases over the country (World Bank, n.d.). Projections that characterize increase in temperature use the reference period 1986–2005. This consistency makes them useful to get a sense of how the situation might worsen.

In the RCP 4.5 scenario, for the period 2040–2059 (which would correspond to the life expectancy of some power infrastructure, for instance), monthly maximum temperature is expected to increase relatively uniformly throughout the year, with the ensemble median projection a little above 1°C, but the 90th percentile above 2°C for half of the year. In the RCP 8.5, the situation is a little more extreme but stays in these ranges, while values skyrocket for this scenario in later decades. The number of very hot days increases by 1.5 according to the ensemble mean, more than 8 days for the 90th percentile for 2040–2059. In the RCP 8.5, this latest value reaches 18 days.

Precipitation projections are less consistent, with slight increases projected by the ensemble median. To dig deeper into how future climate might impact hazards and risk in Sierra Leone, it is critical to understand which models reproduce best the features of the WAM and teleconnections that play a role in triggering extreme climate events. A discussion on this subject is presented in Annex 2.

2.2. Building Assets Exposed to Coastal Erosion

The multicity hazard and risk assessment projected coastline erosion in Freetown by 2050, by estimating historical coastline recession rates—derived by examining historical satellite imagery—, and extrapolating this rate inland under different assumptions (for instance, Figure 6 shows the coastline in 1969, 2006, and 2017 in northeast Freetown).[7] These estimates were then superimposed with information of current

[7] The coastlines in the satellite images and historical maps were digitized and converted to points at 50-meter intervals, which would be the interval at which the recession rates would be calculated. A perpendicular line was then extrapolated seaward from each point along the current coastline to find where this line intersects the historical coastlines. The distance between the point at the current coastline and the intersection coordinate at the historical coastline could then be calculated. Rate of cliff recession

buildings and infrastructure to quantify the value of assets that would be lost by 2050 as a consequence of urban development, sand mining, and environmental degradation occurring in areas of high coastal erosion hazard.

Figure 6. Historical coastlines in northeast Freetown

Note: Satellite images taken in 2017 of northeast Freetown. The green line represents the 2017 coastline, the orange line represents the 2006 coastline, and the blue line shows the 1969 coastline, derived from satellite images and historical maps.

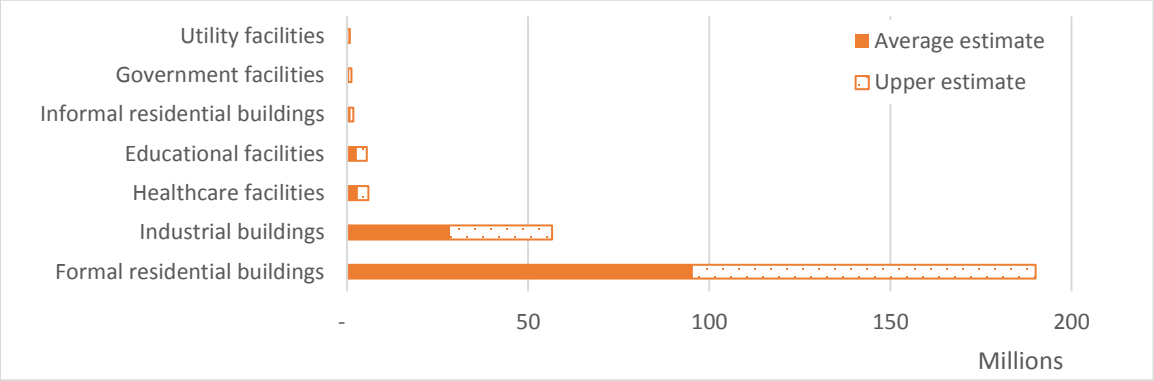
Source: DigitalGlobe and NES/Airbus. Reproduced from World Bank (2018b).

Although significant limitations of this approach exist, the results suggest that assets exposed to coastal erosion in Freetown are concentrated along the southwestern and northern coastlines of Freetown.[8] In terms of building assets at risk, the main wards exposed include Hamilton, Goderich, Aberdeen, Murray Town, Kingtom, Cannaught Hospital, and Cline Town, each of which would see asset damages of more than $5 million under the projected average 2050 coastline scenario. Buildings at risk from coastal erosion (under projected conditions for 2050) have been valued at $131 million (1.4% of exposed assets in Freetown as modelled by the risk assessment), with an upper estimate of $261 million (2.8%), or about $4 million annually. Figure 7 reveals that most of the assets that are exposed to coastline erosion are formal residential (72.6% of exposed assets) and industrial buildings (21.6%).

was then obtained by dividing the distance by the time difference to get an estimated rate at 50-meter intervals in meters per year. This rate was then extrapolated under different assumptions to 2050 to project the future coastline (World Bank, 2018).

[8] For instance, newly built structures, such as docks and ports, should slow down the rate of recession markedly and have not been considered, nor any future mitigation works. See World Bank (2018) for detailed results and limitations.

Figure 7. Value of Buildings in Areas Exposed to Coastline Erosion by 2050 in Freetown

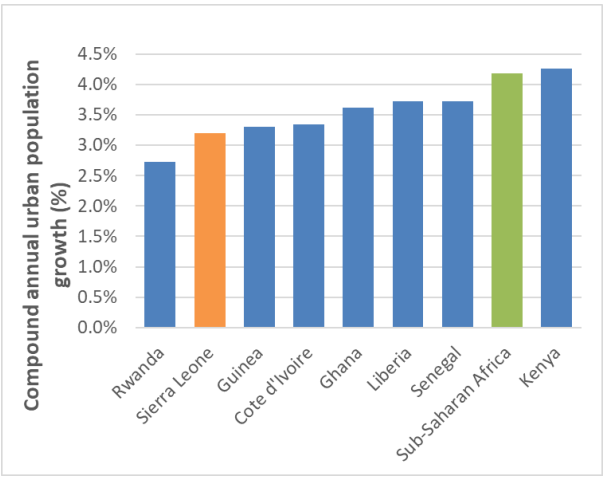


Source: Authors with data from World Bank (2018b).

2.3. Urbanization Trends

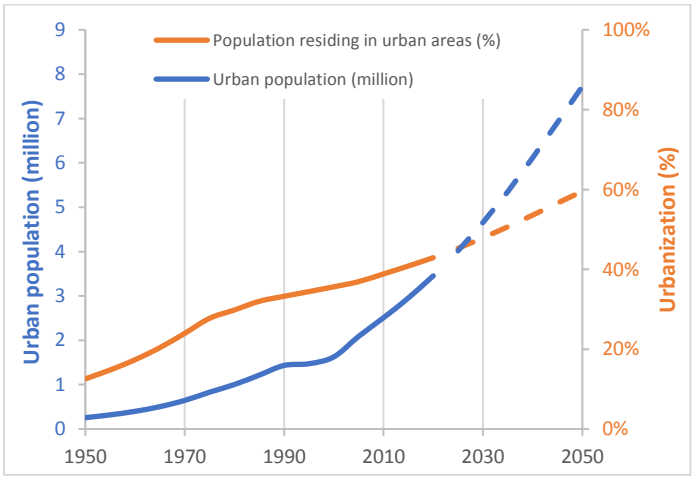
In recent years, Sierra Leone's urban population has grown at a slower pace than regional peers and the regional average (Figure 8), although population projections show that urban population will more than double by 2050, with about 8 million people living in urban areas (Figure 9). Urban population is primarily located in the capital Freetown, with about 1.1 million inhabitants that are expected to become 1.8 million by 2035. Kenema is the second largest city but has less than a fifth the population of Freetown showcasing the concentration of the population in the capital city and its surrounding areas.

Figure 8. Urban Population Growth (2009–2018)



Source: Authors with data from UN DESA.

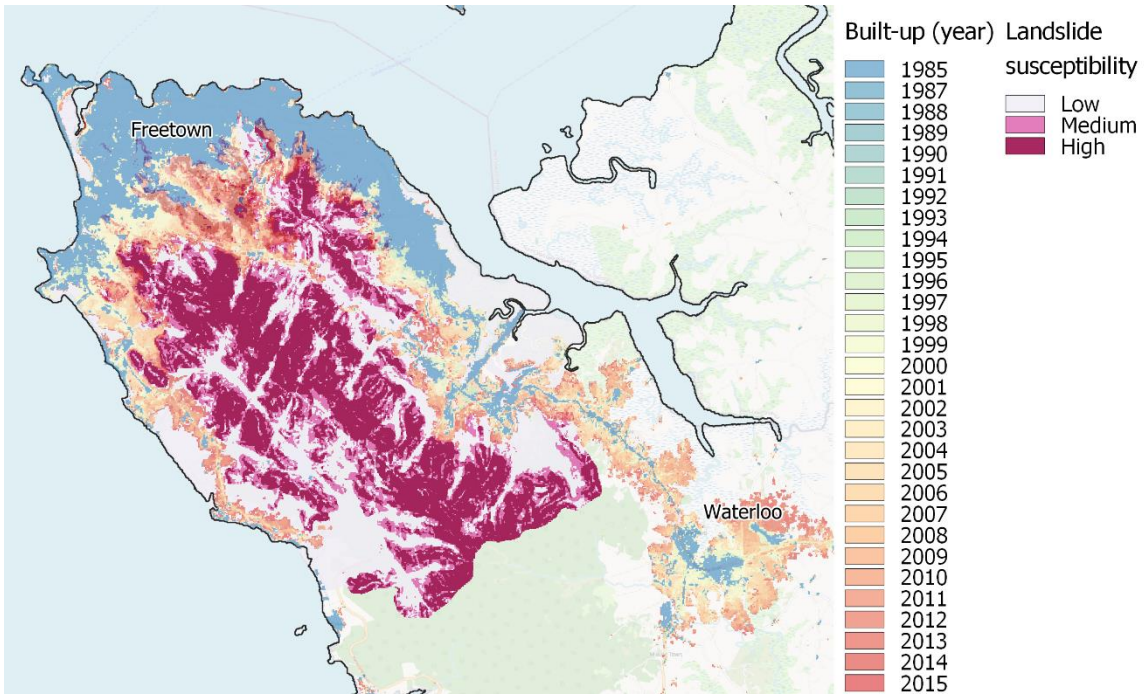
Figure 9. Projected Urbanization in Sierra Leone



Source: Authors with data from UN DESA.

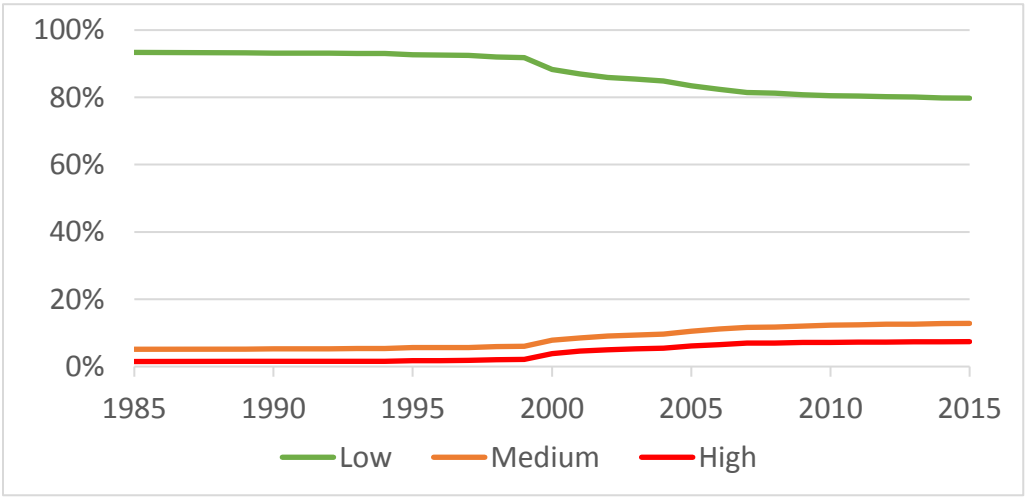
The concentration of population in Freetown has led to settlements growing in steeper areas of the city in recent years, which are more exposed to landslide events as the susceptibility to suffer from these events is higher (Figure 10 and Figure 11). Uncontrolled urban expansion and the lack of affordable housing has also led to inefficient land allocation in Freetown, characterized by the proliferation of slums near the city center, largely concentrated in flood plains and next to waste dumps. This results in the poorest and vulnerable people of the city being exposed to regular flooding during the rainy season in overcrowded coastal areas. This also entails significant health risks, when flooding is combined with solid and liquid waste issues (World Bank, 2018a).

Figure 10. Urbanization in Freetown (1985–2015)



Source: Authors with data from DLR and ARUP.

Figure 11. Building Exposure in Areas Susceptible to Landslides in Freetown (1985–2015)



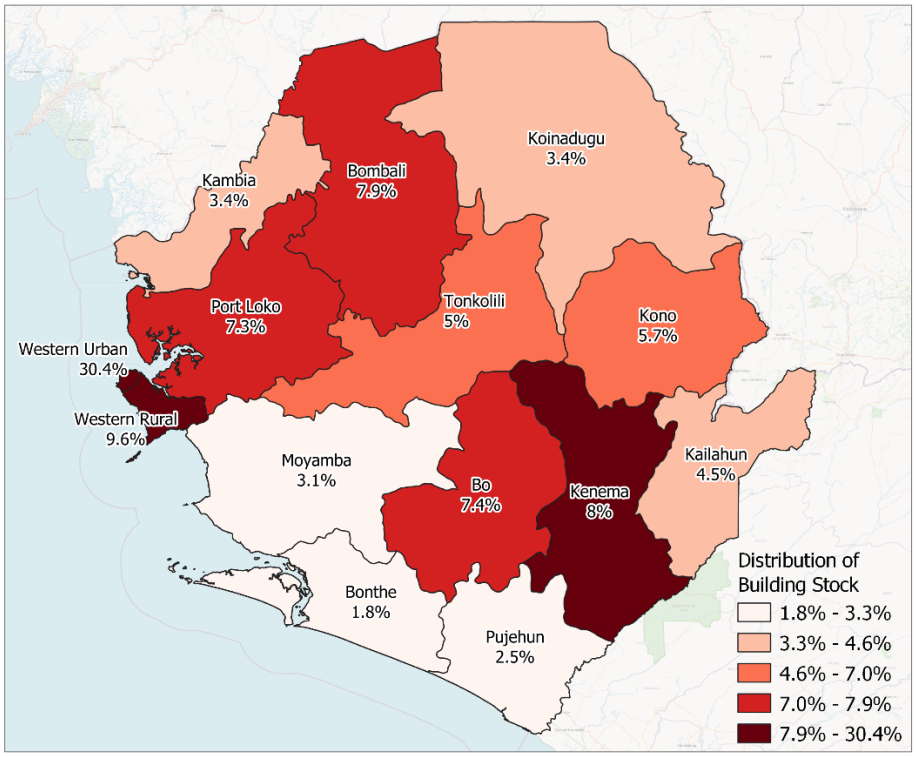
Note: The figure presents the evolution of the percentage of building exposure (originally measured in $) by landslide susceptibility class. The share of building assets located in areas of medium and high landslide susceptibility has experienced a relevant increase since 2000.

Source: Authors with data from DLR and ARUP.

2.4. A Building Exposure Model for Sierra Leone

The building stock for 2020 has been estimated at $10.1 billion (approximately 2.5 times the 2019 GDP), of which $6.7 billion correspond to residential buildings, and $3.4 billion correspond to non-residential buildings. The World Bank's Disaster-Resilience Analytics & Solutions team developed a building exposure model for Sierra Leone with information on the replacement cost of the residential and non-residential building stock at high resolution.[9] The results show that the building assets are concentrated in the Western Area Urban district, followed by the districts of Western Area Rural, Kenema, and Bombali (Figure 12**Error! Reference source not found.**).

Figure 12. Distribution of Building Stock by District



Source: Authors with data from the 2004 and 2015 censuses.

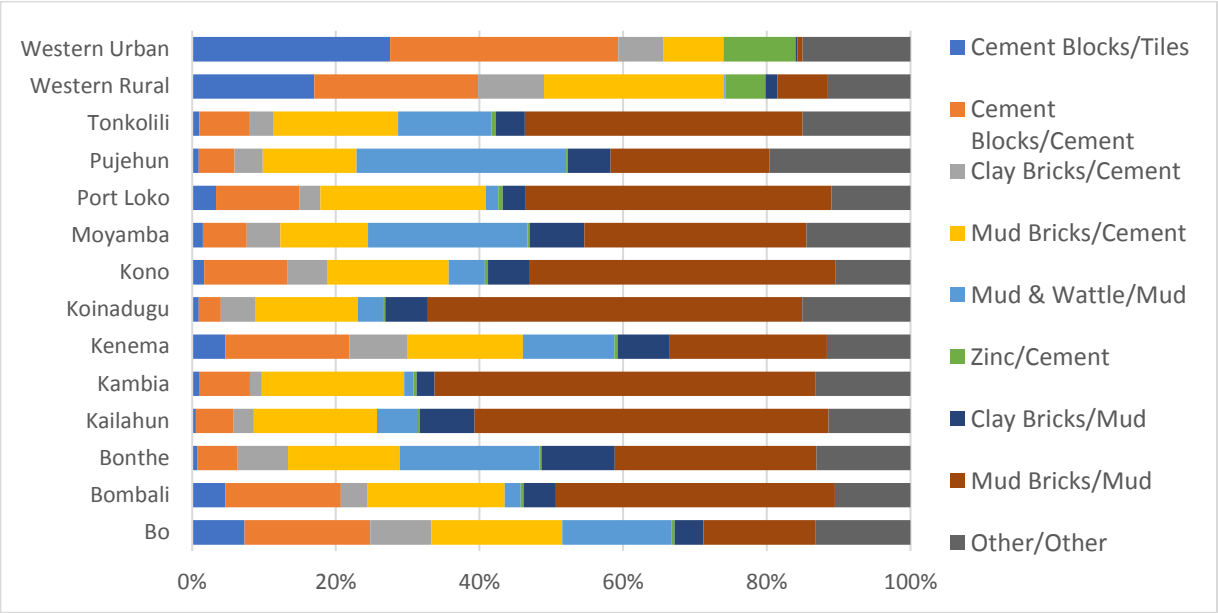
As part of the residential building exposure component, the distributions of households by dwelling type, wall, roof cover, and floor material were examined. Regarding the wall material, most households in Sierra Leone reside in houses with outer walls made of either cement blocks (25%), mud bricks (43%), or mud and wattle (15%). The differentiation of households by roof cover material was insignificant as 82% of them are made of zinc. From a flood vulnerability perspective, the construction material of floors and walls are considered most crucial.[10] 44% of households in Sierra Leone reside in houses with cement

[9] The exposure considers only "buildings" and not "building contents" and are available at the enumeration area for the residential building component and at the chiefdom level for the non-residential building component. The analysis was based on the full microdata set of the 2015 National Population and Housing census carried out in December 2015 as well as on a microdata subset, derived from the 2004 Population and Housing census representing 10% of the original census survey (about 500,000 person records and 85,000 household records).

[10] In addition, the number of floors is an important attribute but, unfortunately, it was only captured in the 2004 census (97% of the households lived in single-story houses).

floors, whereas 46% reside in houses with mud floors. Based on information on wall and floor material available, a residential building typology schema from a flood vulnerability perspective was proposed, consisting of 14 structural classes, summarized at district level on Figure 13**Error! Reference source not found.**.[11]

Figure 13. Residential Buildings Floor Area (m^2) Distribution by Typology (Wall/Floor Material)



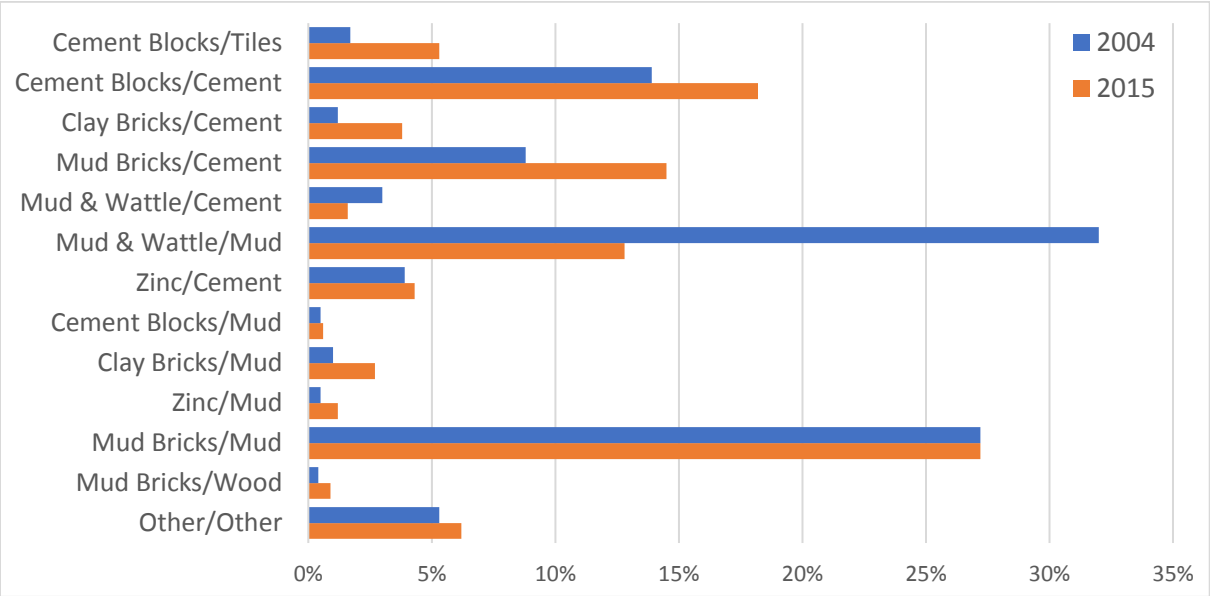
Note: 5 typology classes are summarized in the 'Other/Other' typology.

Source: Authors with data from the 2004 and 2015 censuses.

Results reveal that in addition to accounting for a large share of the total building assets, the Western Area Urban and Western Area Rural districts also concentrate a large amount of cement block wall houses. The rest of the districts exhibit a larger share of constructions made of mud bricks walls and mud floors. A comparison in the proportion of structural typologies between 2004 and 2015 shows that poor quality walls (for example, mud and wattle, zinc) or floor (for example, mud) materials are gradually being replaced with better quality materials such as cement blocks or clay brick walls and cement floors, respectively (Figure 16**Error! Reference source not found.**).

[11] An additional class was proposed of houses made of concrete block walls and concrete roof (1.7% of total households), as they are considered to be either reinforced masonry or reinforced concrete frame structures, by far the most flood-resistant structures with higher unit cost of construction when compared with the other typologies.

Figure 14. Households' Distribution by Structural Typology in 2004 and 2015 in Sierra Leone

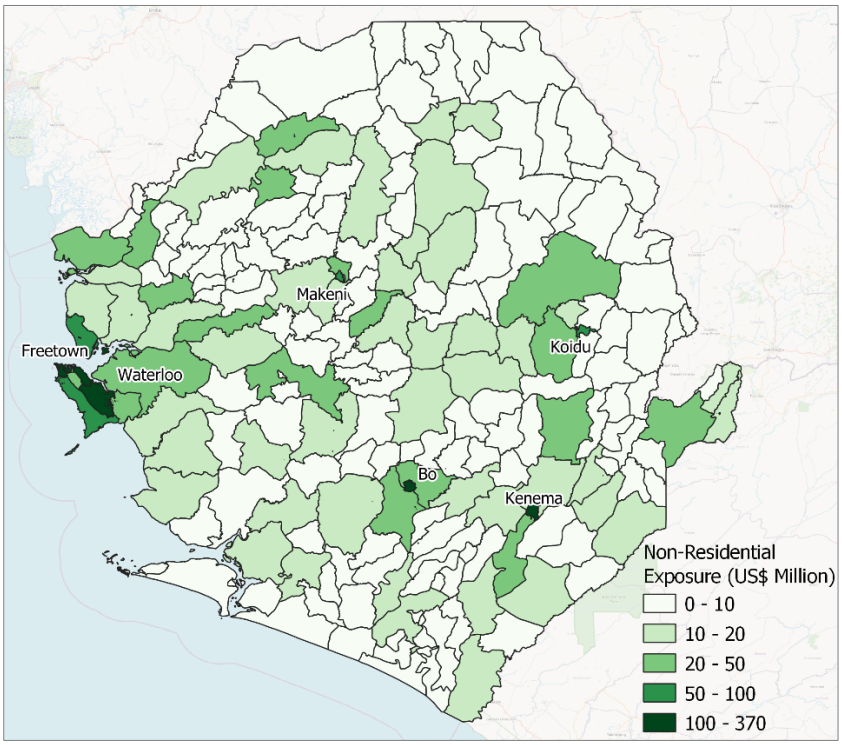


Source: Authors with data from the 2004 and 2015 censuses.

The non-residential building component of the exposure model was derived from labor statistics available in the 2015 population and housing census. The model provides five different non-residential building-use types, for which built floor areas per employee (m^2) and unit costs of constructions were estimated (US$/$m^2$).[12] The distribution of non-residential building exposure is presented in Figure 15. Spatially, the exposure is concentrated in the main urban centers.

[12] The labor data give the number of people aged 10 and over that were employed in 24 economic sectors. From this detailed categorization, the data were aggregated into five broad non-residential building-use types: Industrial; Offices (including Public Administration and Hotels); Critical Buildings (including Educational, Health, Worship, Culture, Utilities, etc.); Retail (including Restaurants); and Warehouse (including Commercial and Agricultural warehouses).

Figure 15. Distribution of Non-Residential Building Exposure by Chiefdom and Building-Use Type in 2020



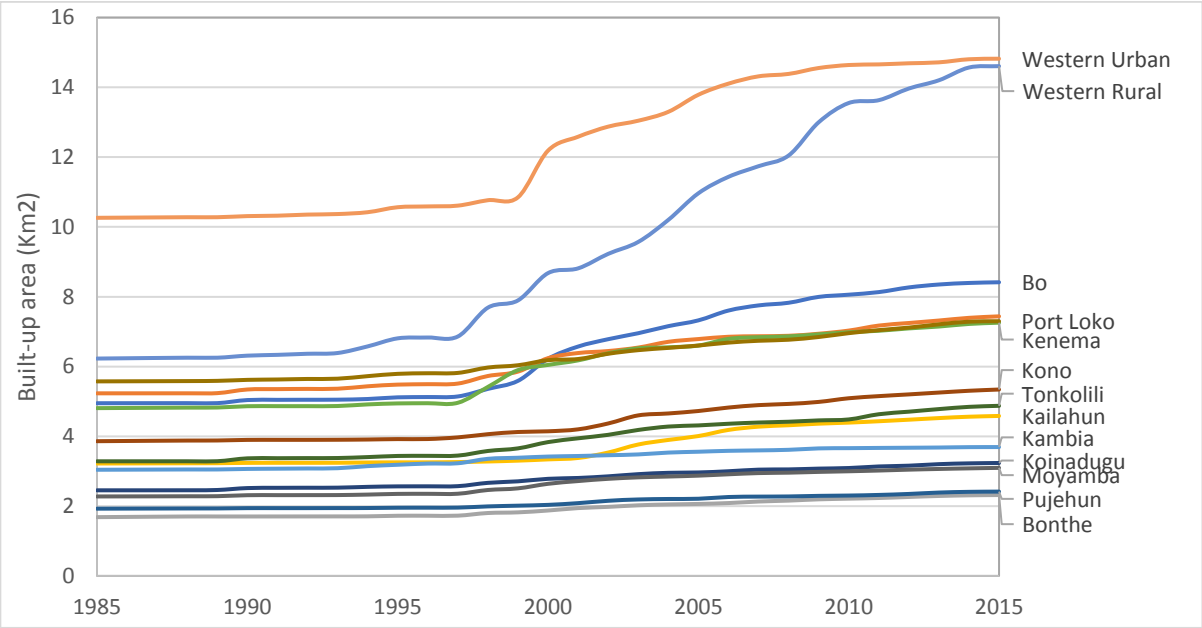
Use Class	Employed Population (%)	Non-Residential Exposure (US$, %)
Warehouse	63.4%	29.8%
Industrial building	7.2%	18.5%
Office building	8.7%	15.2%
Retail building	16.7%	24.0%
Critical building	3.6%	12.4%

Source: Authors with data from the 2004 and 2015 censuses.

The evolution of built-up surface over time in the different districts of the country was assessed through two additional datasets—the World Settlement Footprint Evolution (1985–2015) dataset from the German Aerospace Agency, and Digital Globe's Building Footprint dataset. The results, presented in Figure 16,**Error! Reference source not found.** show that in addition to the Western Urban district, the Western Rural district (primarily Waterloo) and Bo have experienced a significant increase in built-up surface since 2000. Built-up surface in the Western Rural district has grown at a 3.5% rate annually between 2000 and 2015, reaching levels of built surface comparable to those of the Western Urban District.

Although there was a large increase in built-up surface in the Western Rural District since 2000, the concentration of the economic value of the building stock in the Western Urban District, as well as its distinct building typology distribution, point at higher replacement costs of building assets in the Western Urban district (estimated at $149/m^2), when compared to the Western Rural District ($113/m^2) and the national average ($96/m^2).

Figure 16. Evolution of Built-up Exposure (in km^2) by District (1985–2015)



Source: Authors with data from DLR, and DigitalGlobe.

3. Macroeconomic Impact of Disasters

Following a brief context of Sierra Leone's economy and macroeconomic outlook, this subsection discusses the impact that fast onset adverse natural events—floods and landslides—can have on Sierra Leone's economy, as well as the mechanisms through which large public health-related events can affect Sierra Leone, with a focus on the COVID-19 pandemic.

3.1. Country Context

After the 11-year-long civil war, Sierra Leone achieved strong economic growth that peaked at 20.7% in 2013, resulting from resumption in iron ore production combined with government investment in infrastructure as well as the development of the agriculture, tourism, and services sectors. This impressive growth period was disrupted by both an unprecedented decline in international iron ore prices starting in late 2013, and the outbreak of Ebola Virus Disease in 2014, together culminating in GDP contraction of 21.1% in 2015 (AFDB, 2017). After a recovery process driven by the agriculture and construction sectors, and iron ore production and export in 2018 and 2019, Sierra Leone's economic activity has suffered from the impact of an unprecedent pandemic in 2020.

Sierra Leone's economic activity is largely dependent on agriculture—including forestry, fishing, and hunting—with the sector employing more than half of the country's formal and informal workforce and accounting for about half of GDP (World Bank, 2018c). However, despite employing only 1.5% of the workforce, the mining sector also plays an important role in Sierra Leone's economy, accounting for about 14% of the GDP, with mineral products and precious metals accounting for more than half of the country's exports (OEC, n.d.). Sierra Leone is essentially a supply-constrained monocultural economy depending on a few commodities for output and export (AfDB, 2017). This dependence on extractive activities has made Sierra Leone particularly vulnerable to exogenous shocks.

Table 2. Sierra Leone Macroeconomic Outlook

	2017	2018	2019	2020 e	2021 f	2022 f
Real GDP growth, at constant market prices	3.8	3.5	5.4	-3.1	2.7	4.2
Private Consumption	-0.4	-7.0	2.7	4.0	9.0	10.5
Government Consumption	-4.8	-1.3	2.7	58.3	-11.8	9.5
Gross Fixed Capital Investment	16.2	63.4	9.0	-28.4	18.8	3.1
Exports, Goods, and Services	23.3	-34.9	19.2	-4.2	3.0	19.7
Imports, Goods, and Services	6.3	-11.5	8.1	5.4	15.8	18.6
Real GDP growth, at constant factor prices	3.7	3.4	5.2	-3.1	2.7	4.2
Agriculture	4.5	3.9	5.6	3.1	3.6	3.9
Industry	-5.3	-2.5	10.2	1.1	7.1	4.6
Services	5.3	4.3	3.2	-13.1	-0.3	4.6
Inflation (Consumer Price Index)	18.2	16.0	14.8	15.6	12.8	10.2
Current Account Balance (% of GDP)	-21.1	-18.8	-14.0	-15.5	-14.3	-12.0
Fiscal Balance (% of GDP)	-8.8	-5.9	-2.8	-5.8	-6.3	-4.2
Debt (% of GDP)	57.8	60.5	71.7	79.4	82.1	78.7
Primary Balance (% of GDP)	-6.6	-4.7	-1.4	0.4	1.0	3.0

Note: e = estimate, f = forecast. Annual percent change unless indicated otherwise.

Source: World Bank, Poverty & Equity and Macroeconomics, Trade & Investment Global Practices.

3.2. Macroeconomic Impact of Adverse Natural Events

Historical data is scarce concerning past adverse natural events and their impact on Sierra Leone, and there is only limited information on the mechanisms through which disasters can affect the country's economy. In general, the risk profile of the country suggests that fast-onset events are usually localized, and their effects constrained in time, which reduces the potential for a large negative macroeconomic impact.

The largest recent event experienced in Sierra Leone is the Freetown floods and landslide of August 2017, which affected about 6,000 people, killed 1,141 people, and caused an estimated $16.8 million in damages and $14.9 million in losses. Since the event was circumscribed to a few communities, it is estimated that the impact on economic growth and the overall economic activity was negligible. However, the need to mobilize immediate funds for disaster recovery and response put pressure on the government, which had limited fiscal space to respond to the event as the domestic borrowing requirement had almost reached its limit (2% of GDP), while payment arrears to suppliers and contractors continued to accrue. Although fiscal authorities had earmarked $6.4 million for contingencies, hardly any funding was available when the disaster struck on August 14, 2017 (World Bank, 2017).

In this setting, the Office of National Security (including the military and the police) and the Ministries of Health, Energy, Education, and Water Resources implemented extrabudgetary spending to respond to the disaster. The August 14 events significantly impacted budget implementation, with adverse impacts on revenue mobilization estimated to have exacerbated the problems. Overall, the fiscal deficit was expected to have widened in 2017, largely because of expenditure overruns in response to the disaster. The World Bank approved an IDA grant of $10 million to support Sierra Leone in its efforts to recover from the disaster in Freetown through the Freetown Emergency Recovery Project (P166075).

3.3. Macroeconomic Impact of the COVID-19 Pandemic

3.3.1. Macroeconomic Situation in 2020[13]

Following a rebound in economic activity from 3.5% in 2018 to 5.4% in 2019 driven by agriculture and construction as well as the resumption of iron ore production and exports, it is estimated that Sierra Leone's economy contracted by 3.1% in 2020. The COVID-19 pandemic caused a sharp contraction in the services sector activity, reflecting the suspension of international flights, closure of land borders, and business closures, especially in the hospitality sector. Growth in agriculture was estimated to slow with disruptions both in labor supply due to the lockdown and in delivery of key inputs such as seeds and fertilizers. It is estimated that headline inflation reached 15.6% by the end of 2020 from 14.8% in 2019, reflecting food supply constraints as lockdowns and border closures disrupted domestic and international food supply chains. Food inflation (year-on-year), which had declined to 5.4% by end-December 2019, reached 17.3% at end-July 2020. Contrastingly, nonfood inflation declined from 21.1% to 10.2% at end-July 2020, reflecting lower prices for transportation, hotels and restaurant, and goods and services.

The Leone depreciated by 5.1% against the US dollar in the first half of 2020, reflecting lower-than-expected export receipts, while the current account deficit is expected to have increased to 15.5% of GDP in 2020 from 14.0% in 2019, due largely to the widening of the trade deficit as exports fell while imports increased. Total expenditure is estimated to have increased to 26.1% of GDP from 20.6% of GDP in 2019, with increased spending to implement public health measures and mitigate the impact of the crisis on households and businesses. The overall fiscal deficit is estimated to have increased to 5.8% of GDP compared to an original projection of 3.3% of GDP. Total public debt is estimated at 79.4% of GDP in 2020 (up from 71.7% in 2019), largely reflecting the larger fiscal deficit.

3.3.2. Sierra Leone's Economy in the Context of a Pandemic[14]

An assessment was conducted by Monasterolo et al. (2020) to isolate the effects of COVID-19 on the dynamics of the real economy and public finance of Sierra Leone using the EIRIN Stock-Flow Consistent and Agent-Based Models. The COVID-19 shock was modelled and its impact on the economy was benchmarked against a business-as-usual baseline scenario, with the results reported in Table 3. In a scenario characterized by a worldwide impact of COVID-19 and lockdown measures, Sierra Leone experiences a negative economic impact mainly through shocks on exports (for instance, titanium ore, diamond, and aluminum ore), remittances, and—to a lesser extent—international tourism, affecting the services and industry sectors. COVID-19 also impacts domestic demand due to lockdown measures in the second quarter of 2020. The combination of domestic and external demand reduces real GDP in April and May 2020, and leads to a drop on aggregate supply due to the decrease in firms' sales expectations. In the following two months, the GDP downturn slows down and even reverts to a slight increase due to the support of the IMF (early June) and the World Bank (mid-July) (IMF, n.d.).

[13] The source of the values presented in this subsection is World Bank (2020).
[14] The source of this subsection is Monasterolo et al. (2020).

Table 3. Evolution of Macroeconomic Variables as modelled in the COVID-19 Scenario

Variable	Jan 2020	Jun 2020	Dec 2020	Jun 2021	Dec 2021	Jun 2022	Dec 2022
Real GDP	100	96.6	94.6	96	94.5	92.5	91.2
Inflation Rate	100	93	94	97	95	95	93
Unemployment	100	114	162	193	222	236	236
Nominal Wage Growth Rate	100	99.7	97.2	95.8	94.4	93.5	93.5
Public Debt to GDP Ratio	100	102.8	107.6	106.3	108	110.5	113.4
Export to GDP Ratio	100	81	75	94	95.5	97.3	98.5
Aggregate Demand	100	92.7	91.8	94.4	93.1	91.6	90.5
Aggregate Supply	100	100	97.2	95	93.4	91.6	91

Note: Values relative to the base period (January 2020 = 100).

Source: Monasterolo et al. (2020).

The model shows that the external demand shock lasts for the whole year of 2020 and the increase in unemployment keeps wages lower with respect to the baseline scenario, reducing demand and in turn reducing investment, especially in the Industry and Service sector, and not allowing GDP to catch up to the baseline scenario. A slight recovery occurs in early 2021, led by the recovery of external demand. However, after the said recovery, the shock on GDP worsens as firms revise their economic expectations downwards, thus inducing a long-lasting negative effect on real GDP in response to self-reinforcing supply-demand effects. Unemployment increases persistently, even after the recovery of external demand due to the demand-supply effect that exacerbates the economic downturn and does not allow unemployment to decrease, and instead doubles in 2021 with respect to the baseline scenario. Linked to high unemployment rates, nominal wages decrease following a Phillips curve-like effect.

Following the COVID-19 shock, in 2020 inflation stabilizes at a lower level with respect to the baseline scenario, mainly led by the decrease in nominal wage in response to high employment and lower economic activity. The pandemic has a negative impact on debt to GDP ratio due to lower GDP and higher debt issuance because of reduced government revenues from taxes. A drop in debt to GDP ratio in July and August 2020 is caused by the intervention of international institutions, whose support allows to increase GDP level without immediately increasing the domestic debt issuance. However, the beneficial effects last until the support is active, while in the following months the debt to GDP ratio keeps increasing due to the worsening of economic activity. COVID-19 also leads to a large drop in export to GDP ratio lasting from April to December 2020.

4. Institutional Setting for Disaster Risk Management

4.1. The Disaster Management Department and the National Disaster Management Agency

In Sierra Leone, the responsibility for coordinating disaster risk management had historically laid with the Office of National Security—ONS (GoSL, 2002). The ONS was established in 2002 by the National Security and Central Intelligence Act (NSCIA, 2002; Part V). To strengthen disaster risk management capacities and set up processes and structures that allow for an integrated and effective response, a Disaster Management Department (DMD) within the ONS was created in 2004.

Mandated by the NSCIA 2002, the DMD held the central responsibility for coordinating and managing national emergencies and both natural and man-made disasters (GoSL, 2006a). Thereby, within the UN

Hyogo and Sendai framework, DMD endorsed a holistic approach to risk management including risk identification and assessment, prevention, preparedness, and response. Besides coordination, which includes different stakeholders at various levels[15], DMD was assigned to promote the integration of disaster risk management into sustainable development programs and develop studies, policies, plans, and commissions to support the national disaster management systems (GoSL, 2006a). These included the Disaster Management Policy of 2006 (GoSL, 2006a), the National Disaster Management Preparedness Plan (GoSL, 2006b), and a National Hazard Assessment.

To further strengthen governmental response capacities as well as the capacity of communities to respond to emergencies, in June 2020 the Parliament approved the National Disaster Management Agency (NDMA) Act (GoSL, 2020) which sets out the institutional architecture to manage disasters and emergencies from the national to the chiefdom level. Besides the NDMA, the Act establishes a multisectoral body called the National Platform for Disaster Risk Reduction, chaired by the Vice President, and comprised of 33 representatives from ministries, departments, agencies, and civil society.[16] The Platform has the primary responsibility for the coordination and management of national disasters. Besides the establishment of the Agency and Platform, the Bill further elaborates on regional and district coordination, on the declaration of state of emergencies (see Annex 1), and enacts the establishment of a National Disaster Management Fund. The NDMA was officially launched on 19 November 2020 by the President of Sierra Leone (State House Media and Communications Unit, 2020).

To support the government on the implementation of these new institutional structures, the World Bank conducted in 2019 a Capacity Needs Assessment for Emergency Preparedness and Response (World Bank, 2019) which discusses in detail the institutional establishment and recommended capacity needs of a fully functional National Disaster Management Agency and Emergency Operations Center for Sierra Leone.

4.2. Early Warning Systems

An efficient Multi-Hazard Early Warning System involves different institutional stakeholders, and actively engages the civil society and communities in the disaster preparedness and response process. In Sierra Leone, the ongoing institutional reforms as part of the recently approved NDMA Act constitute an opportunity to strengthen the coordination for an Early Warning System capable of promptly gathering, processing, and communicating disaster information to local stakeholders and vulnerable communities. Key stakeholders involved in Early Warning in Sierra Leone are presented in Table 4 (World Bank, 2019). It is expected that the Emergency Operations Center (EOC) within the NDMA will play a critical role in establishing protocols and procedures for the coordination of these actors as part of a the soon-to-be-developed National Disaster Management Information Communication System (NDMICS; World Bank, 2019).

[15] Including the Ministry of Transport & Aviation, Ministry of Water Resources, the National Meteorological agency, Red Cross, Provincial/District/Chiefdom Security Coordinators, among others.

[16] Including the Attorney-General, the Mayor of Freetown, the Chief Social Service Officer, the Financial Secretary of the Ministry of Finance, the Secretary General of Sierra Leone Red Cross, and two civil society representatives and a representative of the Association of NGOs, among others.

Table 4. Early Warning Agencies and Interrelationships with NDMICS

Agency	Role and Responsibility
Sierra Leone Meteorological Agency	- Monitor and forecast the weather conditions in the country for all socioeconomic activities that require meteorological or climatology service. - Develop government policy in the field of meteorology, climatology, climate change, and other climate-related issues. - Promote the use of meteorology in agriculture, food monitoring, and in the monitoring of flood, drought, desertification, and other related activities. - Establish, organize, and manage surface and upper air observational station networks.[17] - Provide meteorological information, advice, and warnings for agriculture, civil and military aviation, surface and marine transport, operational hydrology, management of energy and water resources, and search and rescue operations to mitigate the effects of adverse natural events such as floods, storms, droughts, and disease outbreaks.
Ministry of Health	- Monitor and manage disease outbreaks, with a focus on highly contagious and fatal diseases that have a potential of developing into epidemics.
Ministry of Agriculture and Forestry	- Monitor and manage pest outbreaks for crop and animal husbandry.
Environmental Protection Agency	- Provide information on environment and forestry disaster situations like excessive pollution and fire outbreaks.
Government Hospitals	- Provide information on the number of beds, nurses, and doctors available for emergency response in disaster situations.

Source: World Bank (2019) and Government of Sierra Leone (2017).

5. Financing Disaster and Climate-Related Risks

Historically, the government of Sierra Leone has shown limited capacity to finance disaster response and recovery, and has had to rely on international partners and donors. Recognizing the need to strengthen disaster preparedness and response systems, the government is taking actions to improve its disaster risk management institutional framework and is committed to further build up its disaster financing capacities. The following section includes inputs from a study that has been recently finalized to provide inputs for advancing financial planning for disasters and recommendations to build a risk financing strategy.[18]

5.1. Ex-ante Risk Financing Instruments

In the past, Sierra Leone has rather been reactive and made use of post-disaster financing solutions with a relatively high dependency on, and long history of, international aid to respond to emergencies. However, this is changing, and the government seems to engage in developing ex-ante financing

[17] Only a handful of weather stations are currently reporting data for use by scholars and international organizations. Thus, gridded datasets based on satellite data, reanalysis (in other words, modeled data constrained by observations), and/or data from stations located in neighboring countries (along with interpolation techniques) are often used to describe the current climate.

[18] So & Rajput (2020). Sierra Leone Crisis and Disaster Risk Financing Diagnostic. Unpublished World Bank Report.

instruments such as a national disaster management fund and a potential contingent credit. Ex-ante DRF instruments can help governments to respond to different types of disasters in a timely manner. This section elaborates on how the GoSL uses different ex-ante financing arrangements and instruments to plan for disaster reduction and response.

5.1.1. Budget Provisions and Reserves

With respect to the financing of the DRM architecture as well as risk reduction and response, the Ministry of Finance prepares a budget which is approved by Parliament. The summary of the FY2020 enacted budget highlights adverse natural events and epidemics as a prominent fiscal and economic risk and contingent liability (MoF, 2020, p.20–22). Budget allocations to DRM fall under cluster 7 of the Poverty Reduction Strategy Paper (PRSP) IV clusters (Cluster 7: "Addressing vulnerabilities and building resilience") which includes spending for Environment, Climate Change, and Disaster Management. In FY 2019, $1.9 million or 1% of the Total Cluster Budget was allocated to this section (MoF, 2020). It seems that the cluster budget as well as provisions for the ONS are rather intended for administrative and operational purpose as well as potentially risk reduction measures. Any budgeted provisions for emergency response and recovery financing seem to be under different items.

The existing budgetary instruments to finance post-disaster expenditures are not explicitly stated in the government accounts and funds are not specifically earmarked. Looking at past expenditures and comparing current FY2020 allocations with indicative provisions for FY2021 and FY2022—which may consider measures to address the COVID-19 crisis—it seems that 'reserves' for unexpected events (disasters, for instance) are budgeted under the Contingency Expenditure tag—and there mainly under the Contingencies Fund.

The Public Financial Management Act 2016 (GoSL, 2016b) under section 36 states that the Contingencies Fund's provisions and actual aggregate expenditures per financial year under the regular budget (in other words, main estimates) shall not exceed 2% of Non-Extractive Industries Revenue (Non-EIR). 2% of non-EIR in the 2020 main estimates amounts to approximately $12 million.[19] Past actual expenditures under the Contingencies Fund in FY2016 amounted to approximately $7 million, and approximately $1 million in FY2018 (MoF, 2018). The Ministry of Finance (2020) estimates contingency reserves in the indicative budget for FY2021 and FY2022 to be around $5 million and $4.5 million respectively (or 0.1% of GDP).

Further contingent budget instruments that might also be used to finance needs during emergencies are the Special Warrants of the President (PFM Act 2016, section 38) and an unallocated head of expenditure set aside in the Consolidated Fund[20] (PFM Act 2016, section 39). Both items may not exceed 1% of the Non-EIR in the main estimate per financial year each.

Contingent funds are intended to cover the costs and needs arising from rather frequent events with limited impacts. Such funds however have opportunity costs as resources cannot be spent as capital expenditure or in development programs, thus their provisions are typically rather moderate. Based on

[19] Source: MoF 2020, p. 37: non-EIR of approximately $620 million (that is, total domestic revenues of 640m—about 19.4m of EIR).

[20] Consolidated Fund (as per section 111 of the Constitution) consists of all revenues raised by government (in other words, directly, received as trust or under bi-/multilateral agreements) except for money set aside for other funds and purposes under an Act of Parliament.

available data on the costs associated with the response to historic natural catastrophes in Sierra Leone, the current emergency provisions seem insufficient.

Furthermore, poverty-related budget provisions to the National Commission for Social Action (NaCSA), which often partially originate from donor funding, seem to be used to provide relief in the aftermath of a natural catastrophe. One example is the Sierra Leone Social Safety Nets Project which is expected to have a budget of about $3.3 million (that is, $2.9 million from foreign sources) in 2021 (MoF, 2020). Domestic capital expenditures to NaCSA amounted to approximately $1.4 million in 2020.

5.1.2. National Disaster Management Fund

The National Disaster Management Agency Act 2020 mandates the establishment of a national disaster management fund which will receive contributions from (a) monies appropriated for the Agency by Parliament; (b) grants, donations, and other voluntary contributions to the Fund; and (c) other monies that may in any manner become lawfully payable to the Agency. The Disaster Management Policy 2006 already set the establishment of an emergency preparedness fund as a key strategic objective and envisaged an earmarked disaster provision in the national budget which could be accessed in the aftermath of an adverse natural event. According to a 2012 Cordaid report, such a fund was to be created in 2011 by the ONS. The fund was intended to finance reconstruction and rehabilitation, and could receive/access different sources of funding.

5.1.3. Contingent Credit

Sierra Leone does not currently have a contingent credit line, but is in discussions with the World Bank about a potential Development Policy Credit with a Catastrophe Deferred Drawdown Option (Cat DDO). This would allow the government to quickly access financial resources in an event of significant emergency where a predefined soft trigger condition (usually the declaration of state of emergency due to a natural catastrophe or health-related event) is met. In case of an appropriate macroeconomic framework and fulfilled prior actions—often related to institutional or policy reforms—Sierra Leone could access a maximum Cat DDO of about $20 million (corresponding to 0.5% of Sierra Leone's GDP).

5.1.4. Sovereign Insurance and the Insurance Sector in Sierra Leone

Through sovereign insurance and sovereign risk pools, countries can transfer part of their risk, liabilities, and actual financial burden of disaster response and access rapid liquidity in the event of a sufficiently large and severe insured event. Terms of insurance, including the price, are defined through the insurance policy. For example, the African Risk Capacity (ARC) is a risk pool which offers governments insurance coverage for significant drought, extreme weather (Extreme Climate Facility), outbreaks and epidemics (O&E), and soon, flooding, and tropical cyclones as well.

Sierra Leone is a Member State of ARC but at present not (actively) buying any of these insurance products. With respect to pandemics and health emergencies related to specific diseases, as an IDA country Sierra Leone may access (limited) funds through the Pandemic Emergency Facility (PEF) established by World Bank given the predefined trigger conditions are met. Furthermore, other institutions and large private reinsurers may offer tailor-made sovereign solutions as well. In case Sierra Leone buys this insurance, the country should thoroughly assess their need and financing capacity in order to find an efficient and affordable insurance solution. Such insurance would normally cover high severity and low frequency events (above a certain threshold or attachment point). The premiums would be paid

out of national budget (for example by the Ministry of Finance/Treasury) and potential payouts would be received as budget support.

5.1.5. The Insurance Market and Insurance Regulation in Sierra Leone

The insurance market in Sierra Leone is still underdeveloped and inadequately regulated (Business Wire, 2017). Despite some growth driven by mining industry, construction and agriculture, Sierra Leone is still struggling with the effects of the Ebola crisis and a drop in international iron ore prices. Growth in these sectors has increased the demand for certain insurance products and services in the past (for instance, employer liability, life insurance). The insurance penetration rate—in other words, the ratio of premiums underwritten in one year over the GDP which reflects the relative size of the insurance market—has been consistently low.[21] We know from different sources that there are seven to nine insurance companies and six brokers licensed in Sierra Leone, as well as one State-owned reinsurer (Actuarial Post, n.d.). Besides low penetration and rising unemployment, the major challenge and concern of the industry is the weak regulatory framework and missing alignment with international best practice.[22] The low penetration rate of the insurance market leaves the government with large implicit fiscal exposure.

The Sierra Leone Insurance Commission (SLICOM)—established by the Insurance Act of 2000 (GoSL, 2000) and inaugurated in 2013 —is responsible for the supervision, monitoring, and licensing of insurance actors (that is, companies, brokers, loss adjusters), but has limited resources and capacities to fulfill their mandate adequately (Actuarial Post, n.d.).[23] Furthermore, the industry does not provide SLICOM with adequate data on its financial condition. The insurance market in Sierra Leone is regulated by the new Insurance Act of 2016 (GoSL, 2016a) which aims to strengthen SLICOMs role.

5.2. Ex-post Financing Instruments and Arrangements

Sierra Leone is regularly using international support to respond to disasters and the Parliament may make use of supplementary budget or budget reallocations to react to emergencies. Furthermore, the country has a history of successfully implementing social safety nets which help households and individuals to cope during emergencies and with the impact of disasters.

5.2.1. Donations and Humanitarian Assistance

The humanitarian sector and international aid play a crucial role in funding disaster and emergency response in Sierra Leone with the Government largely relying on donations (i.e., cash or in-kind) for immediate response and for recovery.[24] As per National Disaster Preparedness Plan, only extreme events (classified as level 3 disasters) would require international assistance but not emergencies at district (level 1) and national emergencies (level 2). In reality though, even minor events such as group fires often need humanitarian assistance as financing is not available or the budget is not forthcoming (Sandford et al., 2020). However, this source of finance is associated with unpredictability, large variability in volumes of resources mobilized and provides little incentive for the government to take ownership and build up its

[21] In other words, around 0.37% in 2016 according to Africa Re https://www.africa-re.com/dashboards/SL.

[22] Neighboring francophone countries have common standards under CIMA (Conférence Interafricaine des Marchés d'Assurances) which is a regional insurance oversight body with common rules and effective supervisory structures in 15 francophone countries.

[23] In other words, shortage of professional staff, training, manuals and procedures, tools, and technology.

[24] For examples and more detailed information of international response and assistance, see response reports to the 2014 Ebola crisis (National Ebola Recovery Strategy, 2015) and 2017 Landslide (UN Recovery Bulletins, 2017 or UN Sierra Leone's August 2017 Landslide and Floods early recovery and risk management action plan, 2017).

own capacities. According to data from UN OCHA (2020) the average annual humanitarian funding to Sierra Leone from 2010 to 2020 amounts to about $79 million.[25] Excluding the financing of the Ebola response in 2014, which amounted to $712 million, the average annual contributions are about $16 million. Average annual contributions from the humanitarian sector seems to have declined compared to the previous decade. Typically, such funding would be largely off-budget and managed by the development partner itself or go directly to implementing agencies (for example, the Red Cross) or NGOs.

5.2.2. Budget Reallocations and Extraordinary Budget

Budget reallocations or requests for extraordinary or supplementary budget to deal with the impacts of natural and health-related disasters are a common practice in many countries. In Sierra Leone, the Public Financial Management Act 2016 (GoSL, 2016b) lays out the responsibilities of the Parliament, Cabinet, the Ministry of Finance, and other institutions in the budget system and clarifies on conditions, processes, and responsibilities for in-year-adjustments of the budget, including supplementary estimates (followed by a Supplementary Appropriation Bill). The PMF Act 2016 in section 42 states, among others, that supplementary estimates shall be approved by Parliament, cannot go before Parliament before 7 months into the financial year and not more than twice per year (except for the accounts of the Contingencies Fund, the Presidents Special Warrants or the unallocated heads of expenditure), and that budget provisions may not be carried over unless the Ministry of Finance's regulations prescribe it (PFM Act 2016, section 45). The Public Financial Management Regulations 2018 (GoSL, 2018) further clarify that supplementary estimates shall not increase the total State budget, except (i) in the case of a natural disaster, epidemic, illness or unforeseen financial or economic crisis, or (ii) when this can be financed by an increase in revenues other than domestic or external borrowing (PFM Regulations 2018, section 25(1)). Moreover, the Regulations elaborate on the processes for unbudgeted expenditure and overspending (section 30). A review by Overseas Development Institute (Welham & Hadley, 2016) of Sierra Leone's institutional arrangements with respect to public financial management indicated that, as of 2016, the executive had informal power on budgetary issues (for example, on overspending allocations of the unallocated funds) and that cash availability was a significant constraint to changes in budget.

5.2.3. Taxation

No significant indications or evidence of tax increases to finance response or recovery from adverse natural events or other emergencies was found during this brief desk review. However, further investigations might be needed to get clarity on this.

5.2.4. Shock Responsive Safety Nets

Experience suggests that safety nets including cash transfers can be an effective means to help households or individuals cope with the economic impacts and access much needed services and goods during emergencies such as adverse natural events and health crises (see Bown et al., 2020 and Sandford et al., 2020). With a robust and functioning safety net system and infrastructure in place, such programs may adapt rather flexibly to different kinds of shocks and adjust implementation modalities during emergencies (for instance, expanding the number of beneficiaries, increasing transfers, adjustment of target criteria and objectives, etc.). Such systems can also create incentives and enable governments to take increasing financial and political ownership of crisis response.

[25] As-if extrapolation of 2020 data (available from 1st May- 31st December 2020) to account for a full calendar year.

In Sierra Leone, shock-responsive social protection was successfully implemented after the Ebola Virus Disease outbreak in 2014 and the 2017 landslides and floods where the systems were eventually also used to direct and disburse humanitarian assistance from different partners (Sandford et al, 2020). Subsequently, the government had pre-arranged $4 million in contingent finance for emergency cash transfers as part of a World Bank project.[26] These funds were used in relation to the government's COVID-19 response and released within three months after the systems were ready to respond (So et al., 2020).

Sierra Leone's social safety net ("Ep Fet Po") program was launched in 2014 and is implemented by the National Commission for Social Action (NaCSA) as part of the country's efforts to reduce poverty (Sandford et al, 2020). With funding from the government and its development partners, the program reached about 60,000 households during its rapid Ebola response phase and currently under COVID-19 anticipates assisting 70,000 poor and vulnerable households.

A national social protection policy has recently been prepared and is about to be approved by Parliament.[27] The policy establishes a National Social Protection Secretariat (currently under NaCSA), defines measures to set up minimum protection packages and lays out institutional structures and coordination mechanisms for advancing social protection. Stakeholders involved include the Ministry of Labor and Social Security, the private sector, and international and national NGOs (Sandford et al, 2020). Although there was successful collaboration between NaCSA[28] and ONS in the response to the landslide 2017, "social protection" is not yet a formal pillar of the governments emergency response system.

Despite the successful implementations and progress achieved in reforming social safety nets, further strengthening and enabling of such systems is needed. Systematic planning and coordination (in other words, among ministries but also with and within the international community) as well as prearranged, steady funding is needed to advance the system and make it resilient (Sandford et al, 2020).

6. Impact of Disasters on Poverty and Inclusion

6.1. Relationship Between Fast-Onset Disasters and Poverty

Rapid onset events such as the landslide and floods experienced in recent years have had a large detrimental impact on the well-being of the Sierra Leoneans affected. For the most recent landslide and floods of 2017, over 3,000 people lost their homes; but only a third of the households in the affected areas owned their own dwellings (the rest was mostly rented). Nonetheless, for many living in these areas, housing also constituted a source of livelihood as two of the most common livelihoods are small-scale traders and those working as carpenters or masons (World Bank, 2017). According to data from the registration of affected households, more than two weeks after the event, two thirds of the affected adults had still not returned to their normal economic activity.

Past floods have had a larger impact on poor households in Sierra Leone than the 2017 event, as the latter was rather localized in space. During the 2015 rainy season, there was intensive flooding in some areas in Freetown and the Western Rural Area, and more widespread flooding in the Pujehun and Bonthe Districts

[26] The governments Ep Fet Po program was reformed into a shock-responsive safety net program which is supported by IDA and GRIF Financing (under the Social Safety Net Project). The project frontloaded $26 million for assisting households to deal with the COVID-19 crisis.

[27] Status as of 2021 yet to be confirmed.

[28] NaCSA's efforts were implemented under the 'Shelter' pillar.

which affected more than 24,000 people (CRED, 2021). Following the floods, a comparison was made between the people in the Western Area who had been affected by the event and those who had not. Overall, those affected had lower quality housing, fewer durable goods, and higher levels of food insecurity. The value of durable goods owned decreased by 23% and food insecurity increased by 0.65 points (on a scale from 0 to 8) in those households that had experienced flooding.[29] Within Freetown, however, the areas most affected by the 2015 floods were low-lying informal housing areas that were likely significantly poorer than other parts of Freetown before the floods.

In the Western Area, poor households are often more exposed to floods and likely more susceptible to suffer losses from such events. While poverty rates remain well below the rest of the country, Freetown was the only area to experience a significant increase in poverty between 2003 and 2011, from 14% to 21%. The increase in poverty in Freetown was driven by rural-out migration, the slow creation of well-paid jobs, and inflation. Poor households are typically pushed to hazard-prone areas (that is, steep land) due to land ownership and market factors, but also have housing materials of poorer quality, and the livelihood activities conducted by the majority are typically unsafe or less resilient to floods. The relationship between disasters and poverty is bidirectional: the poor live in areas that are less desirable due to the risk of flooding, and flooding makes the households poorer than they would be otherwise (World Bank, 2017).

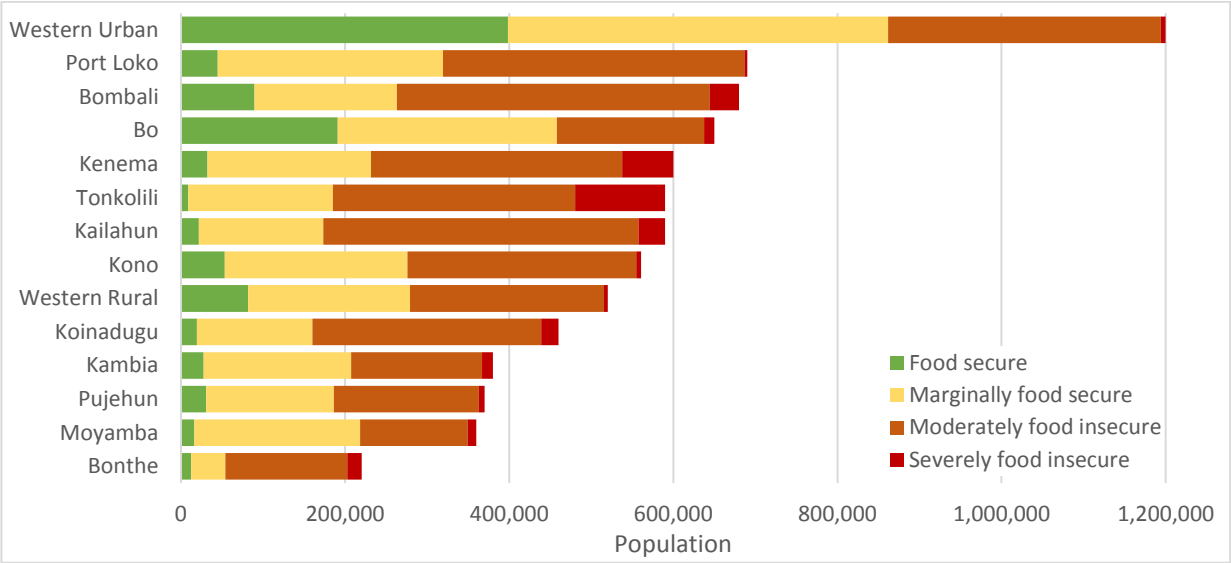
6.2. Food Insecurity in Sierra Leone

In Sierra Leone, a large part of the population has been chronically food insecure, at least since the Ebola Virus Disease Epidemic in 2014. While in September[30] 2018 43.7% of the population was food insecure, by August 2019 this figure reached 53%, with all districts of the country suffering to a considerable extent from food insecurity (Figure 17). Food insecurity has remained high since the Ebola Virus Disease epidemic that hit the country: the previous comparable food security data collection exercise dates back to September 2015, when half of the population was food insecure (Comprehensive Food Security and Vulnerability Analysis — CFSVA). Food insecurity has also been considerably high even in post-harvest period (January – February) when access to and availability of food is supposedly higher. The food insecure population reached 47.7% in February 2020, rising from 34% in February 2019. These figures point at the prevalence of chronic food insecurity in Sierra Leone.

[29] 2015 Comprehensive Food Security and Vulnerability Survey.

[30] September corresponds to the end of the lean season when access to and availability of food is constrained by the peak of the heavy rains and low local agricultural production levels.

Figure 17. Food Insecurity by District in August 2019



Source: Authors with data from WFP (2019).

Food insecurity is driven by multiple factors well beyond adverse drought events, as is the case in many other countries of the region. Sierra Leone has a climate that brings considerable precipitation during the rainy season from May to November. However, even if the overall precipitation over the rainy season remains at normal levels, erratic rainfall patterns—including the late onset of the rainy season, unevenly distributed rainfall throughout the season and flooding as happened in both 2018 and 2019—can negatively affect the already significantly low agricultural productivity levels, reducing yields, food availability, and depleting household food stocks, with a detrimental impact on food security. Other drivers of food insecurity listed in the 2015 CFSVA include shocks related to the Ebola Virus Disease, poor market accessibility, lack of access to safe water, gender inequality, lack of education opportunities, and lack of income generation diversification among farming households.

Rural people who rely on subsistence agriculture directly suffer from the effects of adverse weather conditions, but economic shocks also determine food insecurity levels in urban areas. Food insecurity in Sierra Leone has increased due to economic shocks—high inflation, increased food prices, and reduced income generating opportunities—, particularly for urban dwellers who rely on wage labor opportunities and market purchases to meet their food needs. In 2019, for instance, economic shocks were the main driver of food insecurity, as the national currency depreciated by 10% compared to 2018 levels (CILSS, 2019; SWAC, 2020). In January 2020, the food security monitoring survey revealed that while food insecurity was highest in rural districts, Sierra Leone experienced a sharp increase in the number of urban residents living in food insecurity.

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Annex 1. A Disbursement Trigger for a Cat DDO

Summary

The article 29 of the constitution only allows for the declaration of a *State of Public Emergency*, or for the declaration of a situation which, if it is allowed to continue, may lead to a *State of Public Emergency*. Other DRM-related legislation—including the 2020 National Disaster Management Agency Act—refers to the constitution for the declaration of such S*tate of Public Emergency.* For past disaster events, including Ebola and COVID-19 pandemics, this has been the exceptional state issued in the country.

Proposed Trigger

It is proposed for the disbursement trigger to be the Declaration of a State of Public Emergency by the President of the Republic of Sierra Leone, in accordance with Subsection 1 of Section 29 of the Constitution of Sierra Leone, 1991, Act No. 6 of 1991.

Declaration of a State of Public Emergency

The Constitution of Sierra Leone (Act No. 6 of 1991) provides for the declaration of a *State of Public Emergency*, through subsection (29 1.a), and for the declaration that a situation exists which, if it is allowed to continue, may lead to a state of public emergency, through subsection (29 1.b).

Extract from The Constitution of Sierra Leone (Act No. 6 of 1991)

29. (1) Whenever in the opinion of the President a state of public emergency is imminent or has commenced, the President may, at any time, by Proclamation which shall be published in the Gazette, declare that—

a. a state of public emergency exists either in any part, or in the whole of Sierra Leone; or

b. a situation exists which, if it is allowed to continue, may lead to a state of public emergency in any part of or the whole of Sierra Leone.

(2) The President may issue a Proclamation of a state of public emergency only when—

a. Sierra Leone is at war;

b. Sierra Leone is in imminent danger of invasion or involvement in a state of war; or

c. there is actual breakdown of public order and public safety in the whole of Sierra Leone or any part thereof to such an extent as to require extraordinary measures to restore peace and security; or

d. there is a clear and present danger of an actual breakdown of public order and public safety in the whole of Sierra Leone or any part thereof requiring extraordinary measures to avert the same; or

e. there is an occurrence of imminent danger, or the occurrence of any disaster or natural calamity affecting the community or a section of the community in Sierra Leone; or

f. there is any other public danger which clearly constitutes a threat to the existence of Sierra Leone. *[…]*

Other relevant legislation

The National Disaster Management Agency (NDMA) Act—published as a supplement to the Sierra Leone Gazette Vol, CXLXI, no. 34, dated June 11, 2020—indicates the State of Public Emergency set forth in the constitution as the main exceptional state to respond to disasters. In its article 28 (1), the NDMA Act points out: *"the President may declare a state of emergency in accordance with section 29 of the Constitution of Sierra Leone, 1991 (Act No. 6 of 1991) […]"*.

Declaration of State of Public Emergency for past events

1. **2014 and 2015 Ebola Epidemic[31]:** to combat Ebola, the government of Sierra Leone declared in July 2014 —and later extended in August 2015—a State of Public Emergency. The declaration was done in accordance with subsection (1) of section 29 of the Constitution of Sierra Leone.

2. **2017 Freetown Landslide and Floods:** multiple sources indicate that on August 15-16, 2017, the government of Sierra Leone declared a state of emergency requesting for international assistance and a *Level 3 emergency*[32] (according to the National Disaster Management Preparedness Plan). However, it was not possible to find the legal evidence related to these declarations.

3. **2019 Declaration of Rape and Sexual Violence as a National Emergency[33]:** on December 7, 2019, the president issued a statement for the Declaration of Rape and Sexual Violence as a *National Emergency*. Although the statement does not mention any piece of legislation (constitution, law, etc.) with further information, press releases suggest this corresponded to a state of public emergency in line with the provisions of the constitution.[34] Some concerns were raised on the use of this declaration given exceptional attributions of the president during an emergency situation.[35]

4. **2020 COVID-19 Pandemic[36]:** on March 24, 2020, Sierra Leone's president declared a State of Public Emergency in the whole of the Republic of Sierra Leone for a period of twelve months, in accordance with subsection (1) of section 29 of the Constitution of Sierra Leone.

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31 https://www.parliament.gov.sl/uploads/other_resources/STATE%20OF%20PUBLIC%20EMERGENCY%20PROCLAMATION%207%20AUG%202014%20BY%20PRESIDENT%20ERNEST.pdf

32 A level-three disaster corresponds to an extreme disaster, in other words, any disaster that would require massive national assistance including military involvement and support through outside intervention (or international).

33 https://statehouse.gov.sl/wp-content/uploads/2019/02/Statement-by-His-Excellency-Julius-Maada-Bio-President-of-the-Republic-of-Sierra-Leone-on-the-Declaration-of-Rape-and-Sexual-Violence-as-Public-Emergency-Freetown-7-February-2019.pdf

34 https://www.thesierraleonetelegraph.com/sierra-leone-parliament-approves-state-of-public-emergency-on-rape/#:~:text=Yesterday%2C%20Friday%2022nd%20February%202019,and%20babies%20in%20the%20country.

35 https://thecalabashnewspaper.com/grave-concerns-over-the-declaration-of-state-of-emergency/?pr=146507&lang=fr and https://sierraexpressmedia.com/?p=87905

36 https://statehouse.gov.sl/wp-content/uploads/2020/03/Declaration-of-a-State-of-Public-Emergency-by-His-Excellency-Dr.-Julius-Maada-Bio-President-of-the-Republic-of-Sierra-Leone-%E2%80%93-24-March-2020.pdf

Annex 2. Assessing Future Climate Conditions in Sierra Leone

As highlighted in the document, extreme rainfall events can lead to flash floods and landslides, impact the safety of critical infrastructure, and result in riverine flooding. On the other hand, climate change and sea-level rise can increase the potential for coastal erosion, and changes in the West African Monsoon (WAM) timing could impact agriculture systems.

Given this context, important questions include:

- What specific climate variables and indices can be used to characterize climate hazards (hot days, extreme rainfall, tropical cyclones) leading to these risks?
- Which characteristics of the climate system at the global and regional scale influence the variability of Sierra Leone's climate conditions, aforementioned variables and associated extreme events at different timescales?
- Which features of the West African Monsoon (WAM) need to be captured by data to be usable?

Initial response elements

To study relevant hazards leading to risk, the following indices—which are commonly used within the climate community—may be appropriate.

- **For extreme heat:** maximum daily temperatures in a year, number of days in a year with maximum temperatures above 35 °C, number of days in a year with maximum temperatures above 40 °C, warm spell duration index (annual count of days with at least 6 consecutive days when T > 90th percentile).
- **For extreme rainfall:** maximum daily, 3-day, 5-day, and 30-day rainfall in a year.
- **For cyclone activity:** maximum windspeed observed.

Table 5 below shows potentially useful dataset to investigate past and present climate.

Table 5. Available Datasets to Assess to Monitor Climatic Indicators

Dataset	Type	Variables Covered*	Time Coverage	Temporal Resolution	Spatial Resolution	URL
ERA-INTERIM	Reanalysis	P, T, WS*	1979–2018	12-hourly	~ 80 km	https://www.ecmwf.int/en/forecasts/datasets/reanalysis-datasets/era-interim
ERA-5	Reanalysis	P, T, WS	1979 (1950)-present	Hourly	30 km	https://www.ecmwf.int/en/forecasts/datasets/reanalysis-datasets/era5
CERA20	Reanalysis	P, T, WS	1901–2010	3-hourly	65 km	https://www.ecmwf.int/en/forecasts/datasets/reanalysis-datasets/cera-sat
TRMM / GPM	Satellite-based	P	1997–present	1.5 hours	0.25°	https://gpm.nasa.gov/data/directory
GPCP	Station-based	P	1979–present	Monthly (daily may exist)	2.5° (other may exist)	https://psl.noaa.gov/data/gridded/data.gpcp.html
GHCN	Station-based	P, T	1900–2015	Monthly	5°	https://psl.noaa.gov/data/gridded/data.ghcngridded.html
CRU	Station-based	P, T	1901–2019	Monthly	~100km	https://sites.uea.ac.uk/cru/data

WILLMOTT & MATSUURA (UDEL)	Station-based	P, T	1900–2014	Monthly	0.5°	http://climate.geog.udel.edu/~climate/html_pages/download.html#ghcn_T_P_clim3
GPCC	Station-based	P	1901–present	Monthly	0.5°	https://psl.noaa.gov/data/gridded/data.gpcc.html
CHIRPS	Station and Satellite-based	P	1981–present	Daily	0.05°	https://www.chc.ucsb.edu/data
STATION DATA IF AVAILABLE		P, T	NA	NA	NA	NA
MOD11	Satellite-based	T	2000–present	Daily	1 km	https://modis.gsfc.nasa.gov/data/dataprod/mod11.php

Note: *: P = Precipitation; T = Temperature; WS = Wind speed.

According to the Intergovernmental Panel on Climate Change' Fifth Assessment Report (IPCC AR5), there is "low to medium confidence" in the robustness of projected rainfall change over West Africa due to the inter-model variability in the magnitude and the sign of foreseen change. This can in part be attributed to the inability of General Circulation Models (GCMs) to resolve convective rainfall, synoptic and sub-synoptic precipitation and mesoscale convective systems. Their relatively coarse resolution prevents them to convey the effects of vegetation, orography, and coastlines.

The WAM is a multi-scale process, and models can obviously not represent cumulus-scale interactions due to resolution issues, but some might represent key processes, interactions, and patterns at the global, synoptic and mesoscale better than others. Traditional model validation compares mean of hindcasts to observation or reanalysis data. However, that models reproduce key climate processes and dynamic features is equally important, as it may hint at more appropriate results in future simulation exercises. This is likely especially true when extremes are of interest and processed-based validation concentrating on specific features of the WAM can be used to discriminate which models.

More specifically, criteria for model selection in the region are the correct representation of:

- Wet season (JJAS) precipitation magnitude and location
- WAM annual cycle (onset, monsoon jump, retreat)
- African Easterly Jet (AEJ) and associated African Easterly Waves (AEWs)
- Tropical Easterly Jet (TEJ)
- Saharan Heat Low
- ITCZ location

Further, the WAM is influenced by climate phenomena beyond the region at different frequencies. First, it has been documented that the Indian monsoon sets off the WAM wet season through a teleconnection. The WAM is also impacted at lower frequencies by ENSO (interannual scale), and by the Atlantic Multidecadal Oscillation, which influences the intensity of certain key characteristics. Thus, data used should, as much as possible, be able to capture these oscillations and teleconnections.

Three main global efforts exist to investigate model capabilities to appropriately reproduce the WAM and provide future projections for the region. The African Multidisciplinary Monsoon Analysis (AMMA), the Ensembles-Based Predictions of Climate Change and their Impacts (ENSEMBLES) African project, and

the Coordinated Regional Downscaling Experiment (CORDEX). These efforts use both GCMs, and RCMs. While there are some differences, overall, RCMs tend to carry issues from biases and some of the uncertainties of the GCMs used to parametrize them, and are generally unable of accounting for two-way interactions between regional and global processes.

A rapid literature review[37] suggests that at as of 2020, most GCMs and RCMs still show significant biases and uncertainty for simulating the WAM (in particular regarding precipitation), underestimate low-frequency variability, and that the common practice is still to use multi-model ensembles. However, some important features (monsoon jump, SHL, AEJ, TEJ, etc.) and extreme characteristics are captured by certain RCMs. Generally, simulations have higher skill over West Africa than over the Sahelian region, although some perform poorly over the Guinean Coast, but the construction of ensembles must be location-specific, as biases and uncertainty for different models vary per region. A high-resolution GCM experiment has also been performed and seems to have yielded interesting results.[38]

[37] Comprised of the following articles:

- Akinsanola, A. A., Ajayi, V. O., Adejare, A. T., Adeyeri, O. E., Gbode, I. E., Ogunjobi, K. O., ... & Abolude, A. T. (2018). Evaluation of Rainfall Simulations over West Africa in Dynamically Downscaled CMIP5 Global Circulation Models. *Theoretical and applied climatology*, *132*(1-2), 437-450.
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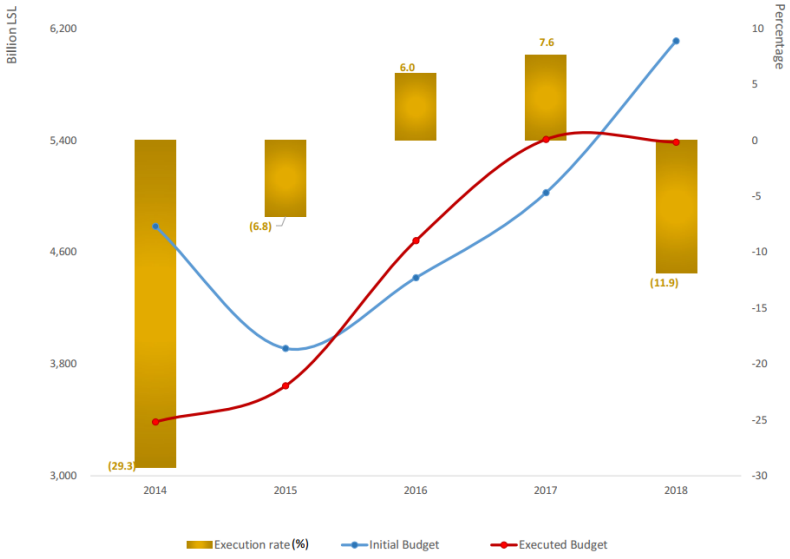
Annex 3. Fiscal Trends and DRM-Related Expenditure and Budget Allocations

Overall Budget Execution Performance – Billions LSL



AVAILABLE INFORMATION

- **Fiscal data has a reduced scope**:
  - BOOST database with limited budget information (2014-18):
    a. Central government
    b. Council.
- **Structure of budget**
  - Economic classification
  - Administrative classification
  - Functional classification
  - Source of budget
- **Budget cycle:**
  - Initial
  - Executed

EXECUTION ISSUES

- Inconsistent execution rates (see FY 2014).
- 7% of the initial budget is not executed by the end of each fiscal year (average underperformance).

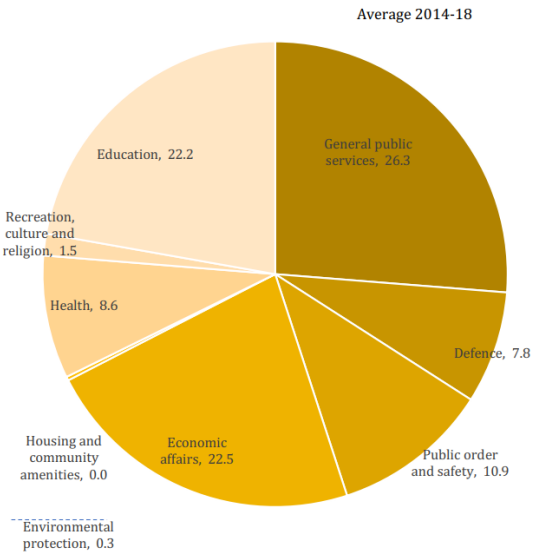
1

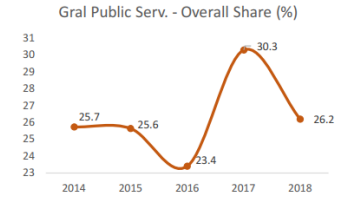
Executed Budget by Function (Share of Total Expenditure - %)

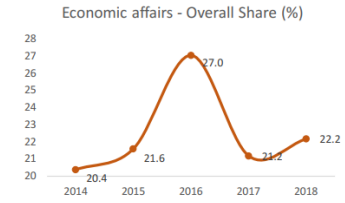
- **Central government (CG) only:** Information from councils is not mapped by function. Councils account for <3% of total expenditure.

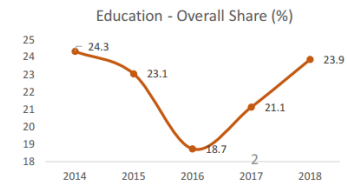
  Approximately 18% of CG expenditure is neither mapped by function.
- **Concentrated expenditure**: On average, General public services, Economic affairs, Education, Public Order, and Health count for nearly 90% of total expenditure.

  Their individual annual share is volatile.
- **Environmental protection has little relevance within public expenditure**. Expenditure in environmental protection as well as housing represent less than 0.5% of CG expenditure each.









2

Volatility YoY of Share of Expenditure, by Sector (%)

	Execution ratio (% change; executed vs. planned budget)					Annual change (YoY, executed budget)			
	2014	2015	2016	2017	2018	2015/14	2016/15	2017/16	2018/17
Central Government	(29.3)	(7.2)	6.1	7.9	(12.0)	4.8	31.6	16.0	(2.0)
General public services	(74.3)	22.5	13.9	21.4	(7.0)	7.1	22.7	12.0	(10.3)
Defense	22.3	(3.8)	24.9	(29.8)	277.1	(1.7)	75.4	(50.4)	8.5
Public order and safety	20.5	(5.1)	17.7	(1.8)	(11.3)	13.3	18.9	14.0	3.4
Economic affairs	40.4	(20.7)	24.8	28.8	(4.5)	13.9	68.3	(32.2)	8.6
Environmental protection	26.7	2.8	(20.0)	6.7	(24.1)	6.1	(13.0)	(36.1)	(12.0)
Housing and community amenities	469.7	603.1	206.0	31.6	39.2	(65.7)	(5.4)	(10.0)	(36.6)
Health	(7.6)	(22.3)	0.3	(9.4)	(21.9)	16.5	32.5	(29.1)	(2.6)
Recreation, culture, and religion	44.9	23.5	17.8	16.6	(28.1)	(16.1)	55.7	(27.8)	55.4
Education	11.0	(14.5)	5.4	(3.8)	(17.4)	1.8	9.3	(2.4)	17.3

- **Data series seems to have important gaps when reporting expenditure.** After reviewing expenditure performance by function, the series shows high volatility either with the execution rate (important underperforming sectors like health or environmental protection) or the annual change (swinging changes in the execution of budget).

3

Identification of DRM-Related Budget Lines (Program-Tagging Exercise)

- **Identification process by function and programs.** Detailed budget information in SL is limited and classifications may have incongruencies (programs and cost centers are listed in the same level of hierarchy).
- Using a tagging identification exercise (based on description): From a total of **830** listed programs/cost centers, only **26** are prone to be DRM-related expenditure.
- Chances of underestimating sectorial expenditure and risking missing information of other sectors are high.

Sector/ Function	Program/ Cost center
ECONOMIC AFFAIRS - Agriculture, forestry, fishing and hunting	**4**
ENVIRONMENTAL PROTECTION – Environmental protection	**1**
HOUSING AND COMMUNITY AMENITIES – Water supply	**1**
HEALTH – Outpatient services	**2**
Hospital services	**1**
Public health services	**2**
NOT MAPPED (aligned to any function)	**15**

4

Identification of DRM-Related Budget Lines (Program-Tagging Exercise)

	2014	2015	2016	2017	2018
Central Govt – Total Expenditure (LSL Billions)	**3,334.3**	**3,492.9**	**4,595.8**	**5,332.4**	**5,227.5**
Identified DRM – Related expenditure (LSL Billions)	**61.3**	**21.0**	**13.4**	**17.9**	**27.9**
04 Economic affairs	1.7	2.5	0.9	1.3	0.6
042 Agriculture, forestry, fishing and hunting	**1.7**	**2.5**	**0.9**	**1.3**	**0.6**
4010102 Cash Crops Production	1.1	1.7	0.3	0.9	0.1
4010103 Food Prod & Crop Prot(North)	0.6	0.8	0.6	0.4	0.4
4010104 FOOD PROD & CROP PROT(SOUTH)	-	-	-	-	0.0
4010105 Multiplication Of Seeds	-	-	-	-	-
05 Environmental protection	2.7	2.2	0.2	-	-
056 Environmental protection nec	**2.7**	**2.2**	**0.2**	**-**	**-**
4060004 Radiation Protection Unit	2.7	2.2	0.2	-	-
06 Housing and community amenities	0.6	0.3	0.2	0.2	0.2
063 Water supply	**0.6**	**0.3**	**0.2**	**0.2**	**0.2**
4060002 Water Services	0.6	0.3	0.2	0.2	0.2
07 Health	19.3	8.3	0.4	0.5	0.5
072 Outpatient services	**0.3**	**0.4**	**0.0**	**0.1**	**0.1**
4010402 Land And Water Development	0.3	0.4	0.0	0.1	0.1
4010403 Land & Water Plan/Res/Ext/Services	-	-	-	-	0.1
073 Hospital services	**18.9**	**7.2**	**0.3**	**0.3**	**0.2**
3040301 Infection Prevention And Control	18.9	7.2	0.3	0.3	0.2
074 Public health services	**0.2**	**0.7**	**0.1**	**0.1**	**0.1**
3040201 Environmental Health (Sani) & Entomology	0.1	0.4	0.1	0.1	0.1
3040204 Neglected Tropical Diseases	0.1	0.3	0.0	0.0	0.1
Not Mapped	37.0	7.8	11.6	15.9	26.7
Not Mapped	**37.0**	**7.8**	**11.6**	**15.9**	**26.7**
1291204 Strengthening Regional Planning	-	-	-	0.0	-
3040010 Directorate Of Disease Prevention & Control	32.0	0.3	0.0	0.1	0.1
4040202 Meteorological Services	0.4	0.3	0.2	0.3	-
4140002 Water Resource Management	-	-	-	-	-
4140101 Water Resources Management	0.6	-	-	1.6	0.6
4140201 Water Resource Management	3.7	5.9	9.2	11.4	9.4
4200001 ENVIRONMENT AGENCY	-	-	-	-	13.8
4220100 Meteorological Operations	-	-	-	-	0.1
6020153 Disease Surveillance Response	-	-	-	0.0	0.1
6020322 Agric Sector Rehab Project	0.1	0.1	0.2	0.1	0.2
6020345 Ebola Fight Back Progs/L 00001	-	0.1	0.3	0.4	0.4
6020346 Ebola Fight Bac Prog S/L 31845	-	0.5	1.3	1.5	1.7
6020348 Rual Water Supply Sanit Cr 2	-	0.3	0.4	0.2	0.3
6020502 Agricultural Sector Support 152	0.2	0.1	-	0.2	0.1
6020601 Bo-Rural Water \$ Sanitation Proj. Cr. No. SI-0040	-	-	-	-	-

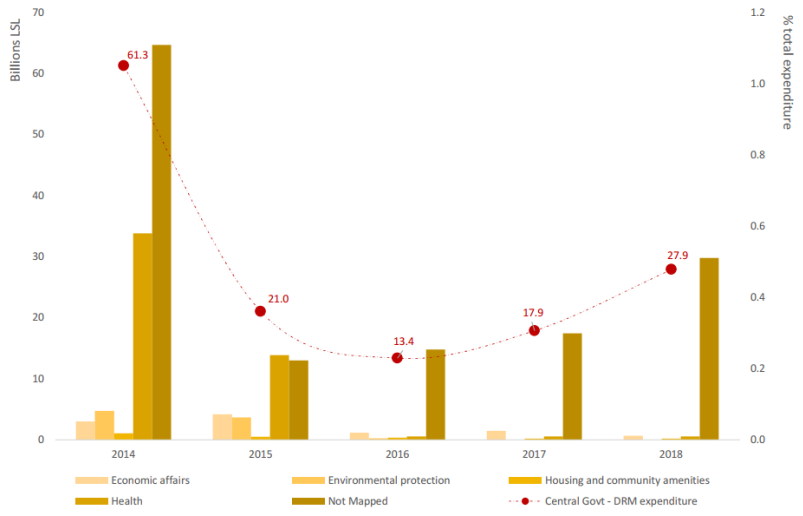
What's driving the identified/prone to be DRM-related expenditure?:

- In **2014**, 83% of the identified expenditure was allotted to disease/infection prevention and control (*Ebola response*).

  In **2018**, 85% of the identified expenditure is allotted to environmental management programs (*flooding response – TBD*).
- DRM-related expenditure decreased over 50% from 2014. Decreasing response allocations?
- How many programs cannot be tagged/ missed information?

5

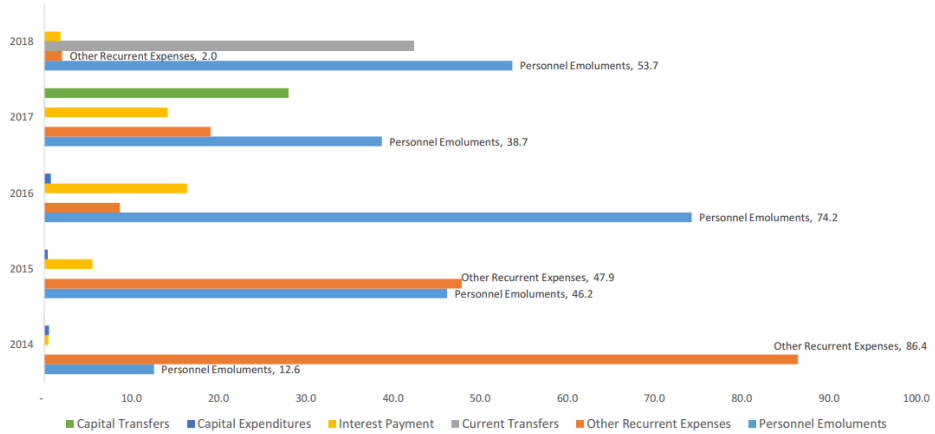
Share of DRM-Related Over Total Expenditure (%)



- **Based on program-tagging, DRM-related expenditure is prone to be underestimated.** On average during 2014-18, DRM-related expenditure represented <0.8% of total expenditure from Central Government. Highest register is from year 2014 (approximately 1.8% of total expenditure).
- **An important fraction of DRM-related expenditure has no association to specific sectors.** On average, 74% of total DRM-related expenditure is explained by programs not associated to any functional classification ("*not mapped*").
- **Allocations in Environmental protection are temporal.** Despite the presence of associated programs, DRM-related expenditure in this function are not constant and during the last 2 FY, there's no registered execution.

6

Composition of DRM-Related Expenditure



- **Allocations of DRM-related expenditure are mostly covering operational/recurrent expenditure.** Approximately 94%% of the DRM-related expenditure is allocated to operational expenditure.
- **Relevance of economic sub-categories is variable**. While Purchases of goods and services drove the expenditure by 2014, its relevance decreases towards the end of the series, favoring wage bill. Capital expenditure has no register by the end of the period.

7

Policy Dialogue Questions Concerning DRM-Related Expenditure

- **What to make of non-referred / not mapped programs?** A relevant portion of overall expenditure cannot be assigned to either a specific sector or function and it is important to have a clear understanding of this situation and its impact on budgeting cycle and effective expenditure. In the case of DRM-related expenditure, it reaches ¾ of the total expenditure.
- **How to identify DRM-related/ sectorial expenditure?** Based on a program-tagging exercise it is possible to identify programs that are substantial to DRM but based on the level of disaggregation and quality of data, it is not possible to have an accurate picture of the overall expenditure (cross-sectorial programs are difficult to identify and count).
- **Which are the main expenditure drivers?** Based on available data (quality and disaggregation issues) it is difficult to identify trends and drivers of sectorial expenditure (how is the expenditure responding to different disastrous events). Based on the review of available budgetary data, it seems that most of the allocations are destined to finance operational expenditure.
- **Is it possible to track the impact of budgetary reallocations?** Before the presence of disastrous events, it is not completely possible to identify changes in budget allocations as response to these events, it not possible to identify contingency funds or emergency extra-ordinary disbursements.

8