



AGRICULTURE AND FOOD GLOBAL PRACTICE

SIERRA LEONE

AGRICULTURAL SECTOR RISK ASSESSMENT



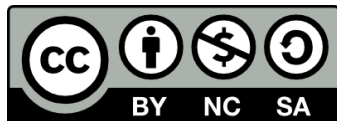
Global Risk Financing Facility

Supporting Early Action to Climate Shocks, Disasters, and Crises



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ACRONYMS AND ABBREVIATIONS

ASI	Agricultural Stress Index
ASRA	Agriculture Sector Risk Analysis
CORAF	West and Central African Council for Agricultural Research
ECOWAS	Economic Community of West African States
FAO	Food and Agriculture Organization
FSRP	(West Africa) Food Systems Resilience Program
GIZ	German Corporation for International Cooperation
ha	Hectare
ICT	Information and Communication Technology
MAFFS	Ministry of Agriculture, Forestry, and Food Security
MT	Metric Tons
NDMA	National Disaster Management Agency
NSADP	National Sustainable Agriculture Development Plan
NWRMA	National Water Resource Management Agency
PPR	<i>Peste des Petits Ruminants</i>
VAP	Value of Agriculture Production
Stats SL	Statistics Sierra Leone
WFP	World Food Programme

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EXECUTIVE SUMMARY

BACKGROUND

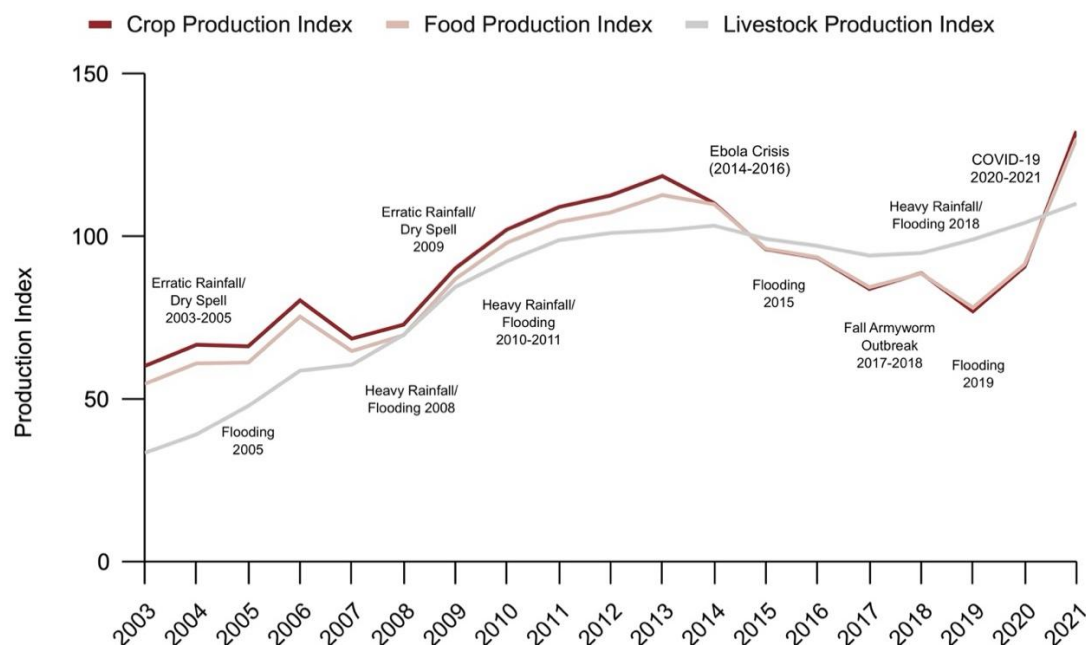
Since the end of the civil war in 2002, Sierra Leone has experienced moderate economic growth at 3.4 percent on average, with agriculture playing a crucial role. Given the potential of agriculture to drive economic growth, the government of Sierra Leone has promoted sector development over the past 20 years through allocation of significant resources toward improving productivity, reviving export crops and the livestock sector, promoting sustainable land management, and developing supply chains and value-added activities. Despite the series of shocks to the country's economy including the Ebola virus outbreak (2014–16) and the COVID-19 pandemic (2020–22), Sierra Leone has been able to increase agriculture sector contributions to the economy from 47 percent to 64 percent. In line with objectives outlined in the National Sustainable Agriculture Development Plan (NSADP) (MAFFS 2009), this represents an all-time high (previously 60 percent of GDP in 1999 prior to a large decline at the start of the war).

Despite its growing importance to the economy and national development goals, Sierra Leone's agriculture sector faces several challenges. Agriculture is dominated by small-scale, subsistence farming under traditional agricultural practices, including rain-fed agriculture. As a result, current average crop yields are low compared with potential yields, and both crops and livestock are exposed to production risks such as weather-related shocks and pest and disease outbreaks. Furthermore, Sierra Leone is among the countries most vulnerable to climate change, largely due to its economic dependence on agriculture and natural resources, which are directly impacted by increasingly frequent extreme weather events and unpredictable weather patterns.

The agriculture sector faces risks that significantly impact stakeholders along all food value chain segments. Coupled with fluctuations in agricultural commodity and input prices, production-related challenges such as weather variations, pests, and disease outbreaks not only affect farmers and businesses within specific supply chains but can also strain government resources. Sudden or substantial declines in production or trade can lead to reduced revenues, impact the balance of payments, require additional compensatory or recovery spending, and negatively impact the government's fiscal position. The recurring cycle of shocks and recoveries diminishes the ability of many countries to promote long-term sectoral development. This report aims to evaluate the existing risks in Sierra Leone's agriculture sector, prioritize them based on frequency and impact, and identify areas that require specialized attention for risk management solutions.

The timeline in Figure ES.1 illustrates key historical risk events that have negatively impacted sector production during the reviewed period. At the national level, the analysis emphasizes those risks with the biggest impacts on agriculture production.

FIGURE ES.1: TIMELINE OF MAJOR SHOCKS TO AGRICULTURE PRODUCTION IN SIERRA LEONE (2014–16=100), 2003–21



Source: FAOSTAT, 2024.

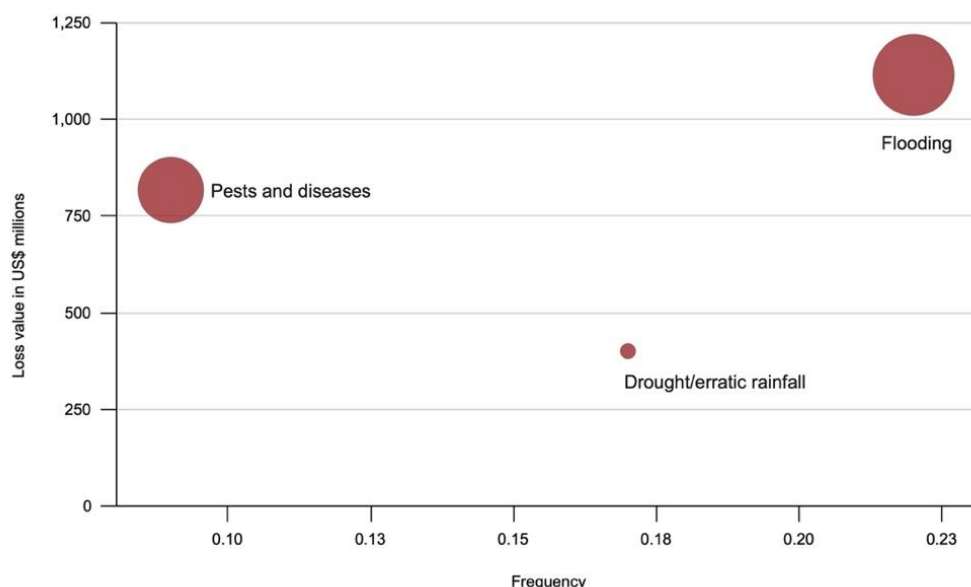
Nevertheless, Sierra Leone’s agriculture sector has immense growth potential if risks facing the sector can be sufficiently managed. In addition to opportunities for value addition and productivity gains, Sierra Leone has untapped land and water resources that could be unlocked for agricultural use. Only 10 percent of the country’s land area is being used for agriculture, while the overall level of water usage for agricultural purposes is low given potential water availability, with irrigated agriculture remaining limited.

This report is intended to support the government of Sierra Leone in the development of a risk management action plan and for disaster risk financing investments. It was compiled with extensive analysis of crop and livestock production, price, and meteorological data records between 2003–2022. It includes evidence from a literature review on production, market, and enabling environment risk events occurring over the foregoing time period and from stakeholder interviews held with farmers, traders, processors, and others sector players, as well as with government and agricultural research staff between June 2023 and March 2024. The results of the analysis are considered in light of the different stakeholders’ vulnerability to the effects of ex post shock events and the resulting ex ante impact upon investment. The most salient issues and results of this analysis are outlined in the report. A considerable volume of supporting data is supplied in the appendixes, including (1) key crop production zones, (2) further analysis of rainfall time series data, and (3) detailed crop yield loss records, among others. The report’s principal findings, conclusions, and recommendations are summarized below.

PRODUCTION RISKS

Average annual agricultural losses resulting from unmanaged production risks in Sierra Leone are estimated at approximately US\$128 million—3.5 percent of GDP. Flooding, pest and disease outbreaks, and erratic rainfall (dry spells) are the most consequential risks in the sector. Floods occur relatively often and result in the largest losses to the sector (see Figure ES.2). Total sector losses are estimated at around US\$2.9 billion in the review period (2003–21), derived from estimates of production losses (see Chapter 4). Rice, which represents 34 percent of the value of agricultural production for the sector, accounted for US\$1.2 billion (42 percent) of total sector losses. Moreover, estimates of production losses suggest that agriculture in Sierra Leone is vulnerable to losses exceeding 15 percent of agricultural gross production value in one out of every three years on average due to unmanaged risks. Flooding occurs approximately once every four years on average and results in substantial agriculture losses to key crops like rice and cassava.

FIGURE ES.2: CUMULATIVE MONETARY LOSSES AND FREQUENCY OF MAJOR AGRICULTURE RISKS IN SIERRA LEONE, 2003–22



Source: FAOSTAT. Calculations made by the author.

Following flooding, outbreaks of pests and disease rank as the second most costly risk affecting agricultural production. Although there is limited documentation of country-wide events, available evidence suggests major loss events occur roughly once in 10 years. The country faces endemic issues with pests like variegated grasshoppers, rodents, and the fall armyworm. Diseases are also prevalent across all key crops, such as African cassava mosaic virus for cassava and root rot for cocoa. The prevailing constraint of low access to and use of chemical inputs (pesticides and fungicides) makes the risk of these outbreaks difficult to contain.

Erratic rainfall and in-season dry spells occur at a national level once every five years and account for the next largest sum of total losses estimated. Losses arise when droughts occur during critical periods of the growing season, leading to reduced crop yields. Wildfire was highlighted as a major production risk by sector experts as part of stakeholder consultations, although its impact in terms of monetary losses could not be quantified due to lack of data.

Like crop production, livestock production in Sierra Leone faces significant challenges due to the prevalence of pests and diseases. Diseases such as the *Peste des petits ruminants* (PPR) and Newcastle disease pose serious threats to small ruminants and poultry, respectively, leading to high animal mortality rates and economic losses. Livestock disease risks are exacerbated by the low number of animal health providers and national vaccination programs.

MARKET RISKS

Market risks in Sierra Leone's agricultural sector encompass challenges related to the pricing, quality, availability, and accessibility of essential products and services. These risks are influenced by factors such as volatile prices of inputs and outputs, unpredictable exchange rates, interest rates, and counterparty risks. The repercussions of these risks extend throughout the agriculture supply chain, impacting stakeholders from farmers to processors and exporters.

One significant market risk seen in the review period is domestic crop price volatility, notably observed in commodities such as rice, cassava, and groundnuts. Price fluctuations are driven by production levels (which are influenced by production risks) and consumer demands. These price variations can deter investments in productivity enhancements and affect the profitability of value chain enterprises such as aggregators and processors.

Export crop price volatility in commodities such as oil palm and cocoa is another notable market risk. Changes in trade policies, informal crossborder trade, and production fluctuations can lead to significant price variations, affecting the profitability of producers and traders on the international market. Exchange rate risks also pose challenges, with past currency depreciation increasing the costs of imported goods and inputs, thus impacting producers' purchasing power and export profitability. Finally, limited access to credit, high interest rates, and counterparty risks further compound the market risks faced by stakeholders in Sierra Leone's agriculture sector.

ENABLING ENVIRONMENT RISKS

Enabling environment risks in Sierra Leone's agricultural sector encompass a range of challenges stemming from changes in the social and economic landscape. The country's ongoing pursuit of rice self-sufficiency has faced hurdles, including the impact of past conflicts on production levels and the reliance on imports during shocks and shortages, leading to market volatility and debt risks for producers. Moreover, aimed at managing domestic prices, frequent policy shifts in tariffs and taxes introduce uncertainty and affect market dynamics, impacting both consumers and producers.

Another critical risk factor is conflict, which has had enduring effects on agricultural infrastructure, land ownership, and institutional support. The civil war (1991–2002) led to substantial losses in crop production and export revenues, and while national-scale conflict is not currently a major risk, unresolved land disputes and farmer-herder conflicts persist. Land access issues, exacerbated by foreign investments and commercial farming expansion, raise concerns about the displacement of smallholders, highlighting the need for effective land tenure regulations and conflict resolution mechanisms. During the period under review, Sierra Leone was hit by the Ebola virus disease and Coronavirus disease (COVID-19). Measures that were put in place to prevent or contain these diseases had negative impacts on the sector, resulting in lower production and market connectivity. Additionally, heavy reliance on a few export commodities poses economic risks, especially amid price fluctuations and declining global demand.

NATIONAL RISK PRIORITIZATION AND MANAGEMENT

Table ES.3 provides an overview of current risks in Sierra Leone according to the impact on the sector and probability of unforeseen events. The risk prioritization was developed in partnership with sector leaders over two participatory workshops. When prioritizing investments in risk management, opting for mechanisms that address risks with high impact and high probability would be the first choice. The red shadings in the figure indicate the level of priority among the risks.

FIGURE ES.3: RISK PRIORITIZATION FOR SIERRA LEONE

	Moderate (5–15% of losses)	Considerable (15–30% of losses)	Critical (30–50% of losses)	Catastrophic (>50% of losses)
Highly probable (1 in 3 years)	Default risk (Co) Domestic price volatility (R, Cs, Gn, O, L) Pest, rodents (Co, O) Theft (Cs, Gn, L) Conflict (R, L)	Theft (Co) Pests + disease (Cs, R) Weeds (R) Exchange rate risk (currency depreciation) (O) Disease, Newcastle disease (L)	Flooding (R) Variability of quality during post-harvest processing (O) Adulteration of harvest from chemicals (Co) Disease, PPR (L)	
Probable (1 in 5 years)	Disease (Gn, Cs)	International price volatility (Co, O) Erratic rainfall (R)	Erratic rainfall (R, Gn) Wildfire (R, Cs) Disease, FMD (L)	
	Wildfire (Co) Flood (Co)			

Occasional (1 in 10 years)				
Remote (1 in 20 years)			Disease, Anthrax (L)	

Source: World Bank 2024 (author's notes from workshop)

Key: Rice (R), cassava (Cs), groundnut (Gn), oil palm (O), cocoa (Co), livestock (L). PPR = peste des petits ruminants; FMD = foot and mouth disease.

A ranking of the most significant risks to each commodity derived from the prioritization exercise can be seen in Table ES.1.

TABLE ES.1: PRIORITY RISKS BY COMMODITY¹

Commodity	<u>Risk</u>		
	Priority #1	Priority #2	Priority #3
Rice	Flooding	Pests and diseases	Wildfire
Cassava	Wildfire	Pests and diseases	Erratic rainfall (flooding and drought)
Groundnut	Erratic rainfall	Theft	Disease
Oil palm	Variability in quality from post-harvest processing	Exchange rate risk (currency depreciation)	International price volatility
Cocoa	Adulteration of harvest from chemicals	Theft	International price volatility
Livestock	Pests and disease	Conflict	Theft

Source: World Bank

The risk assessment identified a set of intervention areas encompassing a broad range of interrelated investments, which together hold strong scope to improve agricultural risk management and strengthen the resilience of agricultural systems in Sierra Leone. Based on the analysis of key agricultural risks, an evaluation of vulnerability levels among various

¹ Table ES.1 reflects a different generalized visualization of the risk prioritization matrix seen in Figure ES.3. It only includes the top three risks for each commodity, assessed qualitatively by experts in the sector after the detailed analysis of losses and frequency of occurrence of each risk.

stakeholders, and the filtering of potential risk management measures, sector stakeholders identified five broad risk mitigation options with high potential to address key agricultural risks.

1. Upgrade information systems to ensure availability of timely and relevant information on weather conditions, prices, and pest and disease risks to farmers, traders, and other stakeholders, coupled with advice and knowledge dissemination on risk mitigation options. This includes early warning systems to sensitize farmers and other stakeholders to production risks and market information about production.
2. Advance extension delivery systems (for example, face-to-face, farmer-driven, based on information and communication technology (ICT)) for improved farmer access to technology and agronomic advice on improved soil, water, and pest management practices (for example, climate-smart agriculture, integrated pest management).
3. Strengthen the development and distribution systems for improved seed varieties (for example, drought, pests, and disease-tolerant crops).
4. Encourage greater private sector involvement in agriculture by facilitating an enabling environment for business and strengthening public-private partnerships. This can lower production risks through the private sector's financial and technological investments in farming and develop stronger market partners in key value chains.
5. Improve water management measures, especially in the lowlands, inland valley swamps and the perennial flooded plains (for example, bunds and water canals, irrigation, flood control canals, etc.), along with new investments and the expansion of irrigation infrastructure adapted to various cropping systems.

While the government of Sierra Leone is already implementing investments in the above areas as part of ongoing programs (for example, through the Feed Salone program, see <https://feedsalone.gov.sl>), there is room for further expansion and strengthening of these interventions as part of a comprehensive risk management action plan which targets the highest priority risks with ex ante risk management strategies.

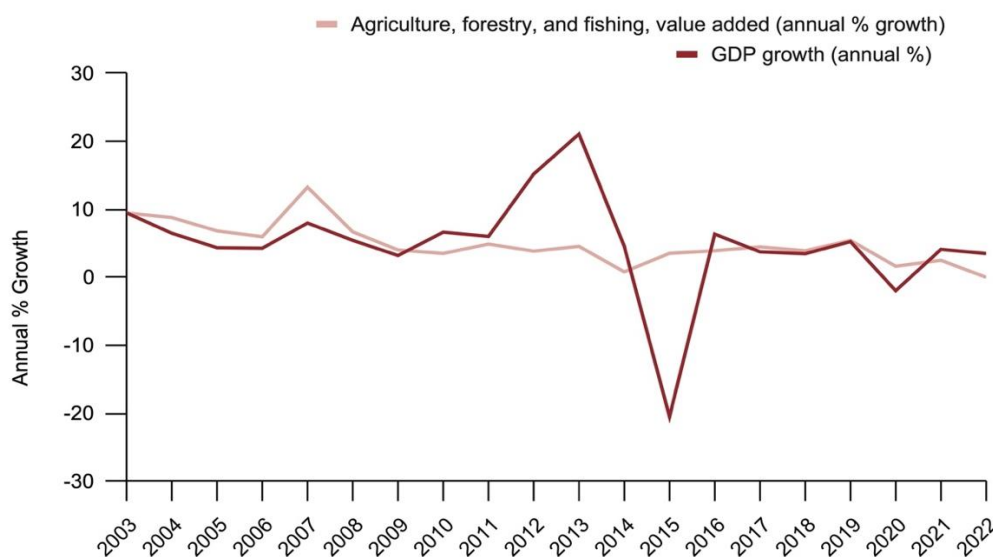
CHAPTER ONE

INTRODUCTION

In the last 30 years, Sierra Leone has endured numerous challenges and shocks that have impacted its economic development. Most notable are the decade-long civil war that lasted throughout the 1990s, the Ebola outbreak from 2014 and 2016, and the COVID-19 pandemic that emerged in 2020. In parallel, extreme climatic events such as flooding have consistently threatened lives and livelihoods. These adversities are mirrored in Sierra Leone's Human Development Index ranking, where it is placed at 181 out of 189 countries, making it one of the lowest globally (United Nations Development Programme (UNDP) 2022). However, the government of Sierra Leone is aspiring to reach middle-income status by 2039, with a national development plan that aims to expand the economy while also addressing food and nutrition insecurity; promoting youth employment, human capital development, and efficiency in the public sector; and improving infrastructure, technology, and digitalization for its citizens (Government of Sierra Leone 2019). As the agricultural sector accounts for 57 percent of the country's GDP and employs approximately two-thirds of the total population (Statistics Sierra Leone (Stats SL) 2017), reaching the goals of the Medium-Term National Development Plan will depend critically on the performance of the country's agriculture sector.

As part of the country's long-term development pathway, agriculture risk management should be seen as a key priority for Sierra Leone. Figure 1.1 depicts the dominance of the agriculture sector in the economy, as its growth is closely correlated with total GDP. However, the exception to this linkage is seen in the first half of the 2010s, corresponding to the rise and collapse of the national mining industry.

FIGURE 1.1: GDP AND AGRICULTURE VALUE ADDED (ANNUAL % GROWTH) IN SIERRA LEONE, 2003–22



Source: World Bank, [World Development Indicators Database 2023](#).

Although poverty has fallen by almost 20 percentage points over the past 20 years, inequality has risen, with those experiencing poverty being concentrated in rural areas (World Bank 2014a and 2022). The focus on advancements in the agriculture sector are critical to alleviating poverty and addressing these growing inequalities, given that 80 percent of the rural population relies on agriculture as the main livelihood.

Strengthening the agriculture sector's ability to cope with agricultural risk, particularly the resilience of smallholder farmers, is becoming a key development focus for Sierra Leone to increase food security, reduce rural poverty, and manage risks that come with climate change. This risk assessment was conducted by the World Bank in the context of the West Africa Food System Resilience Program (FSRP),² a large-scale investment program led by the Economic Community of West African States (ECOWAS), the Permanent Interstate Committee for Drought Control in the Sahel and the West and Central African Council for Agricultural Research (CORAF). This work, supported by the Global Risk Financing Facility, is part of a larger regional initiative on the regional risk management agenda advanced as part of the FSRP to enhance the capacity of ECOWAS and ECOWAS member states to respond to acute food crises.

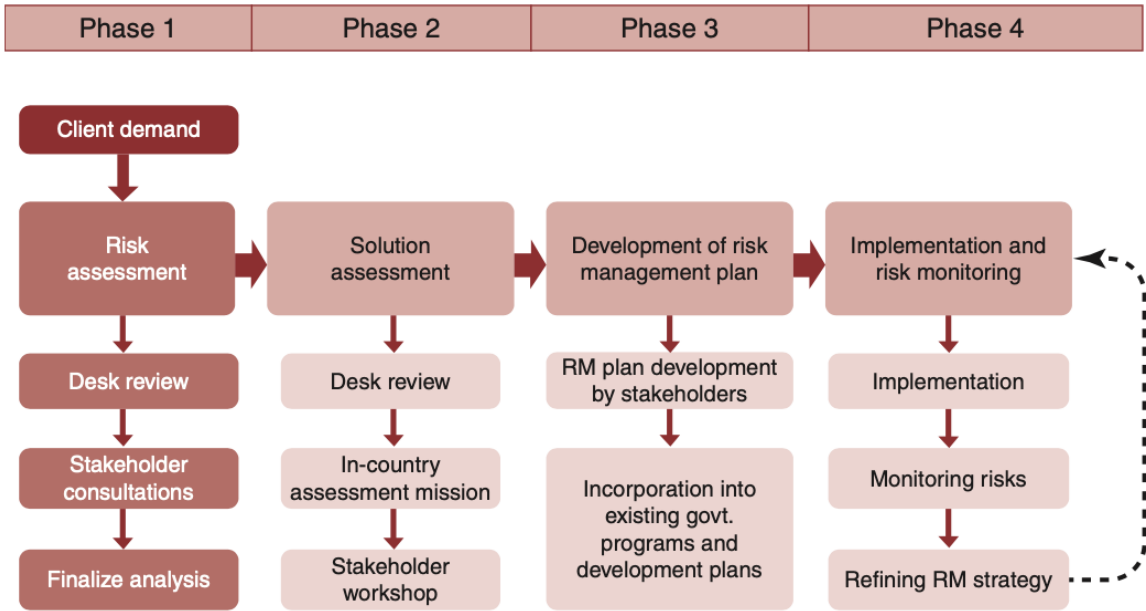
It was within this context that this assessment was carried out by the World Bank in collaboration with the Ministry of Agriculture and Food Security (MAFFS) and the FSRP, with inputs from the Ministry of Trade and Industry, the National Disaster Management Agency (NDMA), the National Water Resource Management Agency (NWRMA), the Sierra Leone Meteorological Agency, the Ministry of Finance, the Sierra Leone Agricultural Research Institute, the Sierra Leone Environmental Protection Agency, the National Federation of Farmers of Sierra Leone, the Sierra Leone ECOWAS Rice Observatory, the Sierra Leone Chamber of Agribusiness Development, the Sierra Leone Livestock Rearers Organization, the National School Feeding Program, the National Commission for Social Action, Save the Children, GIZ, and the World Food Programme (WFP).

This assessment is part of a larger agriculture sector risk management framework developed by the World Bank, containing four phases shown in Figure 1.2 (Choudhary et al. 2016). The present report is focused on Phase 1 (risk assessment). The objectives of this assessment are to (1) identify, analyze, quantify, and prioritize the principal agricultural risks (that is, production, market, and enabling environment risks) faced by Sierra Leone's agriculture sector; (2) analyze the impact of these risks; and (3) identify and prioritize appropriate risk management interventions (that is, mitigation, transfer, and coping) that might contribute to improved stability, reduced vulnerability, and increased resilience of agricultural production and marketing systems in Sierra Leone. Within the context of FSRP activities funded by the Global Risk Financing Facility, this assessment also serves as a contextual basis for ECOWAS to support countries with

² Launched in 2022, the five-year FSRP aims to increase preparedness against food insecurity in participating countries through parallel investments in three interconnected intervention areas, including digital advisory tools for agriculture and food crisis prevention and management, the productive base of the food system, and agriculture risk management and regional integration of food value chains. Phase 1 (2022–27) includes Mali, Niger, Burkina Faso, and Togo; Phase 2 (2023–28) comprises Ghana, Chad, and Sierra Leone; under Phase 3 (2024–29) Senegal joined the program. For more information on the FSRP in Sierra Leone, please see <https://www.fsrp-sl.org/>.

the development of subsequent risk management action plans. In essence, the risk assessment comprehensively identifies, analyzes, and prioritizes risks, thereby laying the foundation for risk management solutions to be designed and implemented.

FIGURE 1.2: AGRICULTURE SECTOR RISK MANAGEMENT PROCESS FLOW



This report is developed in support of the government of Sierra Leone. The findings compiled in it are meant to provide evidence and inputs for the government-led development of a risk management action plan for the agriculture sector and disaster risk financing measures. It was developed in tandem with the government-led Food Security Crisis Preparedness Plan, which was developed in 2024 as a national operational plan that defines the criteria for what constitutes a food security/nutrition crisis in the country, as well as food crisis response coordination mechanisms via step-by-step protocols detailing the responsibilities of relevant authorities. While the Agriculture Sector Risk Analysis (ASRA) can serve as an input to the development of ex ante risk mitigation planning, the Food Security Crisis Preparedness Plan focuses on ex post disaster response.

METHODOLOGY

This methodology follows the procedures developed by the Agricultural Risk Management Team of the World Bank’s Agriculture and Food Global Practice (Choudhary et al. 2016). To capture risks across the sector, the assessment focuses on the largest commodities, which account for 70 percent of Sierra Leone’s agriculture production value as of 2022. It also considers commodities such as cocoa and oil palm because of their significant national export earnings. The commodities selected due to their significance in national agricultural production include the following:

Food crops: rice, cassava, and groundnut

Export crops: cocoa and oil palm

Other: livestock

The agriculture sector risk assessment is based on both quantitative and qualitative analysis. Production risks were quantified by losses for each commodity and mapped to different events, with consideration of their frequency and impact. Market and enabling environment risks were qualitatively assessed.

For the purpose of this assessment, *risk* is defined as the possibility that an event will occur and will affect a farm or firm's performance or the successful functioning of the overall supply chain. In risk assessment analytical work previously conducted by the World Bank in other countries, time periods of at least 30 years were used for analysis to capture an accurate picture of the risks to the sector. However, because of the decade-long civil war in the 1990s and early 2000s, it was not possible to identify trends throughout the past 30 years. Instead, the assessment focuses on risk to the agriculture sector over the past 20 years in post-war Sierra Leone.

Stakeholders were consulted throughout this work, including from the government of Sierra Leone, development agencies, non-government partners, ECOWAS representatives, and academia. Stakeholder consultations took the form of a series of expert interviews; a technical workshop focused on risk identification, prioritization, and management solutions; and a final validation workshop for the assessment.

The report is broken down as follows: Chapter 2 provides an overview of Sierra Leone's agriculture sector, including climatic and economic conditions as well as key constraints. Chapter 3 contains an overview of the most significant agriculture sector risks for the selected food crops, export crops and livestock, categorized by production risks, market risks, and enabling environment risks. Chapter 4 analyzes the impact of these risks, considering the frequency and severity of past impacts. A vulnerability assessment of different interest groups is presented in Chapter 5. Finally, Chapter 6 contains the prioritization of identified risks and potential strategies to manage these risks.

CHAPTER TWO

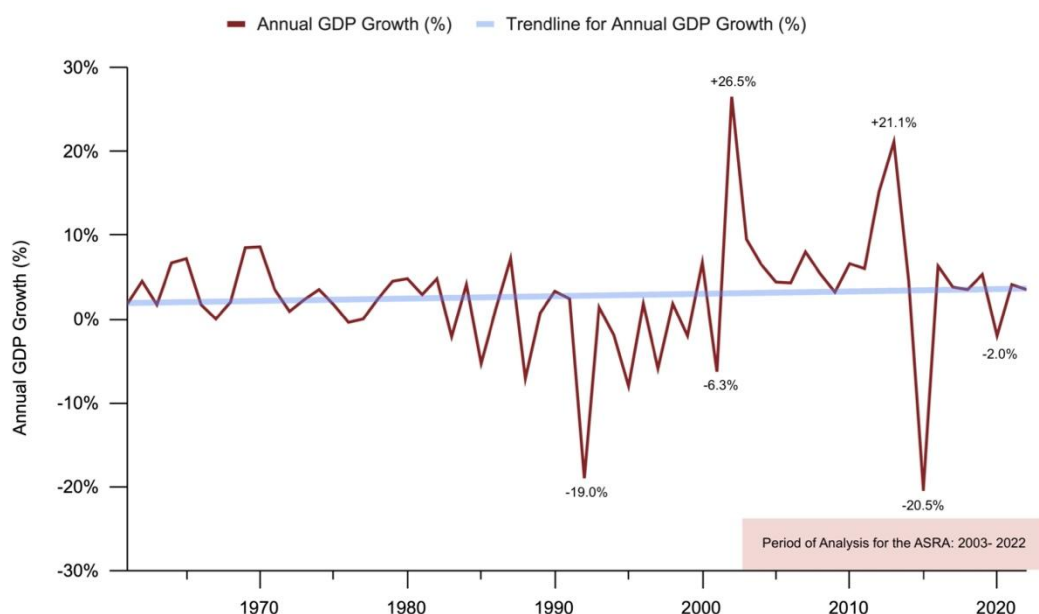
AGRICULTURE SYSTEMS IN SIERRA LEONE

To support the analysis and discussion of agricultural risk in Sierra Leone, this chapter provides an overview of the country's agriculture sector as context to inform the discussion on risks in later chapters. Key characteristics of the sector which are relevant to risk are highlighted. The analysis focuses mainly on the 20-year period from 2003 to 2022, though this chapter provides key country context which may pre-date the review period.

COUNTRY CONTEXT

Sierra Leone is situated along the coast in West Africa, sharing borders with Guinea and Liberia. It spans a land area of 71,740 km² and has a population of 8.8 million people.³ Since its independence in 1961, Sierra Leone's annual growth rate has averaged 2.8 percent per year with high interannual volatility (Figure 2.1). The economy experienced two major surges in the last 20 years: one marking the end of the civil war in 2002 and then a boom in the mining industry in 2013 (Fielding et al. 2015).

FIGURE 2.1: SIERRA LEONE'S ANNUAL GDP GROWTH, 1961–2022



Source: World Bank 2022.

The 60-year growth trend is low for the region, resulting from several stresses, including two notable crises in the country's recent history: the civil war from 1991–2002 and the Ebola virus

³ See [World Bank Open Data](#).

epidemic from 2014–16. Following the COVID-19 outbreak and subsequent disruptions to global supply chains, the economy contracted by 2 percent in 2020. In 2022, Sierra Leone’s economy grew by 3.5 percent, just slightly below the regional average of 3.7 percent. Total GDP in 2023 amounted to US\$3.81 billion.⁴

Sierra Leone is one of the poorest countries in the world, with a Human Development Index of 0.477—ranked 181 out of 191 countries in 2022. GDP per capita was US\$478 in 2022. However, in recent years, the national poverty rate has generally decreased. The poverty rate (as measured by US\$1.9 poverty line, 2011 purchasing power parity) was estimated at 43 percent of the population in 2018, based on the Sierra Leone Integrated Household Survey. This represents a significant decline from 54.7 percent in 2011. Additionally, despite a rapidly growing population, the number of poor fell from 3.6 million to 3.3 million from 2011–18.

Existing poverty remains concentrated in rural areas, with a poverty incidence of 78.7 percent and the poorest households being those headed by people who work in the agriculture sector. More than 70 percent of the rural poor are also women, most of whom are engaged in agriculture. The economy is highly vulnerable to domestic and external shocks due to its dependence on agriculture, which is rain-fed and subject to erratic weather changes, as well as mining, which is sensitive to shifts in global demand and prices.

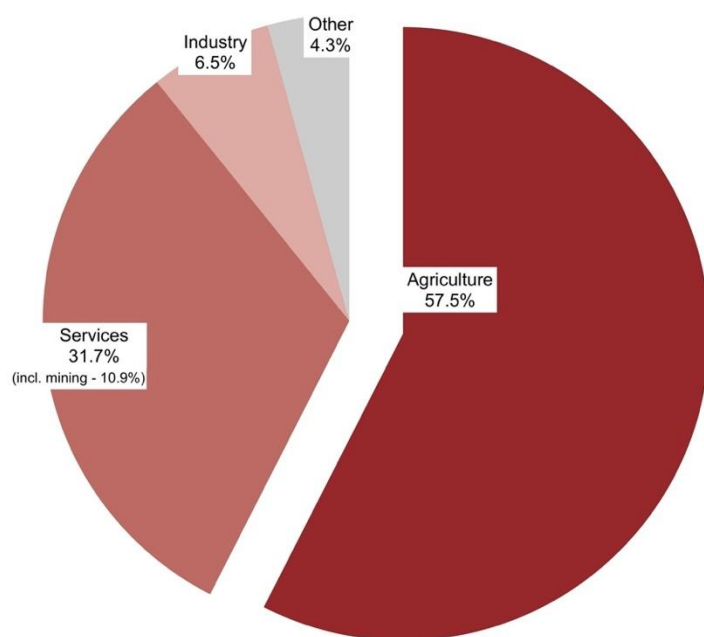
ROLE OF AGRICULTURE IN THE ECONOMY

Sierra Leone has enormous agricultural growth potential. The country’s total land area amounts to 7.22 million hectares (ha), of which 74 percent is suitable for agriculture (Food and Agriculture Organization (FAO) 2024). Only 10 percent of the total land area is being used for agriculture. As seen in Figure 2.2, the agricultural sector drives Sierra Leone’s economy, contributing to over 57 percent of the country’s GDP and employing about two-thirds of the total population (World Bank 2021). The majority of those working in the sector live in rural areas, cultivating farms between 0.5–2 hectares in size and depending on agriculture for food and income (CRS 2021).

Despite the availability of arable land and high rainfall, agriculture production has remained below its potential, with most crop yields being lower than or equal to other countries in Sub-Saharan Africa. According to the West and Central African Council for Agricultural Research and Development (CORAF), low levels of national agriculture productivity in Sierra Leone stem from challenges related to a shortage of experts in national agricultural research, weak producer organizations, low access to technology, weak infrastructure, institutional and financial obstacles to private sector development, and government capacity constraints (Mahmood 2016).

⁴ See [World Bank Open Data](#).

FIGURE 2.2: GDP COMPOSITION, 2022



Source: Stats SL 2023.

The current level of food production is insufficient to meet national demand. According to the World Trade Organization, in 2022, Sierra Leone's account balance was in a deficit of 10.3 percent of total GDP (World Trade Organization 2023). Total food imports in 2020 were worth US\$564 million. The trade deficit is most clearly seen with rice, the most important crop in the country. It is the most important staple crop, with an annual per capita consumption of 104 kilograms and is also the primary crop grown in the country, contributing to 20 percent of agricultural GDP. However, rice production is insufficient to meet domestic demand. Annual rice imports are high and in 2018 alone were estimated to cost US\$153 million. Other notable crops include cassava (9.7 percent of total agriculture GDP) and groundnuts (4.8 percent of total agriculture GDP). These crops are not only widely produced but are important to the local diet. Finally, the country also has a sizable fishing industry as part of the agriculture sector, contributing to 10–12 percent of its GDP due to the large reefs off its coast.

In 2020, 38 percent of Sierra Leone's export value derived from agricultural products. Major export commodities are cocoa beans and palm oil, adding US\$21 million and US\$9 million, respectively, to the economy (Table 2.1).

TABLE 2.1: TOP EXPORT AND IMPORT PRODUCTS BY VALUE, 2018

Top exported products	Value (US\$, millions)	Top imported products	Value (US\$, millions)
Cocoa beans	21	Rice	153
Palm oil	9	Wheat or meslin flour	21
Other vegetables	5	Cane or beet sugar	14
Other oil seeds/fruits	4	Sauces/Preparation	13
Cocoa shells, husks	2	Meat	13

Source: [World Trade Organization 2023](#).

To inform the analysis and discussion of agricultural risk in Sierra Leone, this chapter presents an overview of the country's agriculture sector, with a focus on sector features that pertain most to agriculture risk. Findings from this analysis are used to assess the frequency and severity of Sierra Leone's most significant risks (see Chapter 3). In line with the approach used in the most recent agriculture census that the government of Sierra Leone conducted in 2015, the analysis will cover the country's five regions (see Figure 2.3 for an overview of regions and districts). Note that in 2015 Sierra Leone had four regions when the Thematic Report on Agriculture from the Population and Housing Census in 2015 (henceforth, the National Agriculture Census) was last published (north/northwest combined), so some analysis based on older data will refer to the northern and Northwest collectively as the northern region. The localized analysis in the ASRA provides a better identification of risk hotspots and vulnerable groups.

FIGURE 2.3: PROVINCES AND DISTRICTS IN SIERRA LEONE

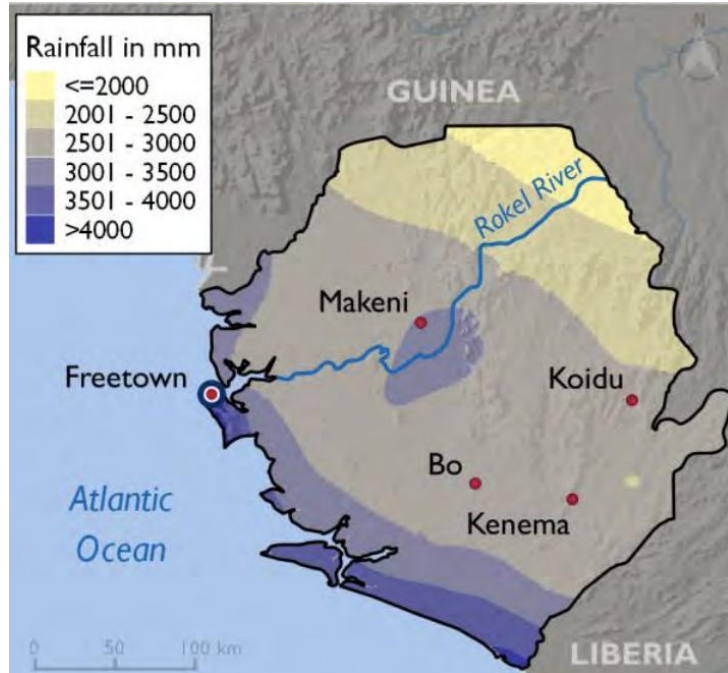


Source: World Bank 2024

AGROCLIMATIC CONDITIONS

Sierra Leone features a monsoon tropical climate characterized by high temperatures and humidity along the coastal zones, while the inland areas experience a milder, temperate climate. The national annual average temperature is 26.7°C, with an average yearly rainfall of 2,746 mm (see Figure 2.4). The rainy season occurs between May and October and is mainly influenced by the Inter Tropical Convergence Zone movement between the northern and southern tropics throughout the year.

FIGURE 2.4: AVERAGE ANNUAL RAINFALL DISTRIBUTION



Source: USAID 2016.

The abundant rainfall and tropical climate make Sierra Leone well-suited for agricultural production, although there is some variability within the country. Sierra Leone is divided into five ecological zones: coastal plains, savanna woodland, transitional rainforest, rainforest, and hills/mountainous regions (Table 2.2). These zones are defined based on agroclimatic and environmental factors such as temperature, rainfall, elevation, types of agriculture, and the duration of the growing period (Morlai 2011). More information on the traditional cropping systems and constraints can be found in Appendix A.

The rainy season in Sierra Leone occurs from May to October, with most of the annual rainfall (approximately 95 percent) concentrated in the months of July, August, and September. Due to the high levels of rainfall during the rainy season, 20–50 percent of the annual rainfall results in surface runoff, which can lead to issues such as flooding, soil erosion, and landslides.

TABLE 2.2: AGROCLIMATIC ZONES IN SIERRA LEONE

	Area of country (km ²)	Altitude	Mean temperature (°C)	Rainfall (mm)	Average length of growing period (days)
Coastal plain	11,016	<150	27.9	3000	260 ± 10
Savanna woodland	27,993	150–300	28.2	2280	255 ± 10
Rainforest/savanna	20,712	150–300	28.5	2730	285 ± 15
Rainforest	12,579	300–600	28.6	2660	314 ± 9
Hills and mountains	14,723	>600	—	—	—

Source: NSADP with data from UNDP/FAO 1979.

Note: — = not available.

Sierra Leone has nine rivers, all of which flow into the Atlantic Ocean from the northeastern to southwestern direction along the coastal plains (Jalloh 2006). The total river catchment area varies between 720–14,140 km². More than half of Sierra Leone's water resources come from surface water. River discharges vary widely according to the seasons: from 10 to 1,296 m³/s during the rainy season and from 8 to 500 m³/s during the dry season. Despite the nation's abundant water resources, localized water scarcity can occur due to deforestation for agriculture and irregularities in the onset of the rainy season, which is the primary source of water (Kamara and Kamara 2010).

The overall level of water usage for agricultural purposes in the country is notably low in comparison to its potential water availability. Irrigated agriculture is poorly developed. Only about 0.37 km³ of the total water potential is used in agriculture each year, irrigating about 30,000 ha of the low-lying region, including sugarcane estates, vegetables, and urban-periurban areas around the northern and western regions. This level of utilization is low (that is, less than 5 percent of the total cultivated area) in relation to the total estimated potential (Pushak and Foster 2011). The large amount of river discharge variability and required investments into mechanization limits the attractiveness of irrigation as a water supply source in agriculture in comparison to rain-fed agriculture.

CROP PRODUCTION SYSTEMS

In Sierra Leone, the agricultural landscape is predominantly characterized by small-scale, subsistence producers with a mean average farm size of approximately 1.63 ha (Fielding et al., 2015). The principal crops cultivated for local consumption encompass rice, cassava, sweet potatoes, groundnuts, and maize, which are integral to the nutritional intake of the rural

population. The share of each crop's contribution to total agricultural GDP can be seen in Table 2.3. Most households farm multi-cropping systems, integrating staple crops into the farm. Cash crops frequently grown by households include cocoa, coffee, oil palm, and cashew nuts, which contribute significantly to the country's export revenues.

TABLE 2.3: AGRICULTURAL GDP SHARE BY COMMODITY IN SIERRA LEONE, 2021 (%)

Commodity	Agricultural GDP Share (%)
Rice	35.2
Cassava	17.0
Fishery	12.1
Groundnut	8.3
Fruits/vegetables	6.6
Livestock	3.8
Maize	2.7
Sweet Potato	1.3

Source: Stats SL 2023.

This agriculture sector risk assessment focuses on a narrow set of key commodities which are considered important to Sierra Leone from an economic and food security perspective. Value of agriculture production (VAP) averages between 2019–21 are used as the indicator for the relative economic importance of different agricultural products in the country (Table 2.4). The five crops selected for the risk assessment have a combined VAP of 61 percent. Rice, cassava, and groundnuts are the crops with the largest VAP. Oil palm and cocoa were selected because they are the most important by value for exports (see Table 2.1). These commodities and the risks associated with each of them are analyzed further in Chapters 3–6. Although fisheries make up a significant share of agriculture GDP in Sierra Leone (12 percent), fisheries were not part of the quantitative analysis as the methodology used for the agriculture sector risk assessment is designed to evaluate risk related to agriculture only.

TABLE 2.4: VALUE OF AGRICULTURAL PRODUCTION OF KEY CROPS

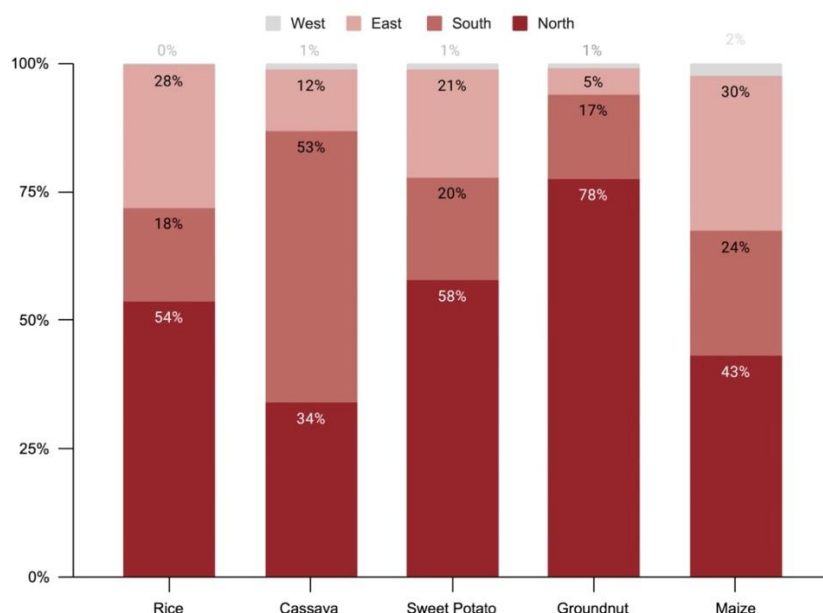
Average VAP 2019–21			
Crop	Constant 2014–16 1000 Intl. \$	VAP (%)	Cumulative %
Rice	518,319	34	34
Cassava	272,115	18	52
Groundnuts	69,178	5	57
Oil Palm	35,045	2	59
Cocoa	23,372	2	61
Total	1,531,060	100	

Source: FAOSTAT 2024.

Note: Int. \$ (International US\$): An international dollar would buy in a given country a comparable amount of goods and services a US dollar would buy in the United States. This term is often used in conjunction with purchasing power parity data ([World Bank](#)).

PRODUCTION TRENDS

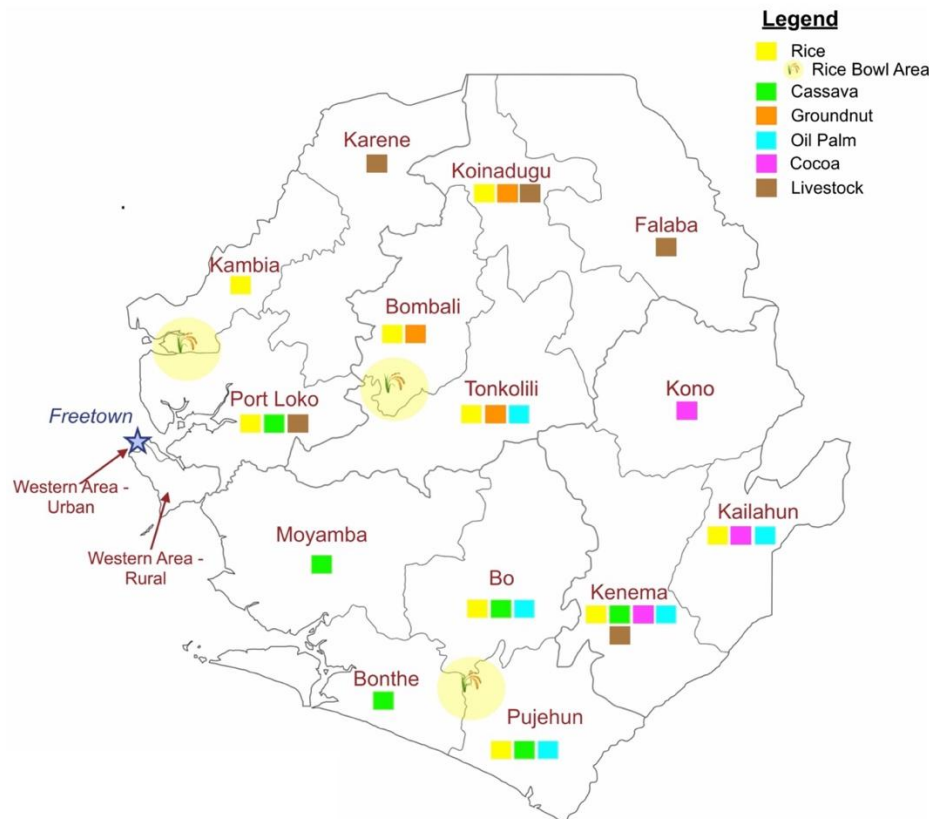
The agriculture sector has grown on average 3.4 percent per year since the end of the civil war in 2002 (UN Sierra Leone 2020). Results from the 2015 National Agriculture Census show the northern region produced almost half (49 percent) of all the food produced in the country, followed by the southern, eastern, and western regions (Stats SL 2017). The northern region leads the production of Sierra Leone's five major staple crops, except cassava, which is largely produced in the South (Figure 2.5).

FIGURE 2.5: QUANTITY OF SIERRA LEONE'S FIVE MAJOR STAPLE FOOD CROPS PRODUCED BY REGION IN 2015 (%)

Source: Statistics SL 2017.

Figure 2.6 shows the mapping of the production zones at a district level for the six key commodities in this report. A full mapping of key commodity production zones can be found in Appendix B.

FIGURE 2.6: MAP OF MAJOR CROP PRODUCTION ZONES BY DISTRICT IN SIERRA LEONE

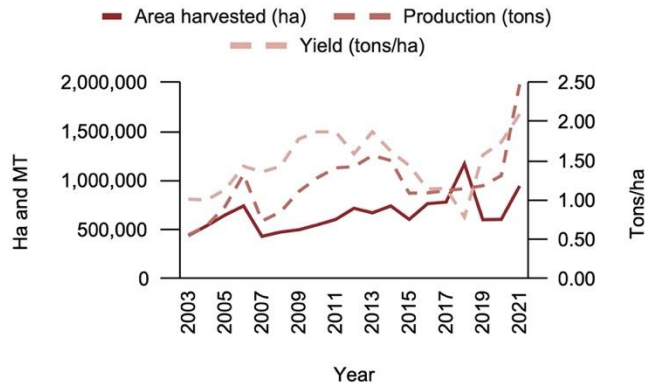


Source: Author's calculations; FAO 2011; Stats SL 2017; FEWS NET 2016

Growth in the sector can be attributed to the recent increased production of rice and export crops. Rice production has increased sharply in recent years, resulting from an increase in area harvested due to government initiatives to increase rice self-sufficiency (Figure 2.7). The area harvested for the next most abundant crop, cassava, has changed very little in the last 20 years, though yield has increased significantly as productivity has grown through heavy fluctuations (Figure 2.8). Data on land area harvested for groundnut and cocoa is highly volatile over the last twenty years, and production follows the general trends in land harvested (Figure 2.9 and Figure 2.10). Some small changes to land harvested can be explained, for example, by the revitalization of cocoa plantations in the early 2010s because of heavy investment of nongovernmental organizations and international organizations (GIZ, Welthungerhilfe, etc.) to rehabilitate and expand the value chain. However, larger changes in more recent years, such as for cocoa, could not be explained. This may suggest an inaccuracy in the available data for this crop and perhaps

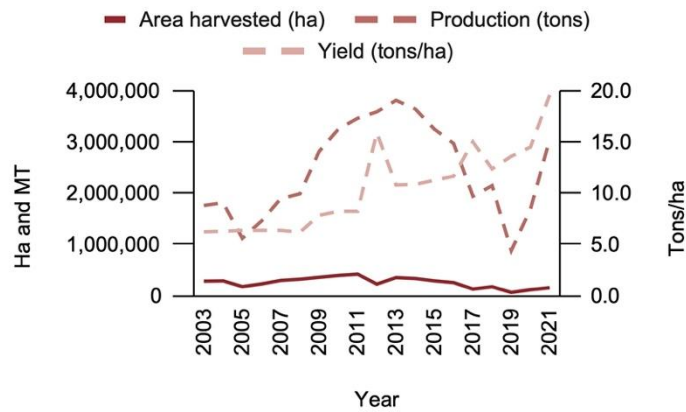
others. Finally, as seen in Figure 2.11, palm oil has experienced a gradual increase in production over the review period.

FIGURE 2.7: RICE PRODUCTION, 2003–21



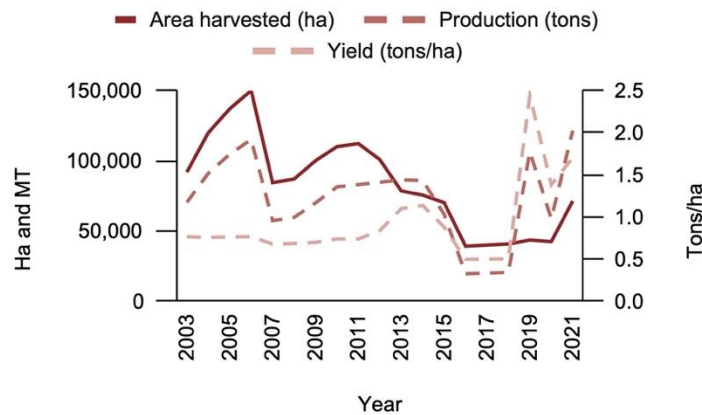
Source: FAOSTAT 2024.

FIGURE 2.8: CASSAVA PRODUCTION, 2003–21



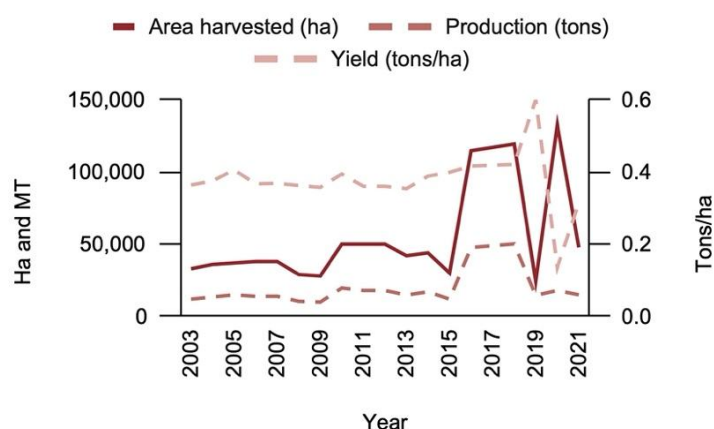
Source: FAOSTAT 2024.

FIGURE 2.9: GROUNDNUT PRODUCTION, 2003–21



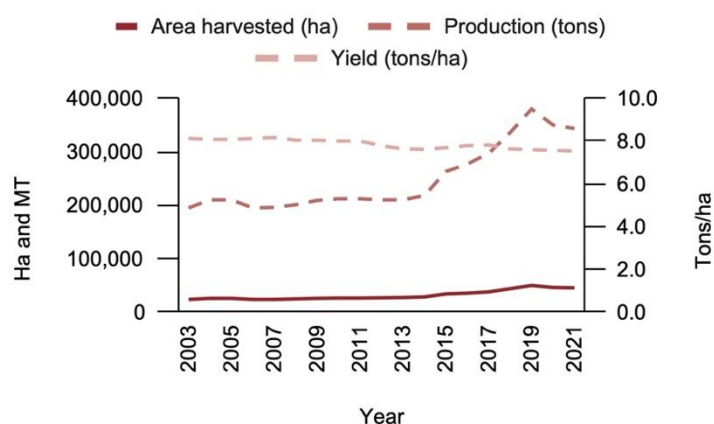
Source: FAOSTAT 2024.

FIGURE 2.10: COCOA PRODUCTION, 2003–21



Source: FAOSTAT 2024.

FIGURE 2.11: OIL PALM PRODUCTION, 2003–21



Source: FAOSTAT 2024.

FOOD CROPS

Rice: Rice is the most important crop in Sierra Leone in terms of production, consumption, and imports. Three-quarters of rural households and about two-thirds of poor households grow rice (Graham, Tchale, and Ndione 2020) and annual per capita consumption amounts to 185 kilograms (WFP 2022). Using the VAP averages between 2019–21 as the indicator of relative economic importance of different agricultural products in the country, rice is the dominant crop, at 34 percent VAP (see Table 2.4). In 2021, Sierra Leone produced 1,979,000 metric tons of rice, cultivated primarily in the northern and southern regions. Of the more than 1.6 million ha of land used for rice cultivation, two-thirds are grown in the uplands (upland rice) and the remaining third is grown in low-lying areas of the country (lowland rice). Generally, the upland rice yield is lower than in the lowlands. According to the MAFFS, this is attributed to upland nutrient depletion and better water availability in the lowlands. Overall, domestic rice yields fall well below the averages of Ghana and Côte d’Ivoire and global peers.

As a result, domestic rice production does not suffice to meet the total demand within the country. The 2015 Agricultural Census indicated that a significant majority (approximately 57 percent) of rural households engage in rice cultivation solely for household consumption, while 41 percent of farming households sold part of their yield and less than 1 percent sold all their rice crop. To bridge the supply-demand gap, the country relies on rice imports, the primary agricultural import. In 2022, the nation imported an estimated 480,000 metric tons of rice, which represented approximately one-third of the total rice consumption for that year, according to the FAO (FAO 2022).

Cassava: Cassava contributes approximately 18 percent of total VAP to the country. In the Sierra Leonean diet, both the root of the crop and its leaves are used. In 2021, 3,048,000 metric tons of cassava were produced, largely in the northern and southern regions. Cassava is a drought-tolerant crop that can grow in low nutrient soils. CORAF-supported research shows that local varieties of cassava are widespread, which tend to be lower-yielding and susceptible to pests or disease such as the African cassava mosaic disease (CORAF 2016).

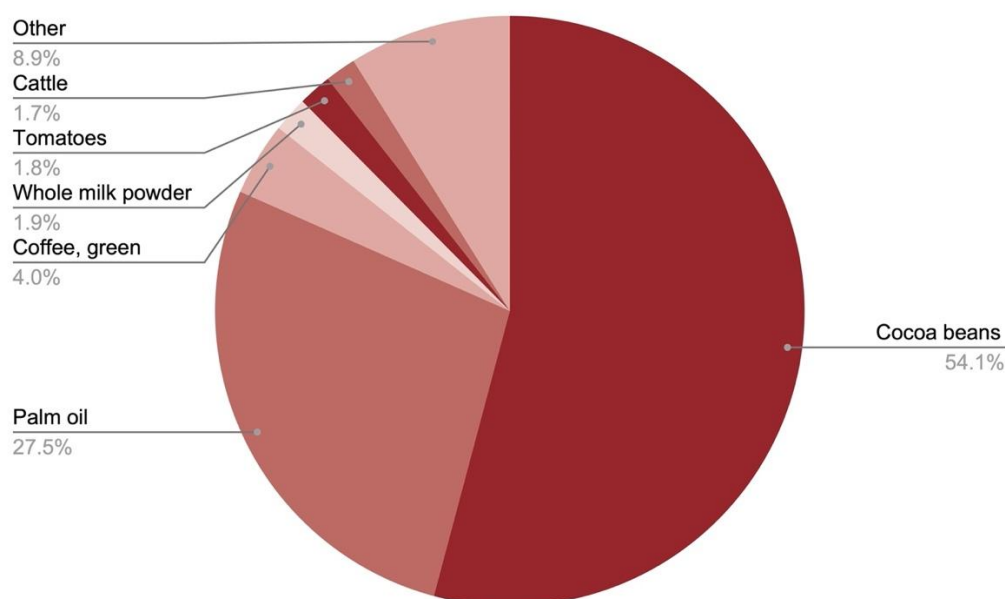
In 2015, about 148,000 households were reported to be engaged in cassava cultivation. Like rice, cassava is produced for subsistence, with 23 percent of households selling none of their yield, 64 percent selling some, and only 13 percent selling all.

Groundnuts: In 2021, Sierra Leone produced 121,500 metric tons of groundnuts, contributing to 5 percent of total VAP (FAO 2022). The crop is used as a major source of protein and vegetable oil for cooking. More than one-quarter of groundnut producers kept all their crops, with only 3.5 percent selling the entire crop.

CASH CROPS

The major cash crops for export in Sierra Leone are cocoa and palm oil. Other agricultural products for export include coffee, livestock products such as cattle (which are regionally traded), milk products, tomatoes, and cashews. Figure 2.12 shows the contribution of each product to Sierra Leone's total agricultural exports in 2021.

FIGURE 2.12: SIERRA LEONE AGRICULTURAL EXPORT SHARES, 2021

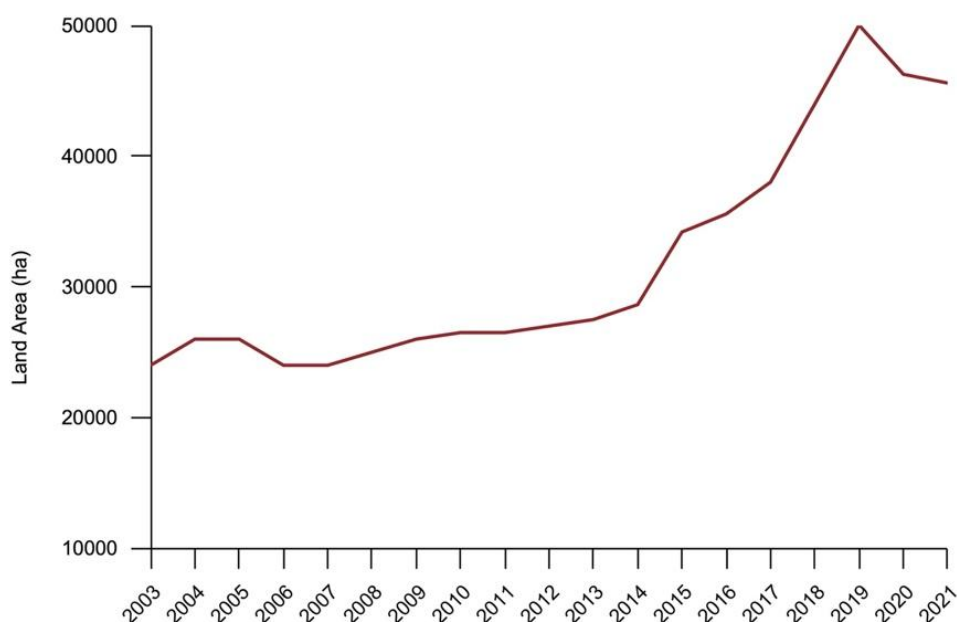


Source: FAOSTAT 2024.

Cocoa: In 2018 Sierra Leone produced 11,848 metric tons of cocoa, with an export value of US\$ 23 million, representing over half of the country's export earnings from agricultural products. In 2019, Sierra Leone exported cocoa valued at US\$33.2 million, ranking 17th globally (World Bank 2020a). Total cultivation area is 235,749 ha, based on the most recent National Agriculture Census in 2015. Overall, 91 percent of all the land area producing cocoa is in the eastern region of the country. Production levels for cocoa have remained about the same for the last 30 years. Cocoa is the main source of income for over 13,000 smallholder households and provides thousands of jobs in small-scale processing and aggregation (World Bank 2020a).

Palm oil: Palm oil production has grown substantially since 2012, indicated by the increased total land area cultivated between 2003 and 2021 (Figure 2.13). In 2020 the country produced 75,000 metric tons. The oil palm fruit is indigenous to the region, with most production in the southern and eastern regions. It is commonly used for cooking in Sierra Leone but has grown in demand worldwide for use as cooking oil, for the manufacturing of food products and cosmetics, and as a biofuel.

FIGURE 2.13: LAND USE IN SIERRA LEONE FOR PALM OIL PRODUCTION (ha), 2003–21

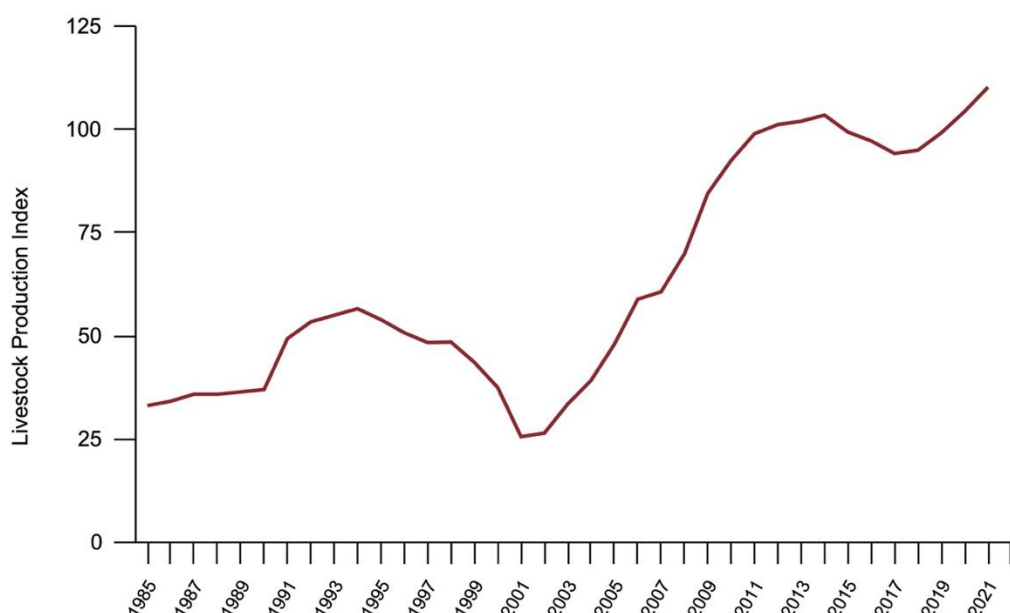


Source: FAOSTAT 2024

LIVESTOCK PRODUCTION SYSTEMS

The livestock sector contributes to 6 percent of Sierra Leone's total agriculture GDP (Leno et al. 2021). More than 75 percent of agrarian households also own livestock, with most animals concentrated in the northern part of the country as of 2015. In this region, cattle graze freely on the savanna woodland vegetation in the wetter months, while in the dry months forage is supplemented with feed. As can be seen in Figure 2.14, production dropped during the civil war period, directly attributed to 70 percent of the livestock in the country being killed as well as the destruction of the infrastructure to support the livestock sector (FAO 2018). Since then, livestock production has grown significantly, except for the Ebola virus years (2014–16), as demand for meat has grown both domestically and regionally (Figure 2.14).

FIGURE 2.14: SIERRA LEONE LIVESTOCK PRODUCTION INDEX



Source: FAOSTAT 2024.

Note: Livestock production index includes meat and milk from all sources, dairy products such as cheese, and eggs, honey, raw silk, wool, and hides and skins. Base years 2014–16.

Cattle: In 2015, 87 percent of the country’s cattle were situated in the northern region, primarily managed by the Fulani tribe—a historically nomadic, pastoralist West African group. Cattle are kept for food and as a source of income and a risk management asset when cash is needed. The productivity of cattle is low, and although there is not a large demand in the country, existing production is not enough to reach self-sufficiency (Sesay and Kallon 2022).

Sheep and goats: Small ruminants like goats and sheep are owned by most households. Sierra Leone had an estimated population of around 2.5 million goats and 1.5 million sheep in 2015 according to the agriculture census report. These animals are used for meat, dairy products, and income generation through trade.

Poultry: In 2015, Sierra Leone had an estimated 4.3 million chickens, the majority of which were reared by individual households. Roughly 10 percent of chickens in the country are raised and held in larger-scale commercial poultry farms, predominantly situated in the western area (Schneider 2010). The country also currently produces other poultry types, such as duck (2 million in 2021) and guinea fowl. Along with fish, chicken is considered the country’s most important source of protein. In 2017, Sierra Leone imported US\$20 million of poultry and egg products. The dependency on imports results from an inadequate supply of animal feed sourced from maize. The low maize production prevents the production of enough poultry and eggs to meet domestic demands (Mobarak 2020).

KEY SECTOR CONSTRAINTS AND TRENDS

While the present analysis is primarily focused on agriculture risk (defined as an uncertain event resulting in negative consequences), it recognizes the interlinkages between risks, constraints, and trends. Sectoral constraints and trends need to be considered in the larger context of developing strategies that manage risk and boost sector development. Constraints in the agricultural sector refer to persistent and foreseeable conditions hampering sector development. In the context of Sierra Leone, such constraints encompass a spectrum of issues including restricted access to and utilization of agricultural inputs such as improved seeds and agrochemicals, weak market linkages, and a low degree of mechanization in farming practices. These issues contribute to the chronically low crop yields Sierra Leone has experienced in the last 20 years relative to averages in West Africa and globally. Trends, by contrast, describe prevailing conditions subject to gradual changes, which can have long-term negative consequences. For example, climate change is projected to result in declining yields over time in Sierra Leone in the absence of adaptation efforts.

To advance agriculture development and enhance food security, the government launched the Feed Salone Strategy in 2023 (see Box 2.1). The five-year initiative builds on a recent agriculture strategy—the National Agriculture Transformation Programme (2018–23), which marked the beginning of a shift toward increasing private sector engagement in sectoral development through the “Enhancing Private Sector Participation in Agriculture” scheme, commonly known as the MAF Policy Shift. This features a major scaling back of direct public spending on agriculture alongside an expanded role for the private sector. The traditional two-track approach to agriculture remains in place, with a focus on export-oriented cash crops alongside expanded food production. The five Feed Salone objectives are designed to build the resilience of the agriculture sector and indirectly address aspects of agricultural risks identified in this ASRA. In addition, the initiative focuses on a number of the value chains that are covered in the present assessment. As a result, this report’s findings could contribute to the identification of targeted investments needed to achieve the five objectives of the Feed Salone program.

BOX 2.1: FEED SALONE STRATEGIC OBJECTIVES AND PILLARS

Objectives of Feed Salone Initiative (2023–28)

1. Import substitutions of key staples: Sierra Leone spends approximately US\$500 million annually on food imports. The target is a yearly reduction of 25 percent on food imports for key value chains over the next five years. The 2024 spotlight will be on promoting self-sustenance in rice, poultry, onions, and cassava flour (as a replacement for wheat flour).

2. Job creation and income generation: The objective is to create at least 35,000 formal job opportunities by 2028, with the potential for thousands more in the informal sector. This will be achieved by developing agroindustrial zones dedicated to comprehensive production, processing, and marketing of key value chains. These include rice, cocoa, coffee, cashew, small ruminants such as sheep and goats, cassava products such as gari and flour, and horticultural products, including fruits and vegetables.

3. Boosting export earnings from agriculture: The aim is for agriculture to substantially contribute to foreign exchange earnings; the focus will be on optimizing value chains such as cocoa, coffee, cashew, and horticulture (fruits and pepper) with the objective of increasing exports of these commodities by 50 percent annually.

4. Alleviating hunger and malnutrition: The Feed Salone initiative aims to bring the Food Consumption Score to an acceptable level (65 percent), halve the prevalence of chronic hunger, and reduce the incidence of micronutrient malnutrition among children by 2028. To realize these objectives, the development of specific value chains, including pulses, tubers—particularly orange-fleshed sweet potatoes and cassava—and aquaculture will be prioritized.

5. Significantly improving climate resilience: Adopting sustainable and climate-smart practices and technologies is essential to build a resilient food system. In the context of this objective, Sierra Leone will promote agriculture practices which enrich soil fertility, improve water retention, diversify crop production, encourage the cultivation of climate-resistant crop varieties, and increase vegetative cover with cocoa and cashew agroforestry.

Six Strategic Pillars to Achieve the Feed Salone Initiative

1. Mechanization and irrigation: Expanding rice production areas, including inland valley swamps and irrigated rice fields, augmented by tractor and other mechanized services.

2. Seeds and input systems development: Utilizing research to ensure the delivery of high-quality inputs for optimal yields in key value chains.

3. Aggregation, processing, and marketing: Streamlining processes for maximized profitability through a reduction in post-harvest losses, increased value addition for key food and cash crops and improving market linkages.

4. Agricultural finance: Tailoring financial instruments and solutions for the sector's unique needs, especially for women and youth.

5. Agricultural technology and climate smart agriculture: Leveraging technology, supporting agricultural research, promoting digitization, and building robust data systems for decision-making support.

6. Empowering women and youth: Supporting women across all strategic pillars. Specific interventions under pillar 6 include, for example, support to women and youth to cultivate high-value cash crops.

Source: MAFFS 2023.

CHAPTER THREE

AGRICULTURE SECTOR RISKS

This chapter considers the types of risks prevalent within the agriculture sector, organized into three categories: production, market, and enabling environment risks. The analytical work done in this chapter comes from quantitative analysis of available production and price data for key commodities in the sector over the last 20 years, a detailed review of secondary literature, and in-depth interviews with stakeholders in the sector. The historical frequency and impact of these risks on the sector are also considered in this analysis. This analysis has been validated with government stakeholders and other sector experts during two workshops. The selected commodities are:

Staple crops: Rice, cassava, and groundnut

Export crops: Oil palm and cocoa

Livestock: Sheep, goats, chicken, and cattle

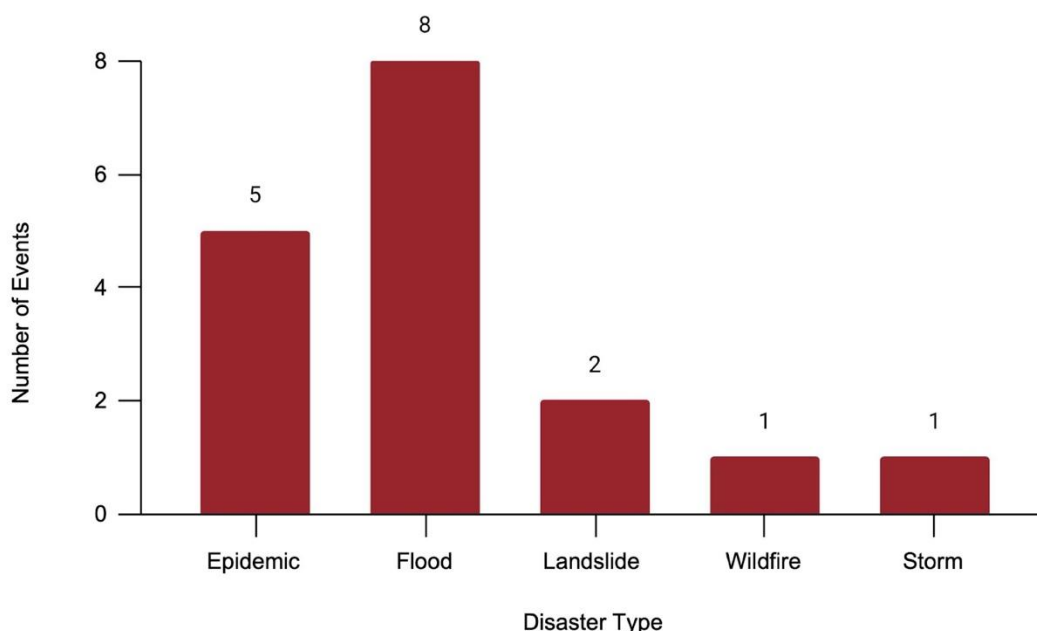
PRODUCTION RISKS

The main sources of production risks in Sierra Leone come from extreme weather events and outbreaks of pests and diseases. Risk events may occur in isolation, but can also present as multiple overlapping shocks, with far greater impacts and higher associated losses.

WEATHER CONDITIONS

Figure 3.1 highlights the major natural disasters in Sierra Leone over the last 20 years that were reported to the EM-DAT, the International Disaster Database. It should be noted that there has been very limited documentation of Sierra Leone's past record of natural disasters, even after 2003, so this list is likely not comprehensive. Additionally, most available documentation focuses on urban hazards, rather than risks and impacts to rural areas and agriculture. Regardless, sector experts confirm that impacts resulting from weather events are among the most significant to the agriculture sector. This section will summarize how shock events impact agriculture, utilizing disaster management records, disaster management action plans, academic publications, and agriculture sector stakeholder insights. Additional analysis of rainfall patterns is included in Appendix C.

FIGURE 3.1: NATURAL DISASTERS IN SIERRA LEONE REPORTED IN THE EM-DAT DATABASE, 2003–22



Source: [EM-DAT](#).

FLOODS

In the last 20 years, there have been eight major floods recorded which have caused significant losses of human life and property destruction, including crops and livestock. According to the International Disaster Database, flooding is the natural hazard that has historically affected the greatest number of people (see Table 3.1). This is corroborated by stakeholders in the agriculture sector, who emphasized flooding as the primary weather-related risk to agriculture. Historically, flooding has occurred across the country during the rainy season, although records show that the western region has experienced the greatest number of events and impacts. Sierra Leone is impacted by flash flooding (pluvial), riverine (fluvial) flooding, and coastal flooding, given its high annual precipitation, proximity to the Atlantic Ocean, and abundance of freshwater sources (Mattai 2017; World Bank 2020b). The most common type of flooding in the country is pluvial flooding, which usually comes as a result of extremely sudden and high volumes of rainfall over a few hours or days, which, when accompanied by poor urban planning and deforestation, causes water to back up on the floodplains.

Flooding has become more prevalent in the lowlands, which is the most productive rice ecosystem in the country. Prolonged or flash flooding can result in significant losses to crop production, especially for rice in these low-lying areas (Panda and Barik 2021; Diagne et al. 2013; AfricaRice 2019). This comes because of the failure of rice to germinate in flooded soils,

crop losses resulting from flash floods, and overall poor yield in cases of long-term stagnant flooding (Agbeleye et al. 2019).

TABLE 3.1: MAJOR FLOODING AND ESTIMATED POPULATION AFFECTED, 2003–22

Flood year	Total population affected
2004	—
2005	15,000
2007	4,500
2008	—
2009	1,455
2010	234
2011	—
2015	24,303
2017	5,000
2019	5,381
2022	12,903

Source: [EM-DAT](#).

Note: — = not available.

Given the geological conditions, flooding has also resulted in the compound risks of landslides, mudslides, coastal/upland erosion, and a high incidence of waterborne diseases. A documented example of the resulting impacts of major flooding can be seen in the western area in 2017. This flood and subsequent landslide occurred after three days of torrential rains in August, affecting 5,000–6,000 people, with 1,141 missing or dead. Related to the agriculture sector, this disaster resulted in direct farmer livelihood losses estimated at around US\$42,000, which do not consider the additional crop, livestock, or agriculture asset losses (World Bank 2017). It is also worth noting that this event took place in an urban district. The impacts of other flood events on agriculture in rural areas are undocumented but estimated to be much greater than in urban environments given the greater proportion of area and livelihoods they sustain.

DRY SPELLS OR ERRATIC RAINFALL

At national level, most of the drought/rainfall deficits go unnoticed because of the abundance of rainfall Sierra Leone experiences. However, if dry spells occur during an unfavorable time of the growing season or are extreme, they can impact crop and livestock production. Figure 3.2 shows the incidence of drought in the last 20 years, using the Agricultural Stress Index (ASI) as a reference for the percentage of cropland affected by water deficits. Four years (2003, 2004, 2009, and 2018) show at least moderate drought across the country. 2004 and 2009 are categorized as

severe drought. In general, the western area has experienced chronic water stress (NWRMA 2021). This is described to come from competing urban water demands.

It should be noted that the assessments of drought included in Figure 3.2 follow the ASI's definition of drought, which uses spatial data to estimate the vegetation health on cropland (see below). However, Sierra Leone's National Disaster Management Agency (NDMA) considers drought to be a prolonged dry period (absence of rainfall) throughout the rainy season. This definitional distinction is important to accurately identify and assess risks to the sector. Most sector stakeholders consulted during preparation of the report agreed with NDMA's definition of drought. They reported that seasonal drought (under NDMA's definition) was rare in Sierra Leone and that dry spells or erratic rainfall better described the risk to agriculture. In considering this, ASI data is used for the baseline analysis, although qualitative inputs on drought and erratic rainfall/dry spells were considered in how risks were described and prioritized (in Chapter 6).

FIGURE 3.2: DROUGHT YEARS BASED ON THE AGRICULTURE STRESS INDEX, 2003–23

Percentage of cropland area affected by drought, nationally and by region					
Year	All country	Northern	Southern	Eastern	Western ⁵
2003	12.25	16.15	12.08	6.67	20.76
2004	26.16	34.65	26.33	12.58	50.00
2009	40.91	41.68	52.41	14.34	17.69
2016	5.33	5.86	7.08	0.45	10.76
2018	13.07	22.6	12.28	0.41	27.69
2019	3.00	2.54	3.71	1.45	23.84
2020	1.35	0.91	1.43	1.19	23.43
2021	0.74	0.39	0.8	0.39	26.92
2022	1.62	1.66	1.96	0.21	21.53

Legend:

Values noted in yellow describe "moderate drought," where 10 percent and 25 percent of cropland is affected by drought.

Values noted in orange describe "severe drought," where 25 percent and 50 percent of cropland is affected by drought.

Values noted in red describe "extreme drought," where more than 50 percent of cropland is affected by drought.

Source: Author's calculations; [FAO/GIEWS, 2023](#)

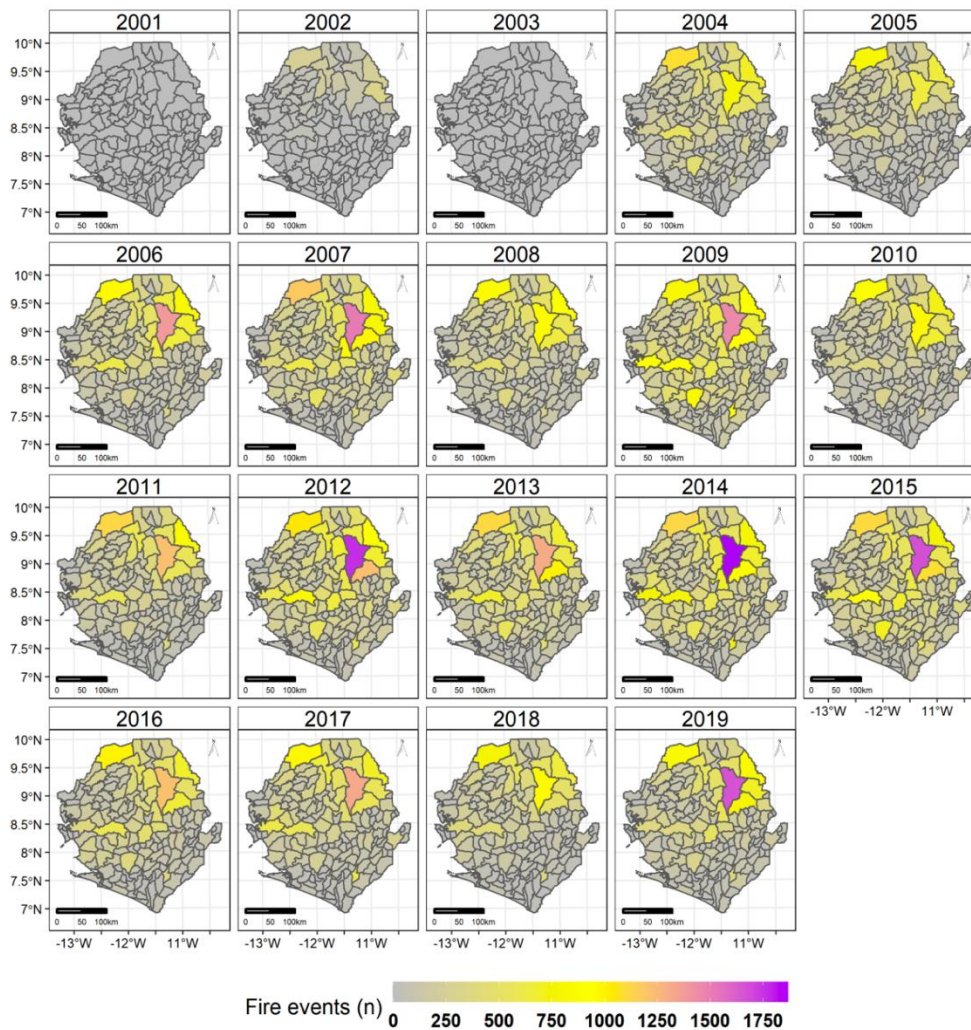
⁵ The western area shows a higher percentage of cropland affected by drought compared to other regions. This can be attributed to chronic water stress, as mentioned in the analysis. However, the total land area and total cropland area are much smaller in comparison to other regions (see Figure 2.3). Therefore, rainfall-related risks to the region may not be reflected at a sector-level.

WILDFIRE

When unmanaged, wildfires or bushfires can lead to major crop and livestock losses, clearing entire farms within minutes. The data from International Disaster Database (Figure 3.1) suggests wildfire risk is minimal in Sierra Leone. This data likely only reflects wildfire resulting from natural hazards. Risk reports from environmental management groups and academic literature suggest that manmade wildfires occur regularly throughout the country. In an academic report by Fayiah et. al published in 2021, 6,000 and 8,000 fire events per year were detected between 2001 and 2019 (Fayiah et al. 2021). Figure 3.3 shows that the northern region, which is much drier compared to the other regions, accounted for most of the fire events from 2004 to 2019. The high volume of fire events across the country arises from slash-and-burn practices throughout Sierra Leone used to clear agricultural land before planting (FAO 2006). These anthropogenic practices are the source of wildfire risk. Overall, 242 wildfires or bushfires were detected at a district level between 2006–16 (HARPIS-SL 2017a).

As seen in Figure 3.3, fires were rare during the civil war years during which farming activities were minimal. Bushfires escalated after 2003, with fire events and occurrences being more severe in 2014, 2012, 2019, 2006, 2007, and 2009. As expected, wildfires occur more regularly in the dry season and impact the drier regions of the country, such as the north. In these cases, wildfires can be a greater risk during times of drought or dry spells, as the frequency and severity of their impact is heightened when the surrounding area is in a water deficit. This may be the case for 2009, where 41 percent of the agricultural land was affected by drought (according to the ASI) and it was the sixth most prevalent year for wildfires within the researched period.

FIGURE 3.3: FIRE EVENTS AND OBSERVATIONS IN SIERRA LEONE, 2001–19



Source: Fayiah et al. 2021.

CLIMATE CHANGE

Sierra Leone is among the countries most vulnerable to climate change risks. In the last 40 years, the average surface air temperature has increased by 0.5°C, showing a significant warming trend (World Bank 2024). Today, Sierra Leone ranks 179 of all countries in the world on the ND-GAIN Index, which summarizes each country's relative climate vulnerability and readiness to manage impacts (ND-GAIN 2022). This is attributed to Sierra Leone's economic dependence on agriculture and natural resources, which are directly impacted by climate change, coupled with the prevalence of extreme weather events and high rates of poverty and unemployment.

The climate projections for Sierra Leone summarized by the World Bank and derived from data from the sixth iteration of the Coupled Model Inter-comparison Projects suggest a temperature

increase of at least 1°C (SSP1-2.6) throughout the country between 2040–60,⁶ with more severe projections closer to 2–2.5°C (SSP5-8.5) (World Bank 2024; Johnson et al. 2012). Average annual rainfall is more difficult to predict, but there is a high level of confidence that the intensity of single rainfall events and flooding is also expected to increase in the region (IPCC 2024).

The extent of future climate impacts on agriculture will depend on the evolution of future global emissions. Some crops, such as rice and cassava, are expected to have greater resilience to changing average temperatures at a national scale because of climate change, whereas others such as groundnuts are projected to see declines in yield (Johnson et al. 2012). Greater instances of erratic and sudden rainfall are estimated to produce losses across all value chains. Considering these two conditions together, the projected increase in the frequency and intensity of extreme weather events will result in critical yield losses, over and above the huge attributed losses incurred by the sector to date. USAID’s 2016 climate risk profile for Sierra Leone also identified the following compounding stressors and impacts to the agriculture sector that come from climate change (USAID 2016):

- » Soil erosion and loss of productive topsoil in steep mountain agricultural areas due to intense rains.
- » Increased disease incidence in staple crops such as rice, beans, and cassava due to rising temperatures.
- » Yield reductions and crop failure due to waterlogging and floods (particularly rice).
- » Post-harvest losses due to infrastructure damage, landslides, and road flooding.

WEATHER RISKS BY CROP

Extreme weather events are expected to result in some degree of crop yield reduction, although specific data regarding the total annual losses due to significant fluctuations in rainfall are currently unavailable. Still, estimations can be made using annual yield data and records of past weather events. Among the crops analyzed in this report, rice exhibits the lowest tolerance to both flooding and moisture deficits.

Although not as significant as floods,⁷ according to sector experts, drought is a risk for rice production (Reynolds et al. 2015). This is particularly the case in the northern districts, where it is a common hazard that occurs from June to September (HARPIS-SL 2017b). The impact is evident in the FAOSTAT yield data for 2003, 2004, and 2018 (Figure 3.4), during which in-season dry spells had a moderate to severe impact on cropland. Its severity mainly depends on the level of moisture deficiency and duration, as rice has a relatively higher water need (Todaka et al. 2015) and is thus highly vulnerable to water stress compared to other cereal crops cultivated in Sierra

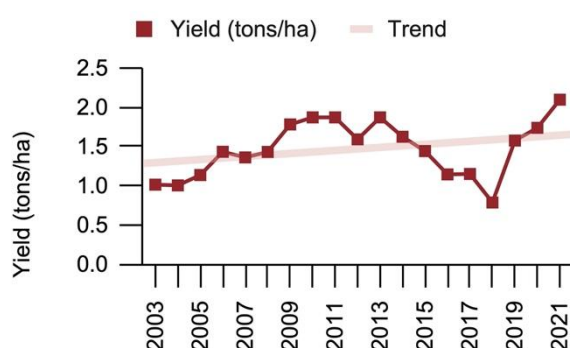
⁶ Compared to a baseline period of 1995–2014.

⁷ A greater discussion on the indicative rice losses attributed to flooding vs. dry spells for rice is included in Chapter 4. At a high-level, analysis derived from literature and FAO production data suggest that dry spells are correlated to years where annual rice yield is lower than average. But experts in the sector suggested that flooding is the greater factor that impacts rice production and yield in Sierra Leone. In referencing expertise in the sector and acknowledging existing data limitations, flooding is considered the greater risk to rice in this report’s analysis.

Leone. Moreover, as compared to several other field crops, rice has relatively weak resistance to drought and is thus more vulnerable to drought than other cropping systems (O'Toole 2004).

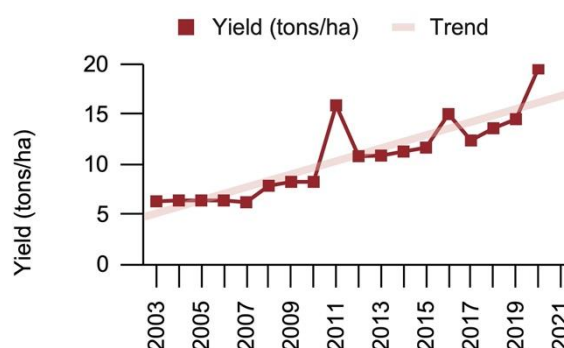
Groundnut yields are similarly susceptible to extreme weather variations, potentially explaining the decline in yields between 2015⁸ and 2018 when the country faced excessive rainfall and drought, respectively (Figure 3.6). Nationally, cassava yield trends (Figure 3.5) do not reveal any systemic impacts resulting from weather-related shocks, as cassava is a highly resilient crop in the face of moisture stress. But historical records suggest that there is a correlation between flooding events and cassava production losses for given years (see Chapter 4). Yields for oil palm and cocoa indicate minimal losses in the review period (Figure 3.7 and Figure 3.8).

FIGURE 3.4: RICE YIELDS (MT/HA), 2003–21



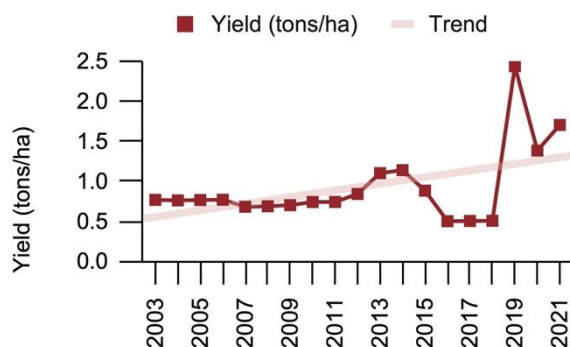
Source: FAOSTAT 2024.

FIGURE 3.5: CASSAVA YIELDS (MT/HA), 2003–21



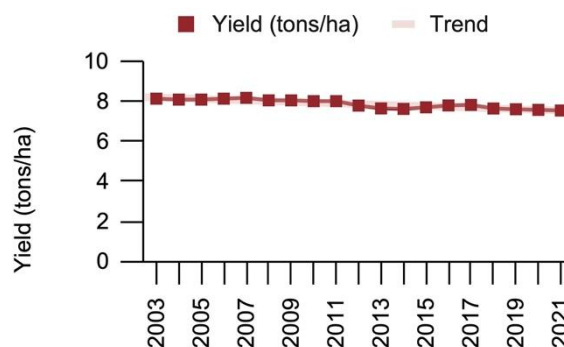
Source: FAOSTAT 2024.

FIGURE 3.6: GROUNDNUT YIELDS (MT/HA), 2003–21



Source: FAOSTAT 2024.

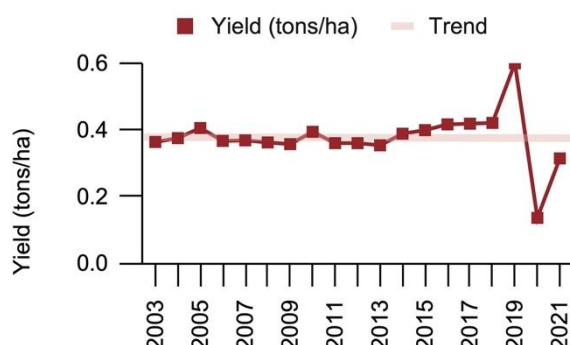
FIGURE 3.7: OIL PALM YIELDS (MT/HA), 2003–21



Source: FAOSTAT 2024.

⁸ Groundnut yields may also have been impacted by the Ebola virus (2014–16) during this time period, as sector experts mentioned that farmer deaths and the lack of communal farming could have limited the yield.

FIGURE 3.8: COCOA YIELDS (MT/HA), 2003–21



Source: FAOSTAT 2024.

PESTS AND DISEASES

Pests and diseases have the potential to result in significant reductions in agricultural production in the absence of effective prevention and mitigation measures. Sierra Leone faces significant pest and disease risks due to the limited utilization of pesticides, disease-resistant crop varieties, and the inadequate availability of veterinary services among farmers. There is currently no official or academic data which quantifies the impact of pests and diseases in Sierra Leone on crops and livestock (MAFFS 2018). Nevertheless, insights into the qualitative impact of pests and diseases on agricultural productivity can be gleaned from the government's Pest Management Plan, district-level research, and discussions with sector experts.

CROP PESTS AND DISEASES

For most food crops, a significant portion of production losses can be linked to challenges related to pests and diseases. These risks are present during the growing season and may persist after harvest, especially when crops are in storage prior to sale or consumption. Although there is no available data on the total annual crop losses caused by pests and diseases, information from government and research institutions regarding the impact of specific pests and diseases suggests that the losses are noteworthy. For example, a survey of 300 cassava farmers across Sierra Leone found that most farmers perceive crop loss by grasshopper infestation to be very severe or severe in the eastern (98 percent of farmers), southern (53 percent), and northern (75 percent) provinces, and that such losses can significantly affect household economic livelihood (Torto et al. 2023). Moreover, rough estimates can be made on post-harvest losses attributable to pests and diseases for major crops in Sierra Leone. In 2021, the African Postharvest Losses Information System listed Sierra Leone's annual estimated post-harvest losses at 103,118 metric tons (or 12.6 percent of production and over US\$112 million in value) for rice. About 45 percent of the 2021 rice losses along the post-harvest value chain occurred during the harvesting/field drying and household or market storage stages in which pests and fungi largely factor in losses.

However, the existing body of literature and reports on pests and diseases in Sierra Leone suggest that these issues are endemic and that outbreaks tend to be confined to relatively localized areas.

In the 2018 Pest Management Plan, the MAFFS identified several pests and diseases that pose threats to the production of Sierra Leone's staple crops. A comprehensive list can be found in Table 3.2. The report specifically analyzes two pests—the variegated grasshopper and the fall armyworm—because of their notable economic consequences in the sector.

TABLE 3.2: PRINCIPAL CROP PEST AND DISEASE RISKS IN SIERRA LEONE

<i>Crops</i>	Pests	Diseases
Rice	● African white stem borer ● Pink stem borer ● African striped stem borer ● Stink bug ● Green stink bug ● Stalk-eyed fly ● Rice caseworm ● African armyworm ● Fall armyworm ● African rice gall midge	● Blast ● Brown leaf spot ● White tip ● Seedling blight
Cassava	● Variegated grasshopper ● Cassava mealybug ● Whiteflies ● Green mite	● African cassava mosaic virus ● Brown leaf spot ● Bacterial stem rot ● Cassava brown streak virus disease
Groundnut	● Rodents ● Groundnut pod borers ● Groundnut aphids	● Early leaf spot ● Rosette disease
Cocoa	● Cocoa mealybugs ● Cocoa mirid ● Cocoa pod borer	● Cocoa swollen shoot virus ● Black pod disease
Oil palm	● African palm weevil ● African spear borer ● Oil palm bunch moth	● Bud rot ● Ganoderma basal stem rot ● Fusarium root disease

Source: MAFFS 2018.

The fall armyworm was initially identified in Sierra Leone in 2017, after its spread across West Africa the preceding year. It feeds on a wide variety of plant crops, including maize, rice, sorghum, and legumes. An evaluation at the end of 2017 conducted by the Crop Protection and Extension Services of the MAFFS revealed the presence of this pest in all 13 districts. Notably, in seven of

the country's districts, approximately 50 percent of all crop plants inspected were found to be infested. These insects feed on plant leaves, defoliating the crop and leading to lower yields as the plant's growth is inhibited. There are no estimates published on losses incurred from this outbreak in Sierra Leone, but other West African countries infested with the pest reported losses between 21–53 percent of the annual production of maize and other cereal crops (CABI 2017).

Other notable pests and diseases to rice include:

- » **Stemborers:** Several species of stemborers, such as the African stemborer and the yellow stemborer, can infest rice plants. They lodge into the plant's stem, which weakens the plant in that area and can lead to reduced rice yields if the plant is weakened or killed.
- » **African rice gall midge:** African rice gall midge larvae feed on the rice plant's growing points, causing gall formations, which stunts plant growth and reduces yields.
- » **Brown spot:** Brown spot is a fungal disease that affects rice leaves, causing small, dark brown lesions. If not managed, it can lead to reduced photosynthesis of the plant and lower yields.
- » **Rice blast:** Rice blast is a fungal disease that can manifest as lesions on leaves, stems, and grains, causing reduced grain quality and yield.

The variegated grasshopper is an indigenous pest in West Africa, and it significantly affects cassava crops in Sierra Leone. The proliferation of this pest significantly reduces crop yield, as it damages both the leaves and roots of cassava, which are both crucial components of the Sierra Leonean diet. Grasshoppers' range expansion and impact are most prominent during the dry season when cassava is the sole annual crop with leaves available. Being at risk of being under water stress, the crop is particularly vulnerable during this period.

Other notable pests and diseases to cassava include:

- » **Mealybugs:** The cassava mealybug is a common pest that feeds on cassava leaves and secretes a sticky substance called honeydew. Their feeding can lead to cassava leaf distortion and reduced photosynthesis. This damages the leaves and limits root growth.
- » **African cassava mosaic disease:** This is a viral disease that causes mottling, distortion, and yellowing of cassava leaves, as well as reduced root yields. It is the disease which has historically had the largest impact on cassava yield in Sierra Leone (Samura et al. 2017).
- » **Cassava brown streak disease:** This is another viral disease that causes brown streaks in cassava roots. Severe infections can result in root rot and a significant reduction in cassava root quality and yield.

Groundnut crops are affected by pests such as borers. However, two diseases are recognized for their relatively greater impact on yield: groundnut rosette disease and leaf spot diseases (Fornah, Samura, and Fornah 2020). Groundnut rosette disease is a viral disease transmitted by aphids resulting in stunted growth, leaf discoloration, and abnormal pod development and ultimately leading to reduced yields. Leaf spot diseases, including early leaf spot and late leaf spot, can affect the foliage of groundnut plants, reducing yield by causing defoliation and limiting photosynthesis for growth.

Among the primary concerns for cocoa production are cocoa swollen shoot virus and black pod disease. Cocoa swollen shoot virus is a viral disease spread by mealybugs that results in stunted tree growth and decreased production. Black pod disease is a fungal infection that affects cocoa pods and beans, causing them to darken, wither, and decay, leading to notable post-harvest losses. The disease affects about 75 percent of farms in Sierra Leone, resulting in low yields (World Bank 2023).

Oil palm cultivation primarily involves monoculture, making it particularly vulnerable to various native pests and diseases such as moths and diseases responsible for stem and root rot. The oil palm bunch moth is a noteworthy pest as it feeds on developing fruit bunches. The larvae infest the fruit, causing them to become unsuitable for processing and ultimately resulting in reduced oil extraction and crop quality. Additionally, several fungal diseases, such as ganoderma, bud rot, and fusarium root disease, infect the plant’s stem or root, weakening the tree and eventually leading to its death in the absence of targeted treatment.

LIVESTOCK PESTS AND DISEASES

There is a wide range of diseases that impact livestock production in Sierra Leone. The prevalence of disease is heightened by the increase in animal production since 2003 and limited access to animal health services such as vaccinations and medications. This report focuses on major transboundary and zoonotic diseases, considering the risk they pose to animal production, food security, international trade, or human health. Table 3.3 provides a list of the most important diseases threatening cattle, small ruminants, and poultry. A full list of the 18 priority animal diseases the government elects to monitor at a district level throughout the country through the Integrated Animal Disease Surveillance and Reporting System is found in Appendix D.

TABLE 3.3: PRINCIPAL ANIMAL PEST AND DISEASE RISKS IN SIERRA LEONE

<i>Livestock</i>	Pests	Diseases
Poultry	● External parasites: Ticks, lice, fleas ● Internal parasites: Flatworms, roundworms, coccidiosis, fowl cholera	● Newcastle disease ● Fowl pox
Cattle, sheep, and goats	● External parasites: Mange mites, ticks, flies ● Internal parasites: Flatworm, nematodes	● Hemorrhagic septicemia ● Sleeping sickness ● Black quarter ● Foot and mouth disease ● Rift Valley fever ● Foot rot ● Diarrhea ● Rumen impaction

Sheep and
goats

- See above

- *Peste de petits ruminants*
- See above

Source: MAFFS 2018.

One of the most prevalent livestock diseases in Sierra Leone is *peste des petits ruminants* (PPR), a viral respiratory disease infecting both wild and domesticated sheep and goats. It is characterized by fever, nasal discharge, coughing, and oral lesions, leading to severe illness and often a high mortality rate among infected animals. It is endemic to West Africa, with most recent outbreaks occurring in 2015 and 2018. Sierra Leone has a low vaccination rate for PPR, given the large population of goats and sheep in the country. In 2015, during the global outbreak of PPR, Sierra Leone vaccinated 1.8 percent of all small ruminants (Zhao et al. 2021). In 2018, no national vaccination campaigns took place. A study conducted in 2022 showed that 68.6 percent of households surveyed across five districts in the country reported the presence of PPR among their flock (Mustapha et al. 2022). Livestock management practices are also associated with high infection rates. Ruminants usually roam freely, which can result in infection via contaminated feed, water, and bedding with other animals. In the northern area, transboundary infection can occur, as animals usually move freely across the border with Guinea.

Newcastle disease is a significant concern in Sierra Leone's poultry industry. This highly contagious and viral disease is characterized by paralysis of the legs and wings, whitish diarrhea, twisted neck and circling, ruffled feathers, coughing, and death. It is transmitted through direct or indirect contact, improper disposal of infected carcasses, or trade. The disease is preventable with vaccination. However, most poultry (78.9 percent of chickens) are reared in the rural areas. The vaccination rate in rural areas is low compared to urban areas and farmers in rural areas thus rely on traditional management systems. One study in Moyamba District found that of the 333 chickens tested for Newcastle disease, 56.5 percent tested positive for the virus (Conteh et al. 2020). This district has no record of a vaccination campaign for the disease. Data on the prevalence of the virus is not available on a national scale.

Routine reporting of livestock disease and treatment was historically very poor in the country until 2021. This makes risk based on past losses difficult to estimate. Table 3.4 includes the notable losses reported nationally between 2003 and 2022, though this list should not be considered comprehensive. According to the weekly surveillance reports conducted by community animal health workers between March–October 2021, 25 percent of the 45,267 head of livestock that were evaluated throughout the year showed symptoms suggestive of disease (Bangura et al. 2022). While some pests and diseases themselves are the source of risk, the main risk to production comes from the lack of veterinary services. Notably, there is a shortage of veterinary officers and medications at the national level, resulting in the treatment of sick livestock by field livestock officers who have only basic training in veterinary medicine. This severely impacts the livestock survival rate, particularly for diseases that are preventable through vaccination or curable with medical care.

TABLE 3.4: FREQUENCY AND IMPACT OF LIVESTOCK DISEASE IN SIERRA LEONE, 2003–22

Year	Description
2011–12	A study in Koinadugu district found 1,649 cases of <i>peste des petits ruminants</i> in ruminants, 1,402 cases of sleeping sickness in cattle, 691 cases of black quarter in cattle, 542 cases of hemorrhagic septicemia in cattle, and 911 cases of Newcastle disease in poultry.
2015	<i>Peste des petits ruminants</i> reported without record of losses.
2018	1,200 cases and 40 deaths of foot and mouth disease reported in cattle, <i>peste des petits ruminants</i> reported.
2019	700 pig deaths from African swine fever in the western area.
2021	150 cattle with brucellosis, 50 deaths from infected cattle brought in from Guinea.
2022	223 livestock deaths from anthrax (91 cattle, 53 goats, and 79 sheep).

Sources: List compiled from World Organization for Animal Health 2023; Sundufu et al. 2014; [FAO 2019](#); [Farmers Review Africa](#); and El-Mahallawy, Hamza, and Ahmed 2022.

The Livestock and Veterinary Services Division of the MAFFS has also identified antimicrobial resistance as a major risk both for livestock production and human health. Increased use of antimicrobial agents in animal husbandry, particularly as a reactionary measure, can lead to the development of resistant strains of disease. This can compromise the effectiveness of antibiotics in treating livestock diseases.

MARKET RISKS

Market risks pertain to challenges that impact the pricing, quality, availability, and accessibility of essential products and services. The prices of agricultural inputs and outputs can be highly volatile, especially in commodity markets where both local and global supply and demand factors are in constant flux. Additionally, market risks include the unpredictability of exchange rates, interest rates, and counterparty risks. Typically, these risks occur at the market level, but their repercussions extend backward to the farm, impacting various stakeholders in the agriculture value chain along the way.

DOMESTIC CROP PRICE VOLATILITY

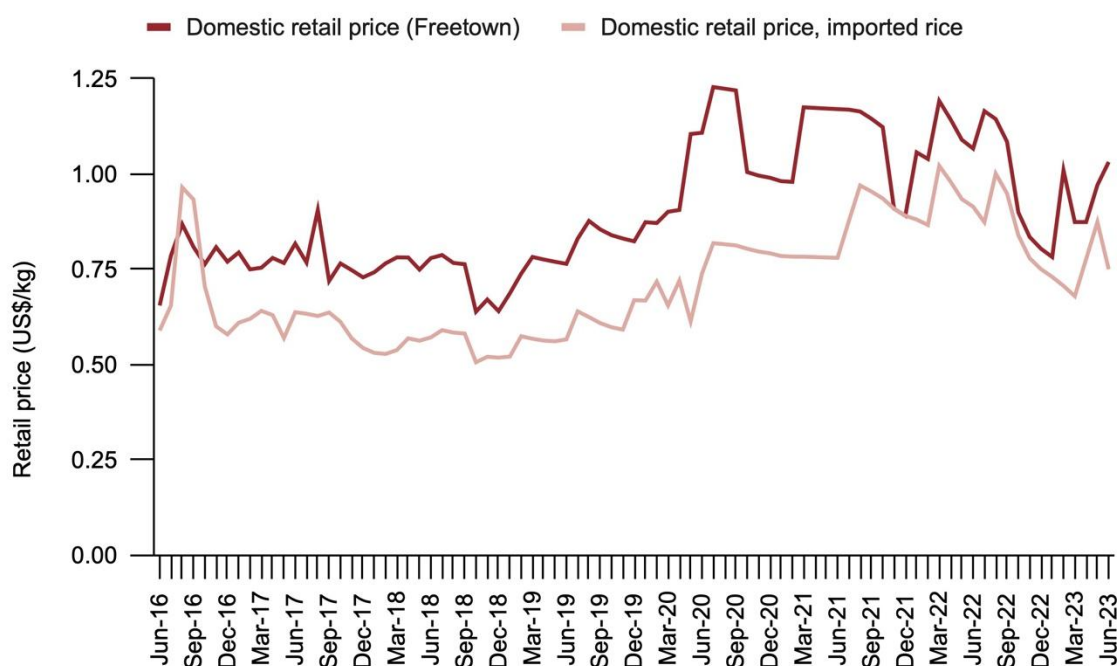
Price variations frequently take place within agricultural markets, stemming from factors such as alterations in supply and demand, along with fluctuations in weather patterns and crop yields. However, when price instability escalates to significant levels, it tends to dissuade agricultural producers from pursuing investments geared toward enhancing productivity. Other value chain actors, such as aggregators, processors, and exporters will also be vulnerable to these price

changes. Their input costs of procuring the commodity will fluctuate, affecting production margins and the overall profitability of the business. Finally, it can also have adverse effects on the accessibility of food for lower-income households who may struggle to respond to higher food costs.

RICE PRICE

The price of rice is subject to changes from both domestic and international factors, given that the national supply comprises both locally produced and imported rice. Figure 3.9 displays monthly retail prices for both domestically produced and imported rice from June 2016 to June 2023. Notably, local prices have consistently remained higher than international prices. This higher price contrasts with the commonly expressed local preference for international rice, driven primarily by the perception of its consistent quality and lower likelihood of containing impurities such as stones (World Bank 2014b). The higher price of domestically produced rice can be attributed to some degree to high marketing costs, thus reducing its competitiveness vis-à-vis imports (for example, due to the poor transport linkages between the hinterland and the Freetown area).⁹

FIGURE 3.9: AVERAGE MONTHLY MARKET PRICE FOR DOMESTIC AND IMPORTED RICE, 2016–23



Source: Author's calculations using relative exchange rate; [FAO/GIEWS 2023](#).

⁹ See Sierra Leone Economic Update for more detailed discussion (World Bank 2023).

Rice prices experience significant fluctuations within a year depending on the time in the growing season and the availability of rice. Market prices for rice, like other food commodities, remain relatively stable during the post-harvest period. However, prices tend to increase seasonally during the lean season from June through August, when household rice stocks are depleted. Higher rice prices during this period can lead to changes in household behavior, including the shift toward alternative staple crops such as cassava. Rice prices are also subject to fluctuations in the international market.

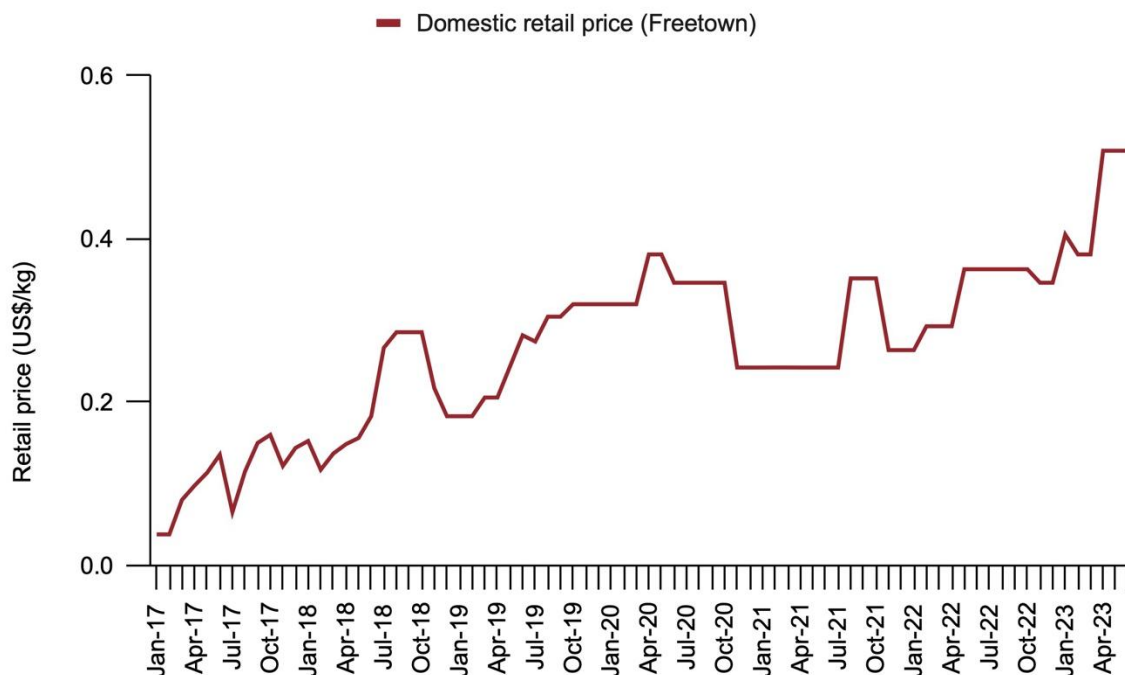
Variation in the percentage of imported rice consumed relative to domestic production has occurred due to changes in production and import policies. In recent years, almost 30 percent of rice came from outside the country (FAO/GIEWS 2022). The primary rice suppliers to Sierra Leone are Brazil, Pakistan, and Thailand, collectively contributing around 60 percent of the total imports (DESA/UNSD 2016). The quality of imported rice varies, ranging from 100 percent broken white rice to high-quality white rice. In 2020, an upswing in the international price coincided with an increase in the domestic retail price both during the pre-harvest period and later in December. The volume of rice imports can also influence rice prices. While domestic rice production remained relatively consistent between 2016 and 2018, at approximately 897,000 metric tons, the values of imports fluctuated significantly from year to year, with figures of US\$118 million, US\$193 million, and US\$152 million in 2016, 2017, and 2018, respectively. The substantial volume of imported rice (approximately 400,000 metric tons) in 2018 resulted in a price drop in locally produced rice, both in the pre-harvest period and later in December. In this scenario, sudden increases in rice imports due to policy changes pose a risk to domestic rice producers, who bear the costs of lower producer prices.

Analysis of rice price variability in Sierra Leone's retail market compared to the global market using the coefficient of variation shows that local price variability of rice is almost double that of the international price (Appendix E). The higher levels of price volatility can be explained in part by erratic changes in rice imports, domestic production shocks, and currency fluctuations. Both local consumers and producers are affected by price risks as they are forced to quickly adapt to erratic and substantial price changes, which may affect food affordability at the consumer level while discouraging investment at the producer level.

CASSAVA PRICE

Cassava has a large domestic market as a staple crop. Fresh cassava is tradable despite risk of perishability over larger distances. However, it can be processed into more durable forms like gari, which are traded within the country and, to a limited extent, exported to neighboring Guinea and Liberia. Retail prices of fresh cassava tubers exhibit substantial fluctuations, although volatility has reduced in recent years, likely owing to enhanced supply resulting from increased production, as depicted in Figure 3.10. Production in 2019 was 881,000 metric tons but increased significantly to reach 3,000,000 metric tons by 2021.

FIGURE 3.10: AVERAGE MONTHLY MARKET PRICE FOR CASSAVA, 2017-23



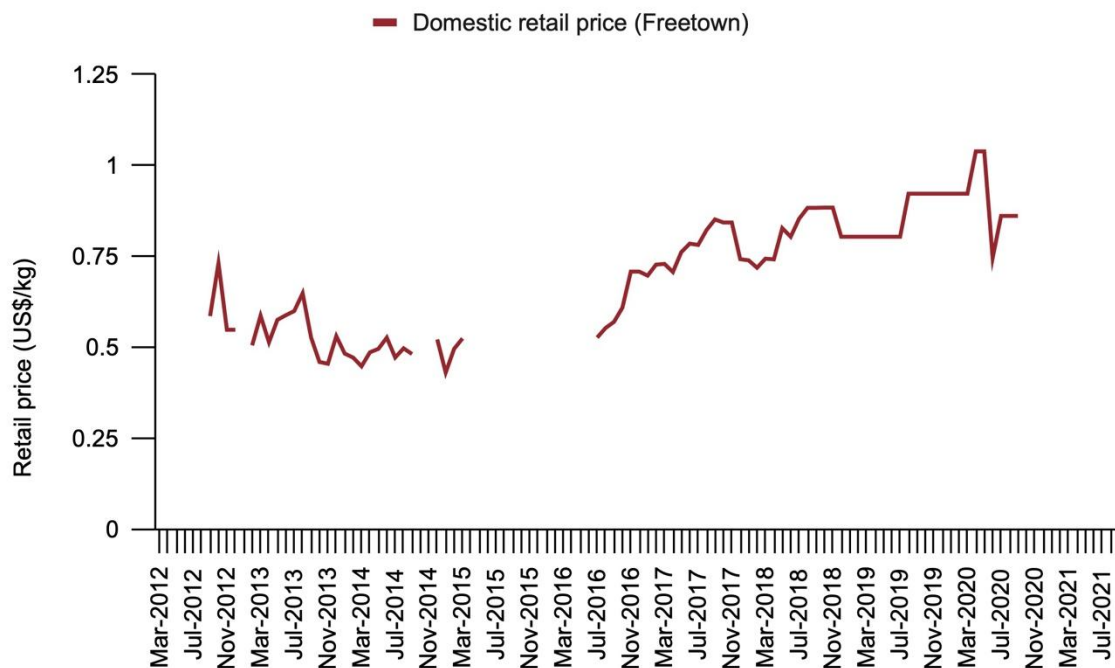
Source: Author's calculations; FAO/GIEWS 2023.

Like rice, cassava experiences high seasonal variability, with elevated prices during the lean season and lower prices in January following the harvest period. Standard seasonal price fluctuations are not typically regarded as risks, as they are anticipated occurrences. However, when variability exceeds expectations in a given year, unforeseen risks can emerge. For instance, in 2018 and 2021, there were substantial spikes in retail prices during the lean season compared to other low annual production, indicating that production levels are the primary determinant of cassava prices.

GROUNDNUT PRICE

Like cassava, groundnut is sold primarily on the domestic market. Although data on domestic market prices are sparse (see Figure 3.11), what is available also shows high seasonal variability. Based on the available production data for groundnut, there seems to be limited correlation between production volumes and price. While the absence of data prevents any firm conclusions from being drawn, this might indicate that price volatility may not be a major risk for groundnut.

FIGURE 3.11: AVERAGE MONTHLY MARKET PRICE FOR GROUNDNUT, 2012–22



Source: Author's calculation; FAO/GIEWS 2022.

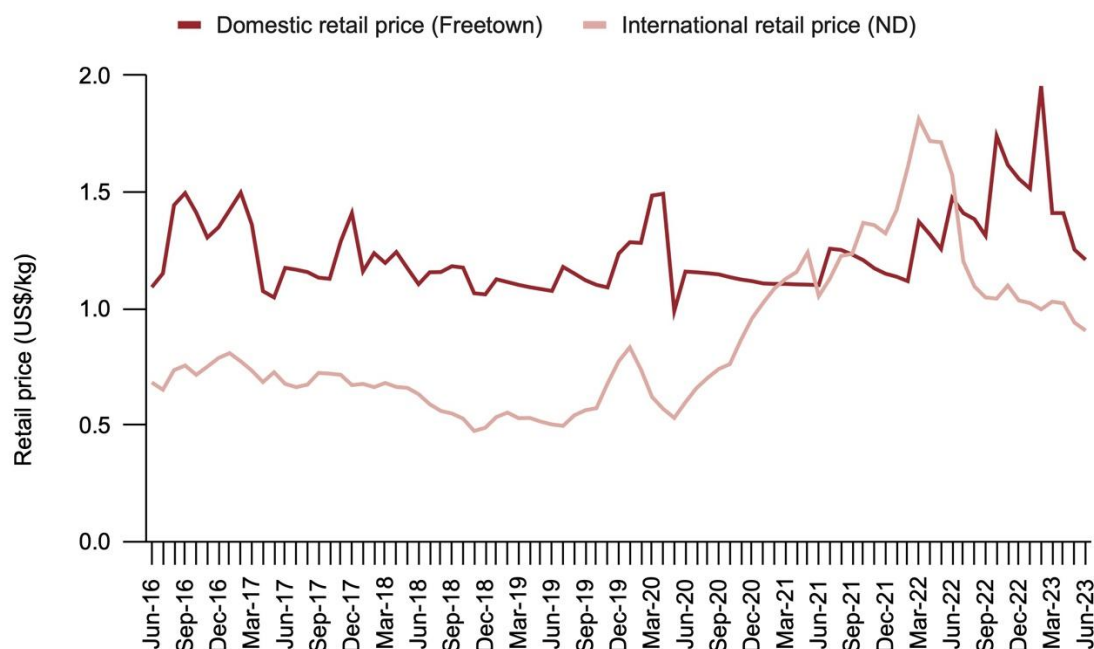
EXPORT CROP PRICE VOLATILITY

For export crops, risks related to trade policy, informal crossborder trade, and the fluctuations in national production are elements that constitute a significant risk for producers and traders.

OIL PALM PRICE

Palm oil is widely traded within the country and exported to Guinea, Liberia, and Senegal as well as to other international markets (FEWS NET 2017). As illustrated in Figure 3.12, palm oil prices exhibit considerable volatility. Like other crops, domestic prices are not fixed or regulated; instead, they are influenced by factors such as demand, supply, and comparisons with international market prices. Access to accurate and timely market information is, therefore, a valuable advantage for smallholders and traders. However, obtaining trade information can be challenging, and the distribution of market power within the supply chain is often highly unequal. This situation poses a notable risk for smallholders, who typically occupy the more vulnerable position in the supply chain. The price data suggests that the volatility observed in the international market is transmitted to domestic prices, with local prices experiencing three times the level of volatility seen in the international market.

FIGURE 3.12: AVERAGE MONTHLY DOMESTIC AND INTERNATIONAL PRICE FOR PALM OIL, 2016–23



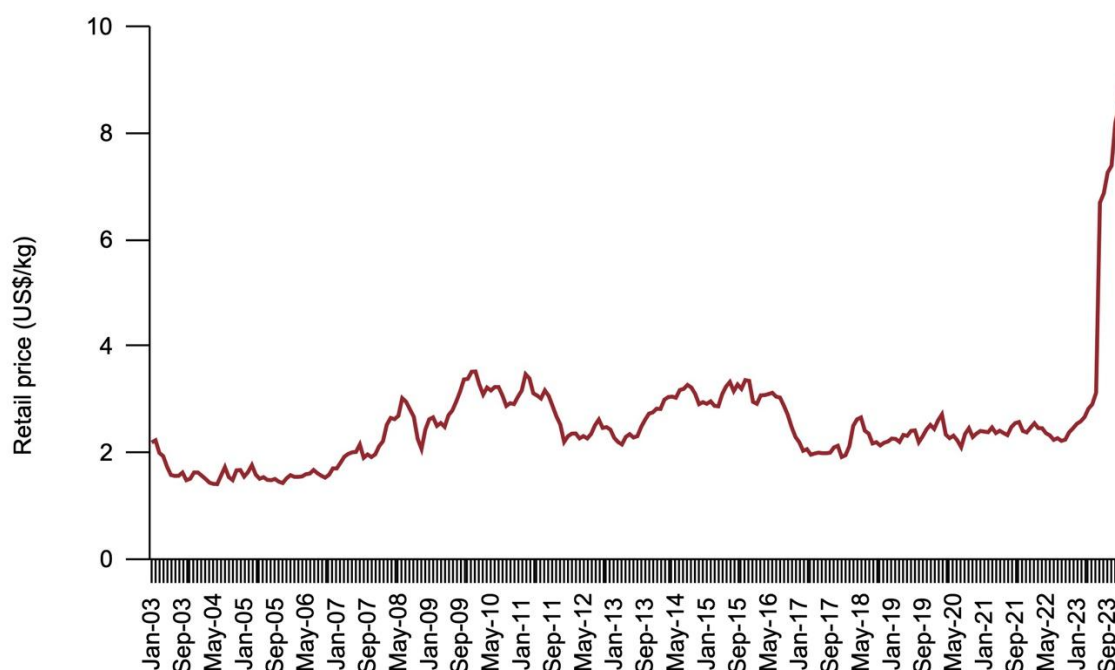
Source: Author's calculations; FAO/GIEWS 2023.

COCOA PRICE

No domestic price data from the last 20 years is available for cocoa. However, since the crop is grown exclusively for export, it is reasonable to derive insights on sector risk based on international price data for cocoa (Figure 3.13).

International price volatility of cocoa reflects the production risks within West Africa in many ways. The region accounts for approximately 80 percent of total global production, with two countries (Ghana and Côte d'Ivoire) accounting for more than 60 percent. As a result, events in the wider subregion that impact production can have large implications on the international price. In the last twenty years, this can be seen notably twice: in 2007–09 when production declined from extreme flooding after a period of drought, and most significantly in 2023 because of extreme weather conditions. Since late September 2022, international cocoa prices have soared (Figure 3.13). The characteristic droughts caused by El Niño have been prevalent through this period (Glauber and Mamun 2024) and were interjected by heavy rains in Côte d'Ivoire and Ghana in December 2023, which destroyed cocoa yields and caused black pod disease, leading to plant rot. The cocoa sector in Sierra Leone is thus highly exposed to price trends and to some extent production trends observed elsewhere in the region.

FIGURE 3.13: AVERAGE MONTHLY INTERNATIONAL PRICE FOR COCOA 2003–24



Source: [International Monetary Fund 2024](#).

The absence of reliable data on local producer prices renders agricultural producers and relevant stakeholders vulnerable to volatility in the international cocoa markets. Despite the structuring of producers into cooperatives and associations, inefficiencies in coordination and management, coupled with a lack of financial transparency, constrain their bargaining power in price negotiations and limit marketing opportunities (MAFFS 2019). To secure cocoa supply for export prior to the harvest season, aggregators, processors, and traders frequently engage in forward contracting with producers. These arrangements entail counterparty risks (elaborated in subsequent sections of this chapter) and can affect the profitability margins for both producers and aggregators, contingent on fluctuations in global market prices.

EXCHANGE RATE RISKS

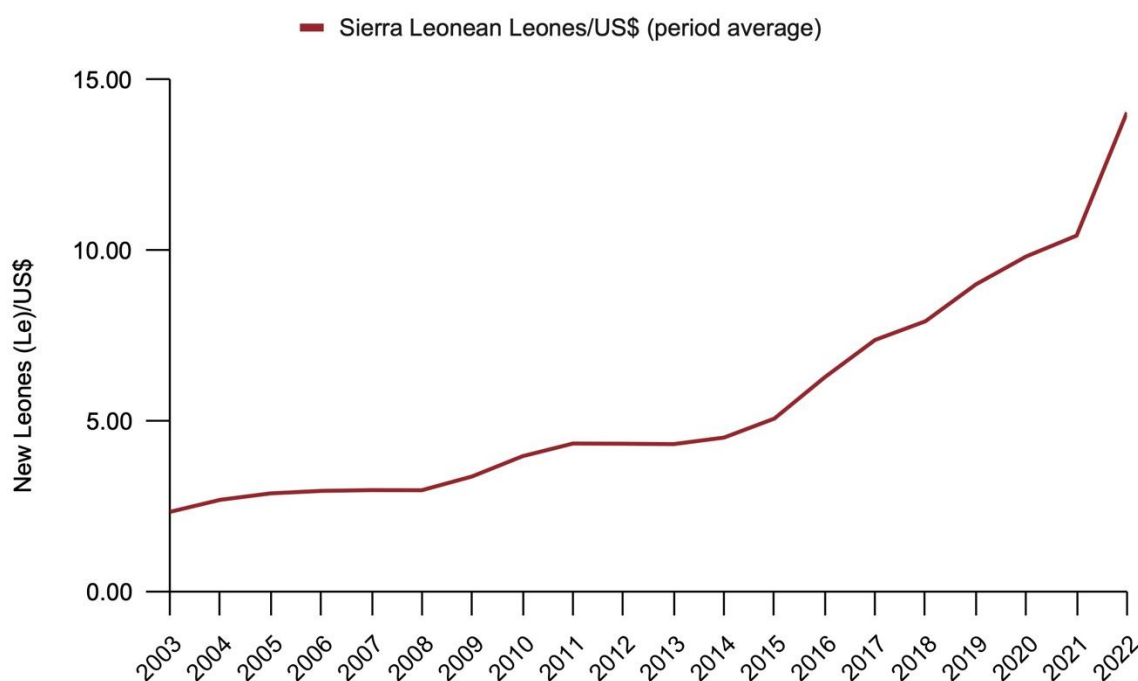
The variability of exchange rates is a risk for the agriculture sector in Sierra Leone, which relies heavily on imports of staple crops and the export of cash crops. Sierra Leone has undergone six exchange rate regimes from its independence to 1989, primarily in response to addressing persistent overvaluation. In reaction to a substantial depreciation of the currency during the period of conflict (1991–2002), the government initiated economic reforms aimed at stabilizing the exchange rate.

Since 2008, there has been a consistent pattern of currency depreciation, as evident in Figure 3.14. This trend of sustained depreciation against the US dollar is also observed in neighboring

countries. Several economic shocks are associated with this overvaluation trend, including the 2008 global financial crisis, the Ebola virus epidemic, and the COVID-19 pandemic. The 2008 global financial crisis resulted in reduced global demand for commodities, which affected Sierra Leone's foreign exchange earnings between 2008 and 2010. Exchange rates remained relatively stable from 2010 to 2015, as a result of increased investments and output in the mining sector, even though GDP growth declined during this period (Koroma, Jalloh, and Squire 2023). Subsequently, there has been significant depreciation since 2015, which can be attributed to the impact of the Ebola crisis and, more recently, the global fallout from the COVID-19 pandemic and other crises with global ramifications, such as Russia's invasion of Ukraine. In the course of 2022, the leone depreciated by over 40 percent against the US dollar in the face of macroeconomic headwinds driven by multiple crises and large increases in the fiscal deficit.

The depreciation of the national currency has resulted in an increase in the costs of imported goods, such as rice, and imported inputs such fertilizer and agricultural machinery. This has contributed to inflationary pressures in the economy and weakened the purchasing power of both producers and consumers.¹⁰ Additionally, high costs of imported inputs also have a detrimental effect on profit margins of exporting farmers.

FIGURE 3.14: OFFICIAL Le/US\$ EXCHANGE RATES, 2003–22



Source: World Bank, [World Development Indicators Database 2023](#).

¹⁰ Average inflation between 2018 and 2023 stood above 20 percent with a peak at over 47 percent in 2023 ([World Bank 2024](#)).

INTEREST RATES

Limited access to credit represents a significant obstacle to agriculture sector growth in Sierra Leone, particularly for smallholder farmers. Agriculture credit accounts for slightly less than 5 percent of the total credit extended by banks (Korsu and Tamuke 2023). This figure is notably low, especially when considering that the agriculture sector contributes to nearly half of the country's GDP. Despite a substantial increase of nearly 200 percent in the total credit value over the past decade, the proportion of credit allocated to agriculture has remained relatively consistent relative to the national total, as illustrated in Table 3.5.

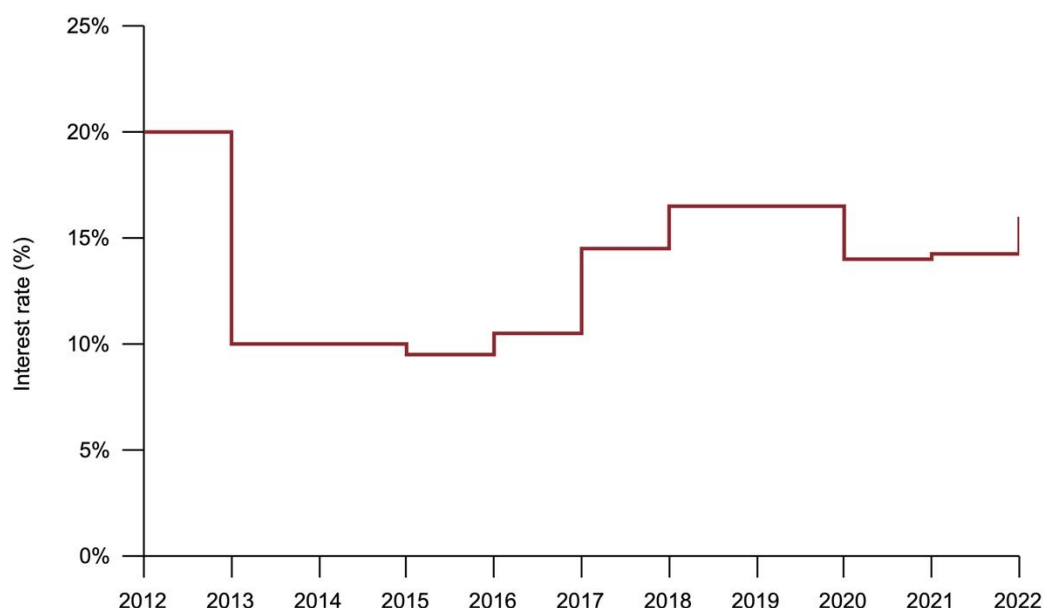
TABLE 3.5: AGRICULTURE LOAN VALUE IN TOTAL COMMERCIAL BANK LOANS AND ADVANCES, 2012 and 2022

	Formal agriculture loans (Le, millions)	Total loans (Le, millions)
2012	63,515,055	1,066,438,318
2022	144,076,229	2,985,044,589

Source: [Bank of Sierra Leone 2023](#).

The relatively limited presence of formal loans within the agriculture sector can be linked to the country's elevated interest rates and limited access to the loan market. Interest rates have remained high in the post-war period, with fluctuations tied to periods of economic instability arising from events such as the Ebola virus epidemic and the COVID-19 pandemic (see Figure 3.15). Financing in the agriculture sector is also considered to carry a high level of risk, given the various production, market, and enabling environment conditions discussed in this chapter. Constraints to accessing credit are also multiplied by the fact that the majority of those employed in the agriculture sector are smallholder farmers, who rarely have other significant assets or alternative revenues to derisk the loan for lenders.

FIGURE 3.15: COMMERCIAL BANK INTEREST RATES, 2012–22



Source: [Bank of Sierra Leone 2023](#).

As a result, informal lending arrangements are more prevalent in the country. Approximately 31 percent of farmers depend on loans provided by friends, relatives, or microfinance institutions such as Osusu (Tarawalie 2019). These forms of loans are also more preferred because they typically offer more favorable interest rates and involve fewer formalities in the loan application process.

INPUT PRICES

In Sierra Leone, the agricultural sector's productivity faces significant constraints due to the limited availability of high-quality fertilizers and the absence of seeds that are suitable to local conditions. Fertilizer usage is primarily seen in commercial farming, which is uncommon in the country. As a result, inorganic fertilizer usage averages only 19 kg per ha,¹¹ which is far below the global average of over 100 kg per ha (FAO 2023). This can be attributed to the high cost of fertilizers, despite the government's subsidized fertilizer program, inadequate regulation of national fertilizer distribution, and the absence of commercial markets for crops that benefit from fertilization, such as rice (GoSL 2019).

Since only a small percentage of farmers rely at present on input markets (such as seeds, fertilizer, and diesel), the volatility in input prices does not significantly impact the broader

¹¹ As of 2020 (see [World Bank Data](#)).

agricultural sector.¹² This same situation now applies to farmers' access to agricultural machinery (for example, tractors) and equipment, with mechanization being estimated at around 2 percent (AfDB 2023). However, as access to inputs such as weather-tolerant seeds, pesticides, and mechanization are being promoted as part of sectoral development strategies (see for example AfDB 2023 and MAFFS 2023), access to inputs and mechanization will likely improve. As a result, it can be expected that some level of exposure to market risk resulting from input price swings will likely increase.

COUNTERPARTY RISK

Alongside the risks related to price fluctuations and financing, individuals involved in agricultural production, trade, and processing also encounter counterparty/default risk. This refers to the possibility that a party involved in a financial transaction or contract may not fulfill their obligations, resulting in financial losses or disruptions. This risk is more pronounced for agricultural products with extensive value chains, such as export crops like palm oil and cocoa. As mentioned, formal credit programs are not widespread in Sierra Leone. For rural banks, microcredit institutions, and other credit providers, repayment issues present a significant hurdle and serve as a notable disincentive to providing loans to farmers, particularly smallholders (GIZ 2011). The inability to effectively manage these risks remains a primary obstacle, restricting farmers' access to credit and increasing the cost of agricultural financing (GIZ 2011).

When experts in key value chains discussed agriculture finance at the ASRA workshop, they agreed that contractual or credit arrangements between small farmers and large-scale producers or processors are not widely embraced. This is primarily attributed to the distrust linked to how buyers enforce contract agreements (International Trade Centre 2022). This issue is related to Sierra Leone's challenge in regulating the effective enforcement of private contracts (GIZ 2011). In a survey of the palm oil industry, it was found that 58 percent of farmers prefer to negotiate with buyers at the time of harvest, despite the associated risk of price fluctuations (International Trade Centre 2022). About 32 percent of farmers choose to negotiate before the harvest, and 8 percent opt for contractual agreements with buyers before the harvest. Due to the limited use of credit or contractual mechanisms, the default risk is confined to a relatively small segment of the sector, and its impact on the broader agriculture sector is not particularly significant.

ENABLING ENVIRONMENT RISKS

Other sector risks arise from changes in the broader economic and political environment in which the sector operates. Examples include unexpected changes in government policy or business regulations, the macroeconomic environment, political leadership, conflict, trade restrictions, logistics, and corruption.

¹² For example, a recent household survey indicated that for seasonal crops, only 41 percent of farmers purchase improved seeds, 8 percent apply inorganic fertilizer, and 2 percent use pesticides (Stats SL 2019). According to a study by the Seed Systems Group (2020), the informal seed sector supplies up to 92 percent of rice seed, indicating a low adoption rate of improved seeds.

POLICYMAKING

The Agricultural Policy Framework issued in 2002 was the first major piece of post-war national policy created to advance Sierra Leone's development targets throughout the agriculture sector. Prior to this, much of the institutional capacities and public sector initiatives were sidelined by national crises, meaning that much of the agriculture sector's policy needed to be revamped for the post-war environment. Since then, Sierra Leone has had several policy-focused roadmaps and pieces of legislation focused on facilitating market access domestically and abroad, building capacity, and lowering barriers for all value chain members in the sector. Because of the high priority assigned to the sector by the government and the consistency with which agriculture policy has been shaped and implemented, drastic policy changes are unlikely and pose very little risk to the sector. However, existing risks to the sector are likely to persist without stronger interventions from the government.

Sierra Leone's government has pursued rice self-sufficiency for much of the country's history, reflecting the importance of the crop to the country's agricultural and food security policies. In the 1970s and 1980s the goal of attaining rice self-sufficiency was at its highest. However, the civil war resulted in major setbacks to rice production and a pause in the implementation of public and donor-funded interventions to support this policy, resulting in a drop of self-sufficiency to 57 percent by 2002.

In 2009, the government launched the National Rice Development Strategy, which ambitiously sought to reach rice self-sufficiency by 2013 by increasing the area of rice cultivation, with a focus on the underutilized lowlands, and increasing the productivity of rice cultivation per unit area. This strategy targeted a land area of 830,000 hectares and an increase in the average rice yield to 2 metric tons per ha to realize the government's self-sufficiency goal. Although rice production and yield have increased between 35 percent and 27 percent, respectively, since 2009 to the present day, both are still far under self-sufficiency targets.

Importing key domestic crops to supplement local production helps to smooth domestic consumption but can lead to abrupt price swings if the market becomes oversaturated. In 2011 and 2018, the domestic rice sector accrued notable losses resulting from the oversupply of imported rice, which caused rice prices to fall. Unexpected price drops due to oversupply can lead to sector-wide debt and particularly strain producers. There is currently no government regulation of domestic food markets in place.

Rice self-sufficiency continues to be a one of the government's key priorities. The approach focuses on incentivizing local production through capacity building and offering incentives for rice-importing businesses to participate in different aspects of the rice value chain, including cultivation, aggregation, processing, and marketing.

To manage price volatility and domestic rice consumption needs, the government has changed its policy on goods and services taxes and import tariffs for rice. Prior to 2007, Sierra Leone had a 15 percent tariff on imported rice. This was lowered to 10 percent and eventually removed

altogether in response to the global food crisis in 2008. In 2024, the government reintroduced a 5 percent import tariff on rice (effective January 1, 2024), with the intent to scale up to 10 percent in January 2025. In addition, the government has also changed its policy on applying goods and services taxes to rice and rice production tools as a mechanism to manage high domestic prices, most recently in 2021. When changed abruptly or frequently within a short, 20-year period, both tariffs and goods and services taxes introduce volatility in the price of rice in the country, with the impacts felt by consumers (Appendix E).

Another major policy risk comes from the structure of the subsidy programs linked to the provision of agriculture inputs, such as fertilizer and seeds. The risks assumed by farmers associated with input distribution programs include the uncertainty over the timing of delivery, the extent of annual support, and inability to access subsidized inputs. There is also a risk of unsustainability in the long run due to the high costs of fertilizer subsidy programs on the government expenditure, and as input demand grows. Fertilizer adoption is generally low in Sierra Leone, in part due to its costs and low perceived benefits, which is caused by the presence of poor-quality fertilizer in the market (see also previous section on input prices). According to data from OEC Sierra Leone, imports nitrogenous fertilizers primarily from Senegal (US\$290,000), India (US\$156,000), Russia (US\$54,300), Netherlands (US\$29,700), and China (US\$25,200) (OEC 2024).

Additionally, according to extension and trade experts, it has been frequently observed that input dealers purchase fertilizer from recipients who prefer to sell their allocation rather than use it, or who have obtained it illegally through the government program. As a result, input dealers could benefit from increased profit margins at the expense of smallholders in need of fertilizer (International Trade Centre 2023).

Finally, heavy dependence on a few commodities to generate foreign exchange poses a higher risk to economic growth and stability. Sierra Leone has experienced a decline in price for several of its export commodities, including palm oil and cocoa, in the last 20 years. This has resulted in a deterioration in its balance of payments.

CONFLICT

Sierra Leone's economy contracted by 43 percent during the civil war from 1991–2002. The civil war had significant and well-documented impacts on the country's agriculture sector. Most notably, the country saw a steep decline in crop production relative to prewar levels. For instance, rice production fell to 360,000 metric tons in 2003, compared to 503,000 metric tons in 1990 (Kwadwo et al. 2009). Production volumes of export crops also declined, leading to a decrease in export revenues. This can be attributed to:

- » Destruction of crops and livestock.
- » Loss of life of people involved in the agriculture sector.

- » Damage to agriculture land and infrastructure, including machinery, processing and storage facilities, and roads.
- » Halt to humanitarian aid and government activities to advance agriculture.
- » Limited trade and export opportunities.

Land access conflict, one of the drivers of the civil war, continues to be an issue in Sierra Leone. After the war, many smallholders returned to find their land and assets occupied or destroyed. As a result, between 2001–06 almost 70 percent of high court cases were related to land disputes (Sturgess and Flower 2013). Customary law governs approximately 95 percent of the nation, relying on unwritten norms and oral customs to dictate land ownership, utilization, and transfer, often to the detriment of specific ethnic communities and women. Prior legislation also prevented land access to “strangers” or non-citizens. However, the recent influxes in foreign investment and expansion of large commercial farming operations have increased the risk of land grabbing,¹³ which is made easier with the new land tenure system. This activity, seen commonly with the expansion of the palm oil industry, yields negative outcomes for smallholders who are stripped of their land and opportunity to earn an income. To better protect land rights, in 2022 the [Customary Land Rights Act](#) and the National Land Commission Act were signed into law, aiming to protect land rights. As required by the National Land Commission Act, a land commission has been established in Sierra Leone.

Related to unresolved land disputes is the risk of farmer-herder conflict, highlighted by sector experts during the risk workshop. In the northern region of the country there is a high density of livestock. In certain districts, such as in Falaba, cattle graze the grassland and occasionally wander onto farmland. This can result in crop damage and losses, which can compound if conflict escalates between groups. This issue occurs within the country and in Guinea because of the porosity of the border, particularly for livestock grazing. While there is a lack of quantitative evidence estimating the impact of such conflicts in terms of losses, damage to cropland is significant enough that programs have been developed to mitigate transhumance-related conflicts in the region.¹⁴

¹³ Land grabbing, as defined by the International Land Coalition in the [Tirana Declaration](#) (2011), is “acquisitions or concessions that are one or more of the following: (i) in violation of human rights, particularly the equal rights of women; (ii) not based on free, prior and informed consent of the affected land-users; (iii) not based on a thorough assessment, or are in disregard of social, economic and environmental impacts, including the way they are gendered; (iv) not based on transparent contracts that specify clear and binding commitments about activities, employment and benefits sharing, and; (v) not based on effective democratic planning, independent oversight and meaningful participation.”

¹⁴ For example, the International Organization for Migration has engaged in a [project](#) in northern Sierra Leone and nearby Guinea that aims to mobilize community members and use data on transhumance to facilitate [conflict prevention mechanisms](#).

BOX 3.1: IMPACT OF PUBLIC HEALTH CRISES ON AGRICULTURE IN SIERRA LEONE

Sierra Leone experienced two major health related shocks in the review period—the Ebola virus outbreak of 2014–15 and the COVID-19 pandemic from 2020–22. The indirect impact of these public health crises is notable in price data for all commodities and production data for most commodities during this time. The Ebola virus epidemic resulted in the loss of 4,000 lives, and 125 deaths were attributed to COVID-19, in national records.

It is estimated that out of 1.2 million households in Sierra Leone during 2013–16, Ebola affected 6,951 households across the country. Many affected households lost family members who were critical to their financial stability (Richardson et al. 2017). In rural areas, this had a sizable impact on the agriculture workforce. The loss of income in these households also increased the prevalence of food insecurity for the surviving family members. The outbreak of the Ebola virus caused the disruption of farming activities, the closure of periodic markets, price volatility, and the depletion of revolving funds of individual farmers and groups. This was also supported by sector experts when describing low levels of rice production seen in 2015 and 2016, which were speculated to be attributed to the lack of communal farming due to the government’s mandate for social distancing.

As Sierra Leone was recovering from the economic impact of the Ebola virus, it was hit like other countries around the world by COVID-19. COVID-19 countermeasures, such as social distancing and quarantine, hampered agricultural production and markets in similar ways to the Ebola virus outbreak. This posed significant risk to the short- to long-term food supply with a negative impact on the economy. In a June–October 2020 survey implemented by Innovations for Poverty Action, findings revealed that nearly 50 percent of respondents reported income reductions, and about 60 percent of respondents reported depleting their savings to secure food for the household (Collins et al. 2020).

CHAPTER FOUR

ADVERSE IMPACTS OF AGRICULTURAL RISK

Agricultural risks pose significant challenges to the productivity and production of agricultural goods, impacting profitability and investment across supply chains. This impact can be measured in the form of both production and monetary losses to specific commodities and to the entire sector. In this way, estimating losses can describe the result of the prevalence and impact of various agriculture risks. This chapter aims to quantitatively assess these production losses for both staple and export crops at a national scale. The various sources of risk are then reviewed to discern the most critical.

Understanding the frequency, magnitude, and geographical distribution of these losses is crucial for effective risk management. Identifying and targeting interventions in this way can mitigate the adverse impact of risks and minimize associated future losses effectively. Subsequent chapters (Chapter 6) integrate the quantitative analysis from this chapter into the larger body of sources, coming from sector experts and literature.

CONCEPTUAL AND METHODOLOGICAL BASIS FOR ANALYSIS

For this study's purposes, *risk* is defined as exposure to a significant financial loss or other adverse outcome whose occurrence and severity is unpredictable. Risk thus implies exposure to substantive losses over and above the normal costs of doing business. In agriculture, farmers incur moderate losses each year as the result of unexpected events such as suboptimal climatic conditions at different times in the production cycle or modest departures from expected output or input prices. Risk refers to the more severe and unpredictable adverse events that occur beyond these smaller events.

This concept differs from the common perception of “risk” by farmers and traders, based on the year-to-year variability of production and prices. It should also be distinguished from constraints, which are predictable and constant limitations to productivity and growth, and which contribute to inefficiencies in production and marketing systems, such as chronic lack of access to inputs.

Losses that occur because of agricultural risks refer primarily to production losses caused by weather-related events such as floods, erratic rainfall, wildfires, pests, and outbreaks.

The following methodology was applied to calculate production losses in a particular year: (1) a historical linear trendline for the yield of each crop was constructed; (2) a second linear trend line was drawn, representing a “loss threshold,” or one-third of the standard deviation of the crop yields; (3) loss years were identified as those in which actual yields were lower than the loss threshold; (4) production losses were calculated using the difference between the predicted value (the original trend line) and actual yield; and (5) losses were totaled and divided by the total number of years examined to determine the average annual loss rate for a particular crop; (6) the annual quantity lost was converted into value terms by using the producer price for each

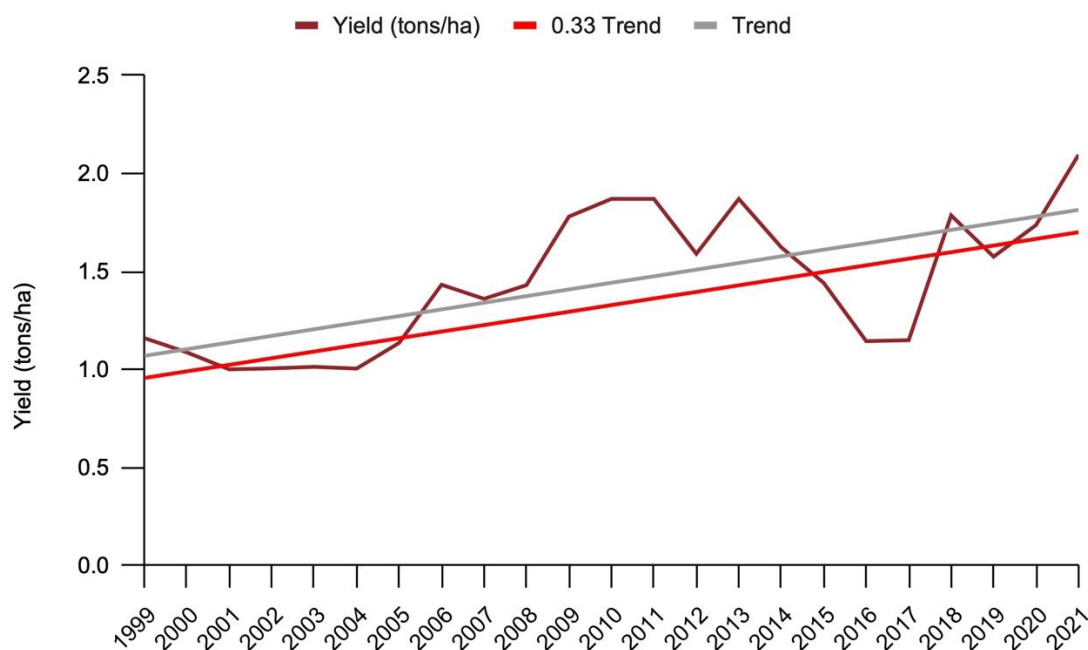
crop; and (7) because producer prices are in local currency, the value was converted to US dollars using the average exchange rate. More detailed methodology is outlined throughout the chapter.

LOSS THRESHOLDS

As agricultural production is inherently variable, the immediate step for analysis is to define *loss thresholds*, which distinguish adverse events from smaller, interannual variations in output. This is achieved by first estimating a time trend of “expected” production in any given year, based on actual production, and treating the downside difference between actual and expected production as a measure of loss. A loss threshold of a 0.33 standard deviation from trend is then set to distinguish between losses resulting from adverse events and those that reflect the normal costs of doing business. Those below threshold deviations from trend allow estimation of the frequency, severity, and cost of loss for a given time period. Figure 4.1 and Figure 4.2 show two examples of the indicative crop loss estimates for rice and cassava, respectively (see Appendix F for all other indicative crop loss estimates).

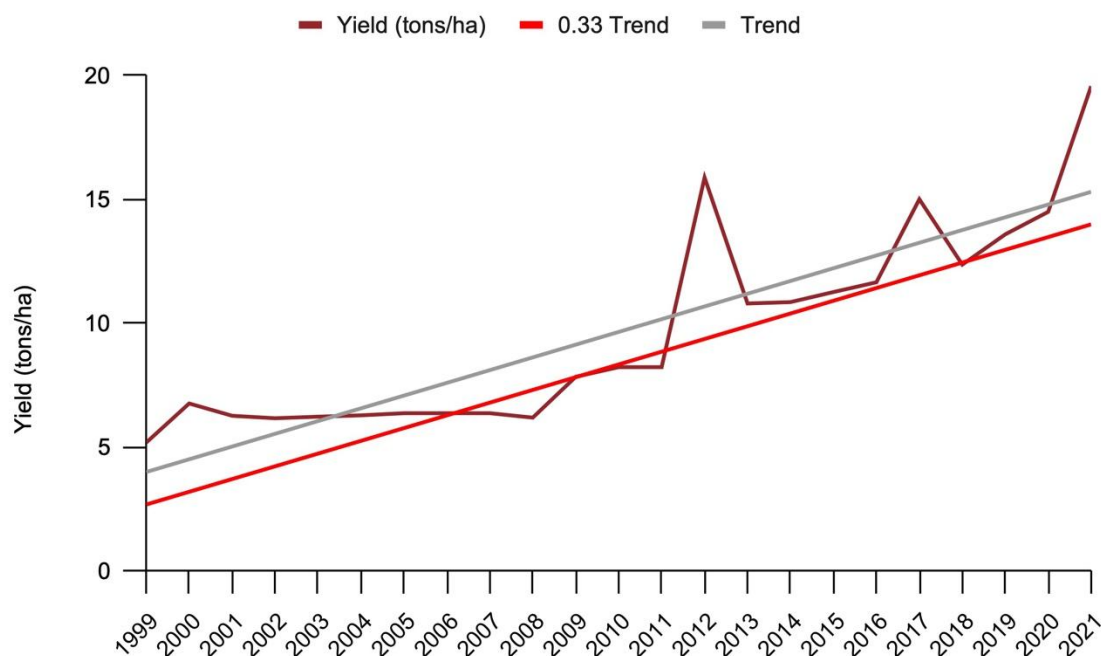
The frequency and severity of losses derived in this manner were also checked against historical records to ensure consistency with actual adverse events. In the case of rice (Figure 4.1), yield losses between 2001–05, 2015–17, and 2019 fall below the loss threshold of what would be considered a normal or an expected loss for the given years. Similarly, for cassava (Figure 4.2) indicative losses due to anomalously low yields occurred in 2007–08, 2010–11, and 2018.

FIGURE 4.1: INDICATIVE LOSSES FROM RISK EVENTS TO RICE PRODUCTION, 1999–2021



Source: Author's calculations; FAOSTAT 2024.

FIGURE 4.2: INDICATIVE LOSSES FROM RISK EVENTS TO CASSAVA PRODUCTION, 1999–2021



Source: Author's calculations; FAOSTAT 2024.

INDICATIVE VALUE OF LOSSES

Available data on actual losses resulting from adverse events are not always accurate or consistent enough to facilitate comparison and ranking of the costs of adverse events. As a measure to address this, analysis was based on estimates of the “indicative” value of losses, which provide a more effective basis for comparison. Indicative loss values are also compared with the value of agricultural GDP in the relevant year to provide a relative measure of the magnitude of loss. Although these estimates draw on actual data as much as possible, it is emphasized that they represent indicative, not actual losses. This model is only suited to crop losses, not livestock, as it is built on data from past production, yield, and harvested area.

DATA SOURCES

An analysis of this nature requires a consistent set of data on both production and prices for an extended time period. Of the various sources of data available, FAOSTAT's data series on the value of gross agricultural production and crop production (1999–2021) was considered the most suitable. These data allow the analysis of risk over a 23-year period.

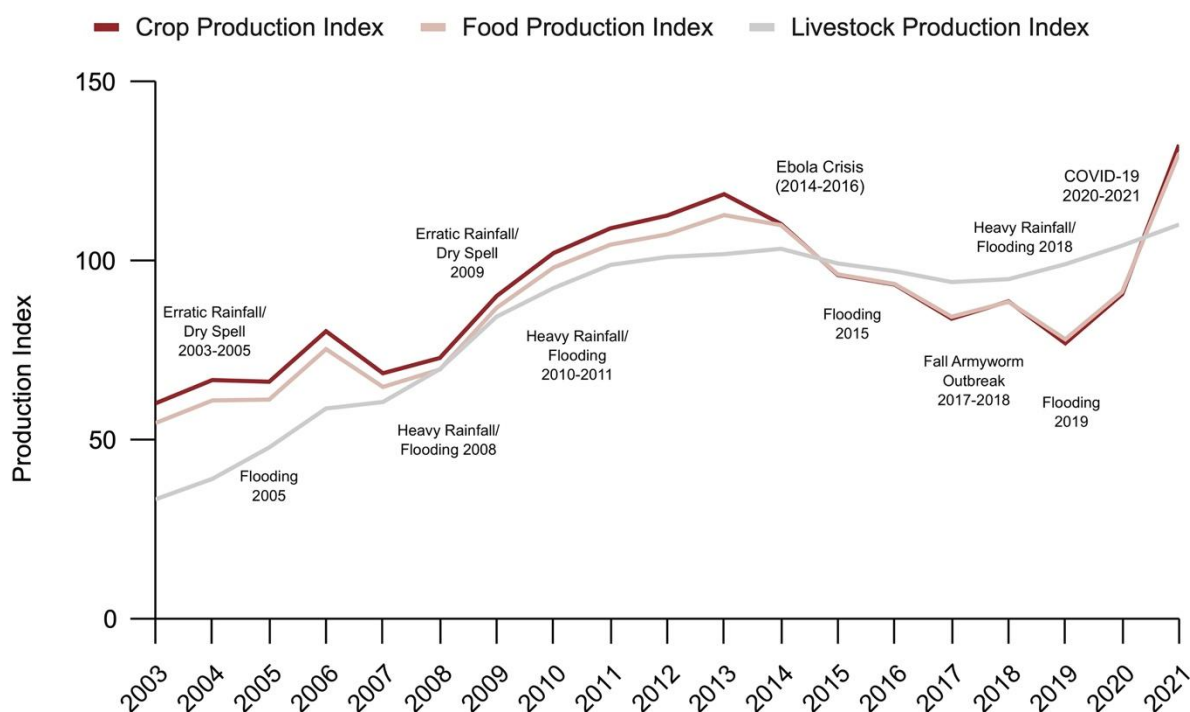
PRODUCTION RISKS

Based on an analysis of available quantitative and qualitative data, the most common risks to agricultural production in Sierra Leone are erratic rainfall, flooding, and pest/disease outbreaks.

During the 23-year period from 1999–2021, Sierra Leone’s agricultural sector was subjected to at least twelve major shocks (see Figure 4.3 and Table 4.1). Flooding emerges as the most common source of production shocks, followed by erratic rainfall leading to in-season dry spells. Although pests and disease are reported as major risks to production, their impact cannot be quantified due to a lack of data. Risk events may occur in isolation, but can also present as multiple, overlapping shocks, as was the case in 2005 with flooding and drought events occurring in the same year, and in 2015 and 2016, with production risks layering on top of the Ebola crisis.

Average annual agricultural losses resulting from unmanaged production risks are estimated at approximately US\$128 million—3.5 percent of GDP. This is based on the indicative values for production losses for the following crops: rice, cassava, groundnuts, maize, sorghum, millet, pulses, sweet potatoes, oil palm fruit, cocoa beans, chilies and peppers, and vegetables. These crops are responsible for about 70 percent of agricultural GDP and therefore representative of sector risks.

FIGURE 4.3: TIMELINE OF MAJOR SHOCKS TO PRODUCTION IN SIERRA LEONE, 2003–21



Source: Author’s calculations; FAOSTAT 2024.

Table 4.1 describes the major adverse events for crop production resulting in losses between 1999 and 2021. The annual frequency rate of these events is 0.52, which on aggregate resulted in a drop in agricultural GDP of 6 percent or more. Sector losses ranging from 15–24 percent occurred in seven of these years. Indicative losses were substantial for these events, as would be

expected, whether measured in value of lost production or as a percentage of agricultural GDP. In total, losses between 1999 and 2021 amounted to US\$2.96 billion.

TABLE 4.1: COST OF ADVERSE EVENTS FOR CROP PRODUCTION, 1999–2021

Year	Description	US\$, millions	Percent (%) agriculture GDP	Percent (%) total GDP
2003	Regional drought, estimated 84,468 MT rice loss	-74.3	-11.6	-2.0
2004	Regional drought, estimated 126,844 MT rice loss	-119.3	-17.0	-3.2
2005	Regional drought and flooding, estimated 89,063 MT rice loss	-93.8	-11.5	-2.5
2007	No identified event* estimated 517,034 MT cassava loss	-213.6	-19.0	-5.7
2008	Heavy rainfall/flooding, estimated 781,001 MT cassava loss	-324.3	-24.5	-8.7
2010	Heavy rainfall/flooding, estimated 561,353 MT cassava loss	-227.3	-16.7	-6.1
2011	Heavy rainfall/flooding, estimated 813,859 MT cassava loss	-313.2	-19.5	-8.4
2015	Flooding in the western area and three districts in the southern province, estimated 102,631 MT rice loss	-158.8	-6.3	-4.3
2016	Pest and disease outbreak,* estimated 383,266 MT rice loss	-426.1	-19.1	-11.4
2017	Pest and disease outbreak,* estimated 413,042 MT rice loss	-390.9	-17.3	-10.5
2018	Regional drought,* estimated 242,170 MT cassava loss	-113.4	-4.7	-3.0
2019	Flooding, estimated 103,171 MT rice loss	-90.7	-3.8	-2.4

Source: Author's calculations; FAOSTAT 2024.

*Causes of losses not verified.

Note: MT = metric tons.

Almost 80 percent of the value of annual losses are attributed to rice and cassava losses, accruing average annual losses of US\$54 million and US\$43 million per loss year, respectively. Rice losses are correlated with both flooding and dry spell events, while cassava losses are generally associated with flooding events based on the weather event data available from FAO's

Agriculture Stress Index and the World Food Programme.¹⁵ In 2004, for instance, three of the four regions in Sierra Leone were under agricultural stress from extreme drought. This correlates with the estimated 126,844 metric tons of rice losses incurred that year. Similarly, in 2010 there was an average excess rainfall in all 9 dekads (~10-day consecutive periods within a year, 3 per month) from May to July ranging from 12–43 percent above normal rainfall according to WFP data (see Appendix C.2). This event correlates with the 561,353 metric tons of cassava losses in 2010.

BOX 4.1: RICE YIELD LOSSES

As an example, looking at rice losses can better show how specific risk types have affected a crop over time and help describe the loss methodology at a commodity level.

After the anomalously low yield years (Figure 4.1) were identified (years below -0.33 of the trend), these years were cross referenced with literature, data, and experts to derive what risks can be attributed to having caused these losses.

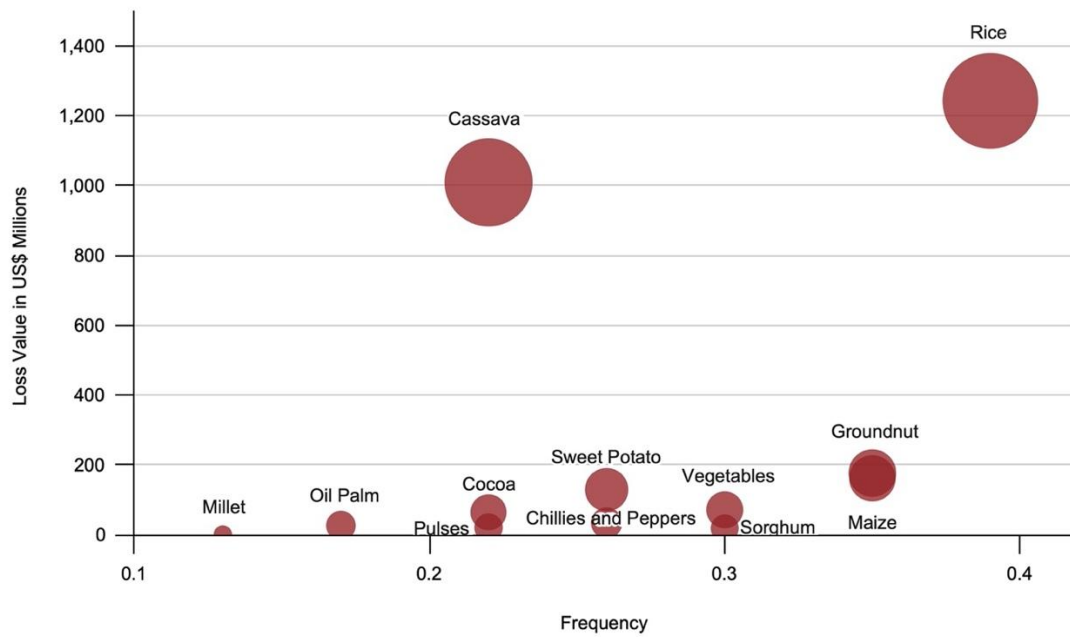
Within the review period, risks associated with production and the enabling environment can be attributed to the noted losses in rice yield. Anomalously low yields between 2001 and 2005 coincide with the aftermath of the civil war, followed by two in-season dry spells (2003 and 2004) and a reported flood in 2005. Pests and disease outbreaks (such as the invasion of the fall armyworm) and the limited amount of communal farming that occurred after Ebola are speculated to have caused the rice losses between 2015–17. Finally, the loss in 2019 can be attributed to significant flooding during the growing season.

As all years had reasonable causal risks identified, the indicative value of the loss was validated and calculated to be US\$1.2 billion for the whole review period. It should be noted that in some instances for other crops, underlying risks could not be identified or did not coincide with loss years, suggesting a lack of data or inaccuracies in the existing data.

Figure 4.4 and Table 4.2 show the indicative costs of adverse events by crop for the period 1999–2021 and their frequency rate by crop. Rice accrued the greatest losses by value in the 23-year time period, accounting for 42 percent of total indicative losses. Rice also incurred losses most frequently, at a rate of 4 loss years within a 10-year period on average. Losses for cassava were also high at 34 percent of total indicative losses, and cassava experienced losses at a rate of 2 losses within a 10-year period. Other staple crops such as groundnut, maize, and sweet potato represented the next largest share of indicative losses, with losses occurring on average 3 in every 10 years. Finally, tree crops such as cocoa and oil palm incurred losses less frequently, on average twice in 10 years, and have relatively low monetary losses to agriculture production given their comparatively lower share in agriculture GDP. The findings underscore the need for implementing agricultural risk mitigation strategies to strengthen national food security.

¹⁵This finding comes from both quantitative and qualitative inputs to the analysis. Data analysis of indicative losses suggested that losses of rice were linked to erratic rainfall or dry periods. However, during stakeholder consultations, sector experts emphasized flood events as the primary cause for rice losses. Given the high level of national expertise present in the country, despite data limitations in the historical record, the report's analysis integrates mixed methodology to inform findings.

FIGURE 4.4: INDICATIVE PRODUCTION LOSSES AND FREQUENCY FOR MAJOR CROPS, 1999–202



Source: Author's calculations; FAOSTAT 2022.

TABLE 4.2: INDICATIVE LOSSES FOR MAJOR CROPS, 1999–2021

Crop	Frequency rate	Production losses (MT)	Value losses (US\$, millions)
Rice	0.39	-1,413,364	-1,242.9
Cassava	0.22	-2,915,417	-1,009.5
Groundnut	0.35	-153,419	-177.2
Maize	0.35	-18,865	- 162.1
Sweet potato	0.26	-327,345	-129.7
Vegetables	0.30	-62,925	-71.9
Cocoa	0.22	-42,647	-65.0
Chilies and peppers	0.26	-4,923	-34.4
Oil palm	0.17	-17,679	-26.8
Pulses	0.22	-18,865	-21.3
Sorghum	0.30	-21,014	-19.2
Millet	0.13	-1,176	-0.96
Total		-4,997,637	-2,961.1

Source: FAOSTAT 2024.

Note: Prices are averaged producer prices in 2022. MT = metric tons.

IMPACTS OF PRODUCTION RISKS

The attribution of yield loss to specific shocks is inevitably an approximation, but is nevertheless useful to compare the losses experienced during different years and thereby to determine the relative impact of different risk events. Table 4.3 indicates the years when specific shocks occurred and their frequency over the period 1999–2021.

TABLE 4.3: DATES AND FREQUENCIES OF AGRICULTURAL RISK EVENTS

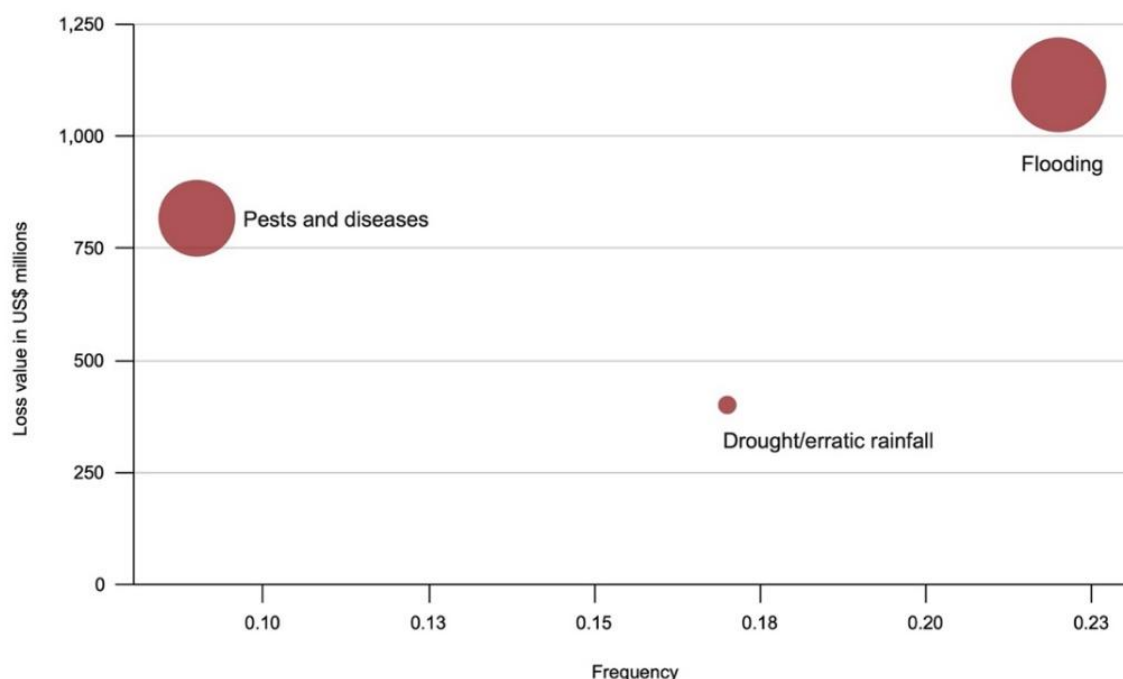
Risk event	Year(s)	Frequency in 23 years
Flooding	2008, 2010, 2011, 2015, 2019	0.22
Drought/erratic rainfall	2003, 2004, 2005, 2018	0.17
Pests/disease	2016, 2017	0.09

Note: 2007 is missing from the dates and frequencies because a risk event was not identified.

The frequencies calculated in Table 4.3 can be combined with the value of production losses associated with the main risks to crop production. The frequency of each risk is based on its occurrence during 1999–2021. The associated loss is an estimate of the indicative costs for each type of risk during the analysis period. Figure 4.5 shows flooding as the major source of risk in terms of value of losses and frequency of occurrence. However, as mentioned this analysis is an estimate. The attribution of losses to specific risks is based on a small amount of available,

national data. More comprehensive data, particularly on the impact of pest and disease outbreaks, would be needed to more reliably assess the correlations between adverse events and production losses.

FIGURE 4.5: FREQUENCY AND CUMULATIVE IMPACT OF VARIOUS ADVERSE RISK EVENTS, 1999–2021



Source: Author's calculations; FAOSTAT 2022.

SUMMARY OF IMPACTS

There is insufficient data available to separate the different impacts of specific risk events/shocks with a high degree of accuracy or to develop an accurate assessment of actual losses incurred because of these events at a local level. Nevertheless, it is possible to draw some broad conclusions from this analysis, namely:

- Adverse impacts on Sierra Leone's agricultural production from risk events are equivalent to at least 3.5 percent of agricultural GDP on average.
- Agriculture in Sierra Leone is vulnerable to losses exceeding 15 percent of agricultural gross production value in one out of every three years on average due to unmanaged risks. A risk producing a loss of 15 percent would be considered "considerable" under the methodology followed in this report.
- Rice, followed by cassava, were the two crops most vulnerable to production risks in relation to total losses (Figure 4.4). Rice losses also occurred more frequently (0.39) and with larger losses.
- The most significant cause of loss is flooding, which accounts for roughly 45 percent of crop yield reductions, particularly for cassava. Drought and erratic rainfall account for 36

percent of crop yield reductions, particularly for rice. Experts suggested in interviews that flooding is an even greater risk to rice than erratic rainfall, in contrast to what was found through the quantitative analysis.

- For livestock, discussions and reports related to historical losses suggest that disease is the main adverse event. According to findings from available literature and expert discussions, *peste des petite ruminants* and Newcastle disease are the most consequential diseases.

CHAPTER FIVE

VULNERABILITY ANALYSIS

This chapter will cover general trends in vulnerability and discuss the impacts of the risks described in Chapter 3 on several of the sector's stakeholder groups, such as producers, processors, traders, and consumers, among others. Identifying vulnerable groups most susceptible to these risks is an important part of assessing risk, as it allows for the development of targeted and effective risk management strategies.

DEFINING VULNERABILITY

In this assessment, vulnerability is defined as the capacity of stakeholders to manage agricultural risk and recover from external shocks. The measure of vulnerability and the method of differentiating vulnerability among groups depends on three factors: sensitivity, adaptive capacity, and exposure (Choudhary et al. 2016). Sensitivity is the “degree of impact of the initial shock.” This could be the loss of assets from an extreme event or how a household's food consumption changes after it is impacted by the risk. Adaptive capacity is the ability to cope with the impact and return to preimpact welfare levels. Access to financing is one example of the presence of adaptive capacity among stakeholders. Finally, exposure is the likelihood of the shock materializing and affecting the group's welfare and assets. In this assessment, likelihood is estimated based on the risk's frequency of occurrence in the last 20 years.

GENERAL TRENDS IN VULNERABILITY

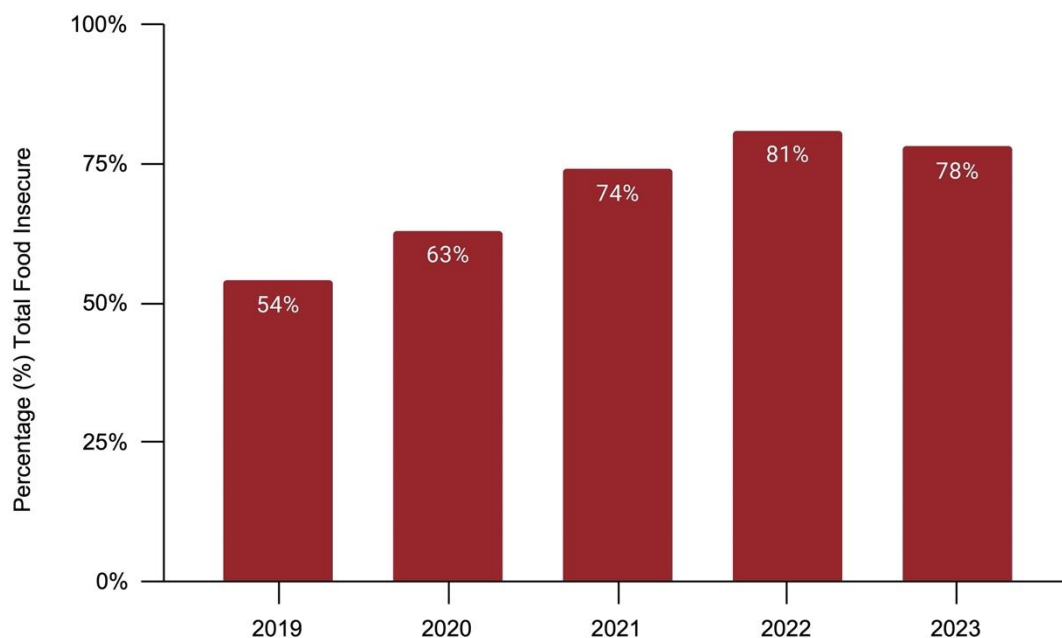
The connection between agricultural risk and vulnerability in Sierra Leone is pronounced, as a significant portion of the population is highly susceptible to risks affecting both supply and demand. Approximately two-thirds of Sierra Leoneans derive their income from agriculture, and household spending on food constitutes, on average, 63 percent of their expenditures (WFP 2021). Major fluctuations in the production and prices of agricultural goods due to agriculture risks therefore impact the livelihood of most Sierra Leoneans.

Producers are a heterogeneous group whose vulnerability can be differentiated according to their level of production, access to markets, or type of commodity grown. Other vulnerable groups can include producer and consumer groups, but are described distinctly because of the unique exposure, sensitivity, or adaptive capacity they may have in comparison to the larger stakeholder group as a whole. This includes traders, processors, exporters, women, and groups operating within specific districts.

FOOD SECURITY

In 2023, 78 percent of the country's population was estimated to be moderately to severely food insecure.¹⁶ Food insecurity throughout the country has risen sharply in the last five years, as seen in Figure 5.1.

FIGURE 5.1: RISING NATIONAL FOOD INSECURITY IN SIERRA LEONE, 2019–23

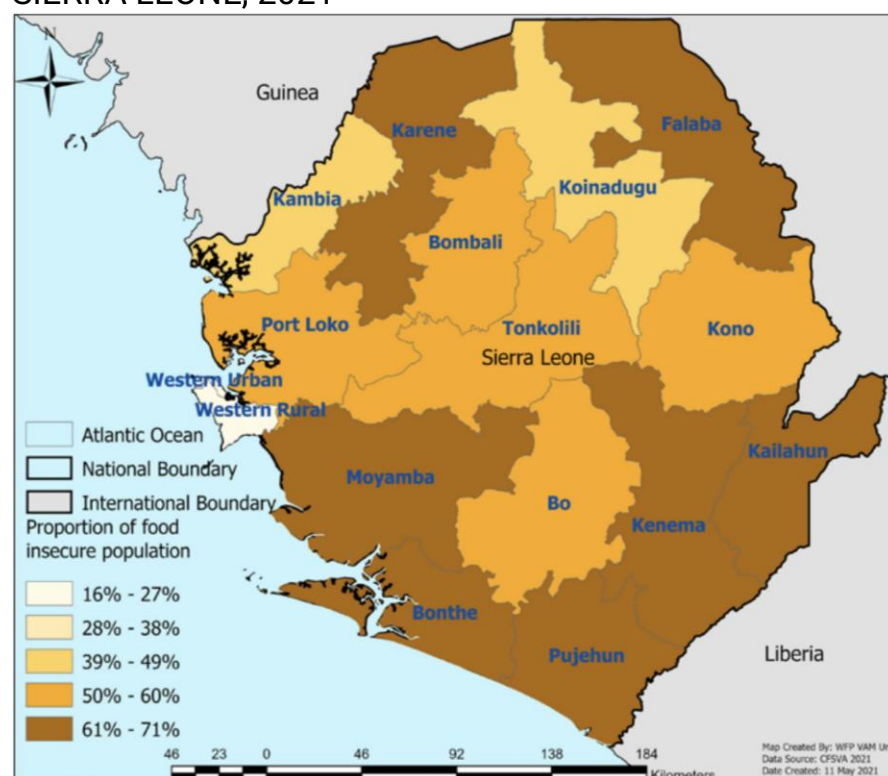


Source: WFP 2023.

Food insecurity is distributed throughout the country, with the northern and southern areas experiencing the highest proportions (Figure 5.2). The group predominantly affected by food insecurity are those whose livelihood is made directly from agriculture. 60 percent of Sierra Leoneans involved in the sector are food insecure (WFP 2021). These statistics highlight the fact that the interconnectedness of food security, poverty, and the risks associated with the agriculture sector and existing challenges in the sector contribute to reinforcing livelihood traps.

¹⁶ In this analysis, the scale from the Integrated Food Security Phase Classification is used. The Chronic Food Insecurity Scale classifies food insecurity that persists over time mainly due to structural causes, including intra-annual seasonal food insecurity. It can be used to identify priority response objectives based on level classification. There are four levels on the scale: Level 1 – None (household classification) / Minimal (area classification); Level 2 – Mild; Level 3 – Moderate; and Level 4 – Severe.

FIGURE 5.2: DISTRIBUTION OF FOOD INSECURE POPULATION BY DISTRICT IN SIERRA LEONE, 2021

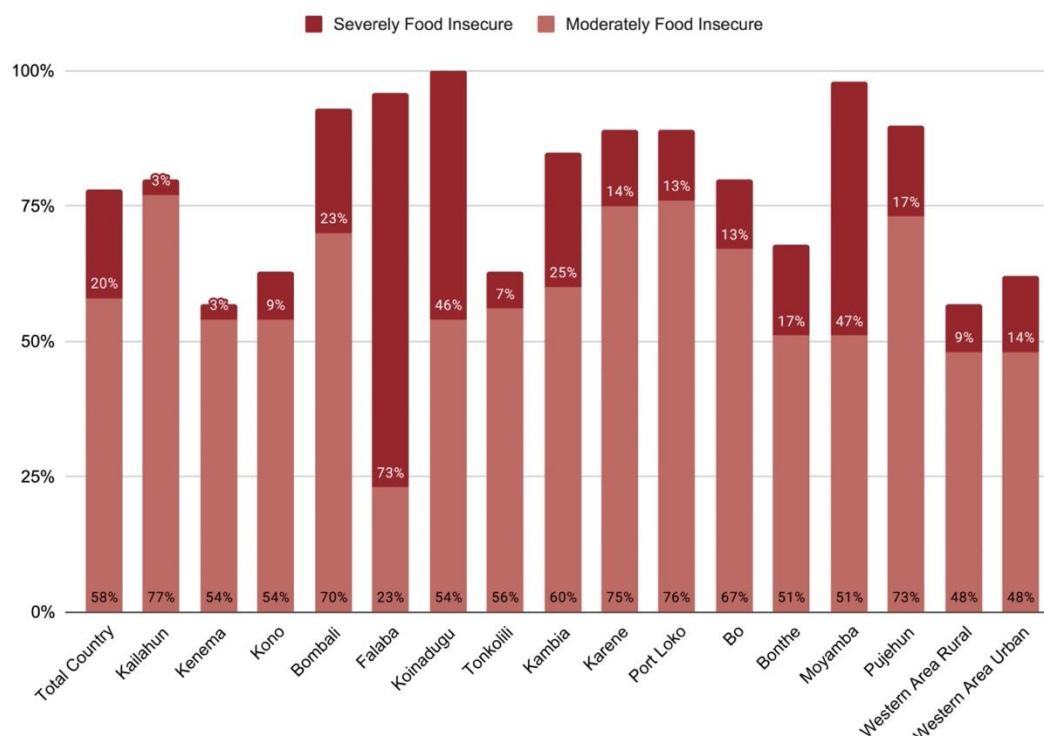


Source: WFP 2021

Overall, 95 percent of households in Sierra Leone spend more than 50 percent of their earnings on food (WFP 2023). Limited income, rising inflation, and higher food prices all produce conditions whereby a substantial portion of earnings is being used to meet basic needs such as food. A 2021 WFP study of 33,760 households found that the most common coping strategy for food price or production strains was to reduce spending on nonfood items (42 percent of the households surveyed), which implies a deprioritization of other important household needs such as savings, education, and health expenses.

Although widespread in Sierra Leone, in some districts such as Koinadugu, Falaba, Moyamba, Bombali, and Pujehun, almost all households are food insecure (Figure 5.3). This corresponds with district poverty levels and districts with the highest total household expenditure going to food (WFP 2023; UNDP 2023).

FIGURE 5.3: PROPORTION OF FOOD INSECURE POPULATION BY DISTRICT IN SIERRA LEONE, 2023



Source: WFP 2023.

GENDER

The demographics of household heads in the agriculture sector has shifted greatly since the end of the civil war. According to the National Agriculture Census (2015), the most recent count suggests that almost 85 percent of households engaged in agriculture are currently headed by men. This has changed significantly since the 2004 census, which reported only 52 percent of households headed by men as a result of the war, where women took up responsibilities on the farm. Despite this transition, women still dominate the sector, making up 70 percent of the agriculture workforce. Like most rural women in Sub-Saharan Africa, women in Sierra Leone are poorly compensated relative to men.

Women in Sierra Leone, particularly those in rural areas, continue to have limited access to resources. The most significant barrier has been limited access to land. Until the Customary Land Act and the Land Commission Act in 2022, women were unable to own or inherit land (Yengoh and Armah 2015; Turay et al. 2023). Although the law has been recently enacted, there has yet to be much progress in women land ownership due to prevailing customs and social dynamics. As a result, women are often only able to gain access to lands that have lower agricultural productivity. Women also have fewer opportunities to access credit facilities, extension services,

and value-added technologies to optimize production (Yengoh and Armah 2015). Without access to these assets, women have limited income options and a limited capacity to manage risk.

LIVELIHOOD RISK PROFILES

Managing risk among stakeholders is vital because agriculture is the main economic and social activity for these groups, thereby directly determining their access to food and nutrition (Yengoh and Armah 2015). The groups identified below are particularly vulnerable to agriculture shocks:

PRODUCERS

Small-scale subsistence farming, at approximately 1.63 ha per household represents the majority of Sierra Leone farms (Fielding et al. 2015). As a constraint, small farmers have limited access to resources such as land, capital, and technology, which restricts their ability to adopt modern farming practices and improve productivity. In general, the group is extremely vulnerable to all production risks and most market and enabling environment risks discussed in the report. These risks take the form of reduced incomes or food availability as a result of significant crop or livestock losses or limited profits. This group is vulnerable because of its high level of exposure to these risks and limited capacity (financial or otherwise) to manage these risks.

BUYING AGENTS

Buying agents, or market aggregators, in Sierra Leone act as intermediaries between farmers and buyers, connecting agricultural goods produced in the country to domestic and international markets. Within the sector, they face significant challenges related to agriculture risks, particularly concerning the reliability of farmers in fulfilling contractual agreements for sale. In some cases, buying agents offer farmers loans at the beginning of the growing season as a way to secure production outputs. If farmers incur production losses due to unforeseen events, they may be unable or unwilling to sell the agreed amount to the buying agents. This results in a contractual breach due to insufficient production quantities or side selling, a practice whereby farmers break contractual agreements in pursuit of higher prices. Buying agents are particularly vulnerable to the uncertainty that comes with the farmers' ability to deliver on the agreed-on commodity quantities, exposing them to the financial repercussions of contractual defaults. If this occurs at a large scale due to the presence of a widespread production risk, this can impact the overall stability of the agriculture supply chain for a commodity or the sector.

PROCESSORS

Agricultural processors in Sierra Leone face numerous challenges which expose them to various risks in their operations. Processors are vulnerable to production volatility that can result in low quality or quantity of agriculture goods for processing. Low access to or poor quality of inputs jeopardize the processors' ability to produce high-quality products. Production risks therefore manifest in low profit margins and reduced competitiveness of processors.

The risk of default on loans by farmers adds an additional layer of financial uncertainty, particularly when farmers encounter unforeseen challenges such as adverse weather conditions. Post-harvest losses are also a risk for processors if they, or farmers, delay processing after harvest. Additionally, the absence of cassava processors in the north compounds the overall risk of post-harvest losses, as goods transit to processing facilities in the southern region of the country.

AGRI-DEALERS

Agri-dealers in Sierra Leone often assume the risk related to variable but generally high costs to import agri-inputs into Sierra Leone in the form of import tariffs. They must operate on longer time horizons for their investments to become profitable, particularly in a country where inputs such as fertilizer and machinery are not utilized by most small farmers. Like most businesses in the sector, agri-dealers do not have access to credit or financing. The demand for inputs is also influenced by production risks, as crop yields inform farmers' willingness to purchase seeds, fertilizer, and pesticides.

TRADERS/EXPORTERS

Influenced by global market trends and local supply and demand dynamics, fluctuations in commodity prices pose a constant challenge for traders, affecting their overall profitability. Any risks to agricultural production such as extreme weather events or pest or disease outbreaks can affect the availability and quality of exportable goods. On top of these risks, logistic challenges such as poor infrastructure and inadequate transportation networks can disrupt supply chains, leading to delays and increased costs for exporters.

PASTORALISTS

In Sierra Leone, cattle are owned by approximately 5 percent of the population, largely residing in the northern region (Sesay and Kallon 2022). Productivity for cattle is quite low and physical risks such as extreme heat, drought, and disease threaten to lower these production levels even more. Pastoralists are vulnerable because of these environmental conditions. Small ruminants (goats and sheep) and poultry are the predominant livestock owned by smallholder farmers.

FISHERS

Although the report deals with land-based agriculture primarily, a discussion of vulnerability is significant to the fishery sector given that one in four fishing families are severely food insecure, the highest of any group within the sector (WFP 2021). In addition, fish are a primary source of protein in more than 63 percent of Sierra Leoneans' diets (Baio and Sei 2019). Risks to the fishing sector relate largely to fish stock management. This is a consequence of the multiplicity of several risks, including overfishing (which in many cases is illegal), unreported and unregulated fishing, warming waters, limiting habitats, and the increasing presence of foreign vessel ownership. All these factors threaten small-scale fishers by restricting catch potentials, income, and food security.

CHAPTER SIX

RISK PRIORITIZATION AND MANAGEMENT

The previous chapters have highlighted the numerous and complex risks within Sierra Leone's agriculture sector. These manifest with varying levels of frequency and severity, and can cause substantial losses to crops and livestock, with profound short-term and long-term impacts on income and livelihoods.

Putting in place effective risk management measures can help mitigate adverse impacts on agricultural supply chains and the livelihoods they support. In practice, risks are also managed in resource-constrained environments, making it virtually impossible to address all risks at once. Thus, it is necessary to prioritize interventions based on which risks occur most frequently and which cause the greatest financial losses.

RISK PRIORITIZATION

In line with the ASRA methodology, a mixed methods approach consisting of a comprehensive literature review, quantitative data analysis, and stakeholder interviews was employed to identify the priority risks for the sector. Due to the lack of comprehensive data (on crop and livestock pests and disease outbreaks, for example) some risks could not be quantified. Instead, they were assessed qualitatively by stakeholders from government, the private sector, academia, and development partners at the ASRA workshop hosted by the World Bank in Freetown on December 4 and 5, 2023. This prioritization was further validated during a virtual roundtable on March 13, 2024. The risk prioritization matrix, seen in Figure 6.1, provides a basic ranking of agricultural risks, where identified risks located in the darker red areas represent the most significant risks.

Overall, the prioritization identified (1) flooding, (2) erratic rainfall, (3) variability in export crop quality, and (4) crop and livestock pests and diseases as the most important risks to Sierra Leone's agriculture sector.

FIGURE 6.1: RISK PRIORITIZATION FOR SIERRA LEONE

	Moderate (5–15% of losses)	Considerable (15–30% of losses)	Critical (30–50% of losses)	Catastrophic (>50% of losses)
Highly probable (1 in 3 years)	Default risk (Co) Domestic price volatility (R, Cs, Gn, O, L) Pest, Rodents (Co, O) Theft (Cs, Gn, L) Conflict (R, L)	Theft (Co) Pests + disease (Cs, R) Weeds (R) Exchange rate risk (currency depreciation) (O) Disease, Newcastle disease (L)	Flooding (R) Variability of quality during post-harvest processing (O) Adulteration of harvest from chemicals (Co) Disease, PPR (L)	
Probable (1 in 5 years)	Disease (Gn, Cs)	International price volatility (Co, O) Erratic rainfall (R)	Erratic rainfall (R, Gn) Wildfire (R, Cs) Disease, FMD (L)	
Occasional (1 in 10 years)	Wildfire (Co) Flood (Co)			
Remote (1 in 20 years)			Disease, Anthrax (L)	

Source: World Bank 2024 (author's notes from workshop).

Key: Rice (R), Cassava (Cs), Groundnut (Gn), Oil Palm (O), Cocoa (Co), Livestock (L).

Prioritization of risk is based on the probability of the event occurring, the anticipated impacts in terms of financial losses, and a qualitative assessment of the capacity to manage the risk, as described in Table 6.1.

TABLE 6.1: RISK PRIORITIZATION CRITERIA

	Prioritization criteria		
	Frequency of risk occurring	Impact (in terms of financial losses)	Existing capacity to manage risk
Less risk	Remote (1 in 20 years)	Moderate (5–15% of losses)	Not on the matrix, but assessed qualitatively
↓	Occasional (1 in 10 years)	Considerable (15–30% of losses)	
	Probable (1 in 5 years)	Critical (30–50% of losses)	
Greater risk	Highly probable (1 in 3 years)	Catastrophic (<50% of losses)	

Source: Choudhary et al. 2016.

Using inputs from the prioritization and the information coming from stakeholder interviews, quantitative data analysis, and literature review over the course of the assessment, it is possible to list priority risks for each commodity (Table 6.2). Variable weather events such as flooding and erratic rainfall emerged as the greatest risks to the sector, based on the aggregation of risks at the commodity level. The list also shows the prevalence of pests and disease as a crosscutting risk throughout the sector, though to a lesser extent for the export (or tree) crops. Still, the reporting of pests and disease across most food crops and livestock suggests that the losses incurred from pest and disease outbreaks are significant, despite not being quantified in the literature. Cocoa and oil palm were affected to a greater extent by variability of quality caused by contamination of beans and fruit from neighboring countries and mixing with outputs that did not comply with common certifications and standards for the export commodities because the use of chemicals banned in export markets. This risk impacts those in the middle of the value chain, such as aggregators, processors, and traders, who may face difficulties selling the adulterated goods on international markets that enforce quality standards.

TABLE 6.2: LIST OF PRIORITY RISKS BY COMMODITY

Commodity	Risk		
	Priority #1	Priority #2	Priority #3
Rice	Flooding	Pests and diseases	Wildfire
Cassava	Wildfire	Pests and diseases	Erratic rainfall (flooding and drought)
Groundnut	Erratic rainfall	Theft	Disease
Oil palm	Variability in quality from post-harvest processing	Exchange rate risk (currency depreciation)	International price volatility
Cocoa	Adulteration of harvest from chemicals	Theft	International price volatility
Livestock	Pests and disease	Conflict	Theft

Source: World Bank 2024 (author's notes from workshop).

AGRICULTURE RISK MANAGEMENT

No single measure can manage all risks. Effective risk management requires a combination of coordinated measures. Some are designed to remove underlying constraints. Others are designed to directly address a risk or a subset of risks. Risk management measures can be classified into the following three categories:

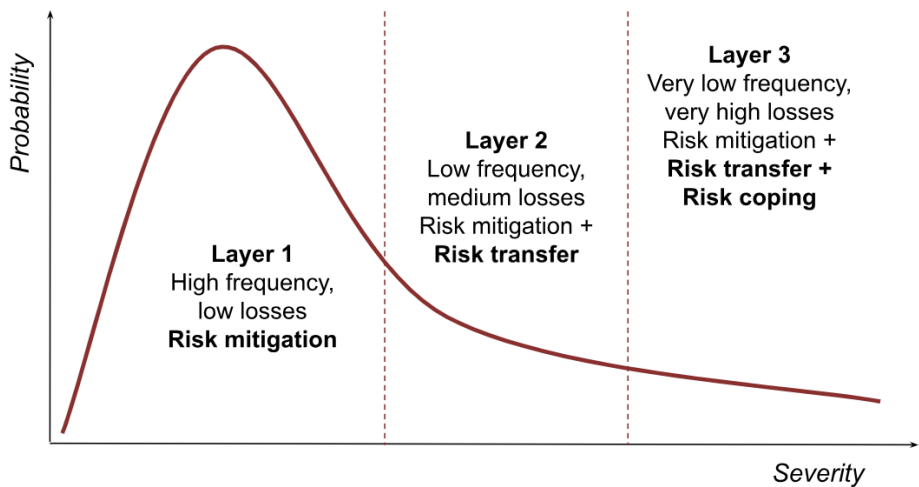
1. **Risk mitigation (ex ante):** Actions designed to reduce the likelihood of risk or the severity of losses (for example, water harvesting and irrigation infrastructure, crop diversification, extension).
2. **Risk transfer (ex ante):** Actions that will transfer the risk to a willing third party. These mechanisms typically trigger compensation in the case of a risk-generated loss (for example, purchasing insurance, reinsurance, financial hedging tools).
3. **Risk coping (ex post):** Actions that will help affected populations overcome crises and build their resilience to future shocks. Such interventions usually take the form of compensation (cash or in-kind), social protection programs, and livelihood recovery programs (for example, government assistance to farmers, debt restructuring, contingent risk financing).

Available resources are often a limiting factor, but integrated risk management strategies (Figure 6.2) are often more effective than one-off or stand-alone programs. This approach involves

combining or “layering” risk measures based on the nature of the risk, including its frequency of occurrence and level of impact.

For instance, responding to risk events of high frequency and low impact may be most effective with a risk mitigation approach, whereby resources are invested in systems that lessen the impact or frequency of a recurrent, yet low impact risk. For risks that occur less frequently but result in higher losses, an approach that combines risk mitigation and risk transfer could be more effective. Finally, for risks that result in high losses, a combination of all measures is most appropriate, including strategies that are designed to absorb or cope with the impact of the risk.

FIGURE 6.2: INTEGRATED RISK-LAYERING SOLUTIONS



Source: Choudhary et al. 2016.

Table 6.3 highlights potential interventions that could help address key risks identified in this assessment, classified by the three types of risk management measures, described above. This list was derived from inputs from sector stakeholders and approaches that have good potential to address agriculture risks in Sierra Leone. This list is not exhaustive. Given the nature of each risk, solutions can be directed toward addressing impacts to the entire sector or value chain or certain stakeholder groups. For example, disease generally produced negative outcomes for all interest groups involved in the value chain, while price risk may affect groups within a value chain differently.

TABLE 6.3: PROPOSED RISK MANAGEMENT MECHANISMS

Risk	Mitigation	Transfer	Coping
Flooding	Improve land management practices. Cultivate rice varieties adapted to flooding	Community risk pooling	Expand social safety nets programs (for example, food-for-work, cash-for-work)
	Strengthen early warning systems and climate information services		Implement decentralized disaster contingent funds for rapid response to local community
	Promote climate-smart agriculture		Use weather index for triggering early warning and response
			Improved access to finance and microfinance
Drought/ Erratic rainfall	Improve land management practices, including irrigation, and other water-saving technologies	Macro-level crop insurance	Expand social safety nets programs (for example, food-for-work, cash-for-work)
	Strengthen early warning systems and climate information services	Farm-level crop and livestock insurance	Use weather index to trigger early warning and response
	Promote climate-smart agriculture		Improved access to finance and microfinance
	Promote diversification toward more drought-tolerant crops		
Pests and diseases (domestic crops)	Develop and disseminate pest- and disease-resistant seed varieties	Yield-based crop insurance	Removal and replanting of infected/infested crops
	Improve and sustain support for early detection and destruction of pests		Fumigate and apply pesticides/fungicides
	Expand access to pesticides/fungicides		Expand social safety nets programs (for example, food-for-work, cash-for-work)
	Conduct awareness-raising and training on the use of organic/locally available pesticides (for example, neem leaves) as well as synthetic pesticides		
	Intensify and strengthen pest and disease surveillance		

Pests and diseases (export crops)	Expand access to pest-/disease-resistant crop varieties	Yield-based crop insurance	Remove infected/infested crops
	Rehabilitate old farms		
	Improve extension for early detection and destruction of pests		Fumigate and apply pesticides/fungicides
	Expand access to pesticides/fungicides		Expand social safety nets programs (for example, food-for-work, cash-for-work)
Pests and diseases (livestock)	Increase vaccination campaigns	Livestock insurance	Conduct strategic livestock vaccination in response to outbreaks
	Intensify and strengthen disease surveillance		Strengthen quarantine measures/mechanisms
	Apply/enforce pest and disease screening at international borders		
	Establish private, quality, comprehensive animal health care facilities		
Price volatility (crops and livestock)	Improve producers' access to market information	Commodity hedging	Expand use of emergency food reserves
	Raise the levels of strategic food reserves to stabilize rice prices	Utilize and enforce producer sales contracts	
	Develop and expand livestock markets		
Variability in quality (export crops)	Promote quality standards		Expand social safety nets programs (for example, food-for-work, cash-for-work)
	Expand access to improved seeds		
	Rehabilitate old plantations		
	Enforce trade/border policy		
	Diversify and expand to other export markets		

Source: World Bank 2024 (author's notes from workshop).

RISK MANAGEMENT SOLUTIONS

The following section discusses a non-exhaustive list of broad intervention areas, many of which are interlinked, which the government and other sector leaders could consider in responding to risks prioritized by this assessment.

STRENGTHENING EARLY WARNING SYSTEMS AND CLIMATE INFORMATION SERVICES

Some of the most critical risks to Sierra Leone's agriculture sector highlighted in this assessment are a direct result of or affected by extreme weather events. These events are expected to worsen with climate change. Early warning systems and climate information services integrate weather, climate, water, and pest- and disease-related information into agricultural risk management. By providing farmers with timely and actionable information, these services can enable them to quickly respond to short-term weather shocks and better prepare for the upcoming farming season, as well as adapt to climate change in the long term. In parallel to the evolution in available weather and climate data (in terms of nowcasts, seasonal to subseasonal forecasts, and climate projections), agromet services are tapping into the widespread growth of information and communication technologies (ICTs) to provide more timely and low-cost information services to farmers.

In 2008 the government of Sierra Leone declared its intent to develop a national early warning system as part of its [National Adaptation Programme of Action](#). Headed by the Sierra Leone Meteorological Department, the infrastructure and climate change data management systems put in place aim to monitor and disseminate timely information on forecasted weather events likely to affect the population (2008 National Adaptation Programme of Action). This system has been updated with projects led by the FAO and UNDP, including the development of the Food Security and Nutrition National Early Warning System at a national and district level. Other early warning system advancements include the Climate Information, Disaster Management, and Early Warning System-Sierra Leone web mapping application tool, community-based early warning systems, and the Hazard and Risk Profile Information System – Sierra Leone.

Under the first component of the ongoing FSRP, Sierra Leone aims to strengthen the production and delivery of early warning systems and weather and climate information, including by investing in modernized equipment such as automatic weather stations and technical capacity building through AGRHYMET, a specialized agency of the Permanent Interstate Committee for Drought Control in the Sahel that provides expertise, technical assistance, and training in areas such as agrometeorology, hydrology, and food security. The FSRP will enable the Sierra Leone Meteorological Department to improve the collection of meteorological data, enhance forecasting models, and strengthen its capacity to alert and inform farmers and relevant stakeholders about potential agricultural risks and climate-related challenges, thereby enabling more effective risk management strategies and preparedness measures in the agricultural sector.

Despite these advancements in recent years, enhancements are still needed for early warning systems and delivery in Sierra Leone given the significant impacts still incurred during extreme weather events. Continued investments to improve forecast accuracy, and better tailored early warning alerts and forecasts to community needs are thus needed to realize the potential of climate information and early warning systems tools as a key risk mitigation instrument.

IMPLEMENTING SUSTAINABLE WATER MANAGEMENT

Sustainable water management ensures that farmers use water in a way that meets both current and future socioeconomic and ecological demand. In Sierra Leone, the majority of farmers rely on rainfall during the cropping periods. As a result, they are exposed to climate variability and extreme events, which impact productivity, incomes, and food security and compromise price stability. In this regard, sustainable water management provides an effective risk management solution in agriculture as it supports the adoption of improved water use solutions, including appropriate irrigation techniques. Also, sustainable water management combined with improved soil and crop management practices, water pricing, reuse of treated wastewater, farmers' participation in water management, and capacity building are vital risk management solutions in agriculture (Chartzoulakis and Bertaki 2015).

Therefore, considering the diversity of agro-ecologies across in the country, agricultural water management practices will have to respond to varying opportunities and constraints involving different target groups and strategies. Specifically, in rain-fed farming systems, improved water control and watershed management options, such as water harvesting, conservation approaches and climate-smart agriculture practices should be promoted. In the case of high-valued crops, farmer-led (private) irrigation development should be promoted, while conventional irrigation scheme development should be considered especially where the economic and social benefits outweigh economic and environmental costs. In flooded plains, water control measures coupled with the cultivation of rice varieties adapted to flooding should be promoted. The African Union has provided a framework for irrigation development and agricultural water management in Africa (African Union 2020). This framework provides a comprehensive description of the three main pathways and the typical farm-enterprises that fall under each pathway as summarized in Table 6.4.

TABLE 6.4: AGRICULTURAL WATER MANAGEMENT PATHWAYS AND TYPICAL FARM CHARACTERISTICS

Pathway	Description	Typical farm-enterprise characteristics
1. Improved water control and watershed management in a rain-fed environment		
Improved water control and watershed management in rain-fed farming	The potential for growth and wealth creation through rain-fed agriculture is vast. Water harvesting and conservation approaches, and climate-smart agricultural practices are centrally important to actualizing these objectives in a rain-fed environment. This pathway calls for planning and implementation at scales that need a watershed approach. Adoption of soil and water conservation practices to intensify production are key technical success factors.	• Rain-fed smallholder plots and farms with mixed farming purposes. Includes flood-recession farming and shallow aquifer use. • Dominant crops are grains, legumes, and tubers. • Intercropping using tree crops, fodder, and other shade demanding crops is common. • Opportunities for crop-livestock synergies and farm-rangeland integration. Family labor is the main labor source.
2. Farmer-led irrigation development		
Individual (private) irrigation for high-value crops	This group comprises farmers who assume a driving role in improving their water use for agriculture. They are characterized by their independent entrepreneurial nature, private financing, and higher appetite for risk.	• Typically grow high-value crops for urban, peri urban, and in some cases export markets. • Typically irrigate small plots of 0.5–2 ha. • Often, but not only, use pumped systems (small-petrol, diesel, solar pumps).
Small-scale community-managed irrigation	These are small-group schemes and are mainly developed through integrated rural development, natural resources management, community-driven development, or social fund projects.	• High reliance on shallow tube-wells in the case of individual irrigation systems. • Mainly horticultural crops. • Multiple cropping and market-oriented. • Family labor on smaller plots and use of employed/paid labor on larger farms.
3. Reformed and modernized irrigation schemes.		
Irrigation scheme development and modernization	In African countries, most of the public irrigation schemes are older with significant infrastructure rehabilitation needs. Modernization of infrastructure, and the organizational and operational modalities, in addition to new scheme development is needed.	• Irrigation schemes include small, medium-, and large-scale farming enterprises. • Farming is often in transition from the original social project origins to market farming. • Sustainable management, operation and maintenance, dependent on profitable market farming, is a key challenge.

Source: Adopted from African Union (2020).

Farmers located in flood-prone ecosystems could adopt farm management strategies such as adjusting planting time to respond to water fluctuations and the cultivation of flood-tolerant (floating) rice varieties. However, this requires effective farmer-centered early warning systems and the availability of flood-adapted varieties. Other farm management practices involve clearing waterways and drainages, especially in the inland valley swamps.

EXPANDING EXTENSION SERVICES

The delivery of agricultural extension services, whether through in-person demonstrations or ICT, is widely acknowledged as a significant contributor to agricultural development. Ensuring dependable access to extension services for farmers is a crucial component of an effective agricultural risk management strategy in Sierra Leone. This access not only plays a pivotal role in mitigating risks but also generates beneficial outcomes. Embracing advancements such as conservation agriculture and integrated pest and disease management and using seeds resilient to drought and diseases, among other innovations, enables farmers to simultaneously reduce their vulnerability to risks and expenses while boosting their overall productivity.

In 2009, the Ministry of Agriculture created the Department of Agricultural Extension to provide vital support, guidance, and education to farmers across the country. These services were designed to disseminate knowledge, innovative practices, and modern technologies to improve agricultural productivity, enhance food security, and uplift rural livelihoods. Other organizations involved in extension work include research initiatives under the Sierra Leone Agricultural Research Institute, as well as donor-funded projects, nongovernmental organizations, and bilateral donors such as ActionAid, Catholic Relief Services, GIZ, USAID, and World Vision, among others. Additionally, private input suppliers, international research programs, and farmers' associations are also engaged to varying extents within the extension system, collectively delivering extension services to farmers.

The primary approach to delivering extension services in Sierra Leone is the Farmer Field School model, initially introduced by the FAO. As of 2018 (when the last Integrated Household Survey was conducted), only 12.8 percent of households engaged in agriculture were visited by an extension worker in the year prior to the survey (MAFFS 2020). Extension and knowledge transfer, however, is limited by the low number of extension workers in the sector relative to farmers. The ratio of extension staff to farmers is at 1:3,000, 10 times higher than the recommended 1:300 ratio.

One key avenue for increasing the reach and effectiveness of extension services lies in the promotion of ICTs for extension (Xu et al. 2023). Technologies such as radio, mobile phones, internet platforms, and other digital tools can amplify the efforts of extension and advisory service providers in disseminating agricultural information to remote locations in Sierra Leone. Expanding e-extension services also presents an opportunity to scale up the disseminations of climate information services and build farmers' capacity using them.

Digital technologies can greatly facilitate the delivery of near real-time information on weather, market prices, disease and pest outbreaks, and the availability of services, allowing farmers to make more informed decisions on what crop to grow, when and how (Abiri et al. 2023). In doing so, ICTs can enable farmers to mitigate production risks and other agricultural risks. The expansion of these services under a centralized framework in the Ministry of Agriculture is currently underway, including through the FSRP.

IMPROVING REGULATORY FRAMEWORKS

Experts in the agriculture sector shared a perception of uncertainty related to regulation and policy implementation designed to address key risks. The exact cause of this uncertainty is not clear, but could be related to past political instability, the rolling back of past policies, or lack of capacity to implement or enforce existing policies. For instance, changes to rice import tariffs can impact prices and domestic production needs. Encouraging increased involvement of stakeholders in reviewing and updating legislation and regulations impacting the agricultural sector could alleviate this uncertainty. More policy and regulatory assistance can be provided for the growth of producer and marketing associations. This broader involvement can foster a stronger partnership between private sector stakeholders and the government, aiming to diminish the perceived policy inconsistencies effectively.

The regulatory environment can be improved by revising policies and regulations and establishing effective market information systems. Any one of these can provide farmers and other stakeholders with better conditions to do business and make decisions to manage the risks they encounter when producing or selling crops and livestock.

A narrower recommendation would be related to promoting wide adoption and monitoring of quality standards for export crops by farmers and processors. This approach can manage risks related to the variability in export quality standards. Supporting the private sector in establishing quality testing sites and stipulating procedures for farmers, commercial processors and traders, and the government can help scale country-wide adoption of quality standards such as organic, free trade, or other sustainable management certifications. This returns higher profits to all stakeholders in the value chain and manages risks related to post-harvest quality and compliance.

In other cases, some risks such as the spread of disease, low crop quality standards, or price volatility come from a limited or variability enforcement of border policies. These risks arise as a symptom of the porosity of the border. Limited enforcement of border policies has, in the past, introduced risks that come from the unregulated movement of commodities across either side of the border. For instance, domestic prices of rice can rise in the event where rice is taken across the border and sold in neighboring Guinea or Liberia. Similarly, lack of screening for crop and livestock diseases or chemical agents on export crops can lead to risk spillover from neighboring countries, leading to production losses or contaminating the domestic harvest.

INCREASING PRIVATE SECTOR INVOLVEMENT

The role of the private sector in Sierra Leone's agriculture sector is still nascent. The NSADP and experts across the sector communicated a need for greater private sector involvement as part of driving growth and managing risks. Private sector involvement can support sector development initiatives currently led by the government. Specifically, the private sector can add value to the sector through increased investment and technology, strengthening farmers' market access and value chains, introducing risk mitigation tools such as insurance, advocating for stronger agriculture policies, and fostering partnerships with government or development partners.

Part of this approach involves creating an enabling environment that attracts private sector investment (NSADP 2009). Historically, key barriers to the private sector's presence in Sierra Leone include limited access to finance, political instability, and limited existing infrastructure such as machinery and road networks. Addressing infrastructural challenges is a key requirement to facilitate private sector involvement, alongside a regulatory framework encouraging investment and innovation. The recently developed "Enhancing Private Sector Participation in Agriculture" scheme, commonly known as the MAF Policy Shift, reflects the urgent need for increased private participation in the sector. The MAF Policy Shift implies a major reduction of direct public spending on agriculture (especially subsidies) alongside an expanded role for the private sector, while stipulating new requirements in policy and program coherence and coordination.

For the private sector to enact impactful risk management solutions, involvement should address existing risks in areas where sector actors have a competitive advantage. Private sector entities often bring in capital and advanced technologies, thus enhancing agricultural production. Private sector driven investments in modern farming techniques, machinery, and infrastructure can improve yields and reduce production risks due to weather or disease. In addition, downstream investments into post-harvest storage and processing facilities for key commodities including rice, cassava, cocoa, and palm oil would help establish better market linkages and enhance overall value chain efficiency, providing farmers with access to markets both domestically and internationally. More efficient value chains would contribute to more consistent demand and fair prices for agricultural produce. This is particularly important given the number of crops vulnerable to domestic or international price volatility in Sierra Leone.

In addition, the private sector has an important role to play in managing risk related to variability quality standards for export crops such as cocoa or palm oil. Investments should be made in technology to research, test, and monitor harvests and ensure crops meet international certification and quality standards.

As seen elsewhere on the continent, private companies can offer risk mitigation tools such as insurance, forward contracts, or crop diversification strategies. These tools can help farmers manage risks associated with price fluctuations, extreme weather events, and other market volatilities.

DEVELOPING INSURANCE MARKETS

In Sierra Leone, the agriculture insurance market is relatively underdeveloped to date, with limited penetration among farmers. The recent launch of 'Salone Access to Finance' in March 2024 marks the first insurance program to be implemented in the country (UNCDF 2024). Since major sector impacts can arise from production risks, risk management financial instruments such as insurance can serve as a useful mechanism to transfer impacts from farmers to third parties. However, private insurance providers often face difficulties in designing and offering affordable and accessible insurance products tailored to the needs of smallholder farmers in many countries in Sub-Saharan Africa, including Sierra Leone.

Collaborations between public entities and private industries in Sierra Leone could create opportunities for the private sector to deliver insurance services to the sector and increase involvement. Examples of these partnerships exist in the region, including insurance services in Tanzania, Rwanda, Zambia, and Nigeria offered by ACRE Africa.¹⁷ Within this framework, agricultural insurance stands as a prime candidate for a public-private partnership as it maintains commercial viability on the private sector side while allowing for necessary government subsidies to bridge access gaps. A well-executed program of this nature holds the potential to significantly enhance the agriculture productivity of smallholder farmers, especially when integrated with other risk management strategies. However, a key challenge lies in extending coverage to small-scale farmers across vast areas without incurring excessive administrative costs. Index-insurance programs offer a solution, offering immediate payouts to farmers following a predefined event such as delayed onset rains or extreme rainfall events. The effectiveness of these programs relies on a detailed understanding of local soil types and climate variations and robust metrics to design triggers for the payout. While advancements in technology may reduce these barriers, feedback from beneficiaries will also be needed to design an effective risk transfer approach in Sierra Leone.

IMPROVING ANIMAL HEALTH AND VETERINARY SERVICES

Enhancing disease surveillance systems, particularly in rural areas, is crucial for early detection and prompt response to outbreaks for livestock. The Ministry of Agriculture's Livestock and Veterinary Division operates an Integrated Animal Disease Surveillance and Reporting System program within the Animal Health Epidemiology Unit. Under this program, 16 priority animal diseases are monitored throughout the country. Monitoring is done through a network of district livestock officers, who rely on community animal health workers to report alerts on disease situations in their communities. Disease surveillance has developed since 2018, but expansion of the surveillance system through training of district livestock officers and community animal health workers is needed to detect all outbreaks.

Strengthening vaccination programs against prevalent diseases and promoting good animal husbandry practices are also essential components of a livestock pest and disease risk

¹⁴For more information, see <https://acreafrica.com>.

management strategy. In the past, in response to major outbreaks of diseases (as in 2010 for Newcastle disease), vaccination campaigns targeting outbreak hotspots were implemented to limit the impact and spread of disease. These exercises are currently limited by available funding but are often effective at managing this risk.

Finally, Sierra Leone now faces a chronic shortage of animal health specialists. Mitigation of disease risks by investing in the training and education of local veterinary professionals and farmers in disease prevention, control measures, and proper animal care at the district level could significantly improve the overall health of livestock populations.

PRIORITIZATION OF RISK MANAGEMENT MEASURES

Most of the measures outlined above are complementary in nature and have potential to contribute to improving agricultural risk management systems in Sierra Leone in the short, medium, and long term. However, decision-makers in often resource-constrained environments are compelled to find the quickest, cheapest, and most effective measures among myriad policy options. Ideally, a detailed, objective, and exhaustive cost-benefit analysis will help in selecting the most appropriate intervention options. Conducting a detailed cost-benefit analysis of a wide variety of options can often be a prohibitively costly and time-consuming process.

The use of decision filters is an alternative approach to evaluate and prioritize among a lengthy list of potential interventions. This can aid decision-makers in making appropriate resource allocation decisions more expediently and more cost-effectively. The following decision filters were developed and used by the World Bank Agriculture Risk Management Team and facilitate a rapid assessment to obtain a first order of approximation, based on its assessment of the situation in the field. Whatever the filtering process and criteria adopted to evaluate decision options, it is important to ensure their clarity and consistency.

Table 6.5 describes the basic filtering criteria the assessment team used to rate each intervention presented in Table 6.3, based on a scale of 1 to 5 (1—No; 2—marginally; 3—somewhat; 4—yes; 5—absolutely).

TABLE 6.5: FILTERING CRITERIA FOR RISK MANAGEMENT SOLUTIONS

Criteria	Description
Applicability to current agricultural policy/programming or business objectives	Public sector: Is the proposed solution in line with current/existing agricultural policy/programs/priorities, and so on? Private sector: Is the proposed solution in line with current/existing business objectives, and so on?
Feasibility of implementation	Is the proposed solution “easy” to implement in the short to medium term?
Affordability of implementation	Is the proposed solution affordable to put into action/implement?
Scalability of implementation	Is the proposed solution easy to scale up/make available to an increased number of beneficiaries?
Sustainability in the long-term	Is the proposed solution sustainable in the long term?

Source: Choudhary et al. 2016.

Sierra Leone has a well-established history of investing in strategies for mitigation and coping with risks. Outlined in the 2021 National Adaptation Plan, the government is aligning initiatives from the Environmental Protection Agency, the Sierra Leone Meteorological Department, the NWRMA, and the NDMA to build capacity to manage production risks, such as flooding, that are likely to escalate with climate change.

The efforts undertaken by the government of Sierra Leone and development partners are actively protecting livelihoods, fostering adaptation, and reinforcing resilience against the effects of natural disasters and climate change. However, as highlighted by this report, agricultural value chains in Sierra Leone remain highly vulnerable to a number of risks that disrupt the country’s economic growth, cripple poverty reduction efforts, and undermine food security. The risk assessment highlights the need for a more targeted and systematic approach to agricultural risk management in Sierra Leone.

Based on the analysis of agricultural risks, the assessment of vulnerability levels among different stakeholders, and a careful filtering of potential risk management strategies, this assessment presents recommendations for the government of Sierra Leone's consideration, derived from discussion with sector stakeholders (Table 6.3). The suggested areas for intervention cover a diverse set of interconnected investments. Collectively, these recommendations (below) offer significant potential to enhance agricultural risk management systems and bolster agricultural resilience in Sierra Leone.

1. Expand and enhance early warning systems and climate information services to ensure availability of timely and relevant climate information as a mode to predict and manage extreme weather events. This strategy can also be applied to improving the dissemination of price data and pest and disease information to farmers, traders, and other

stakeholders, coupled with advice and knowledge disbursement on risk management options.

2. Advance extension delivery systems (for example, face-to-face, farmer-driven, ICT-based) for enhanced farmer access to technology and agronomic advice on improved soil, water, and pest management practices (for example, climate-smart agriculture and integrated pest management). This measure should include: i) decentralized delivery at different levels to facilitate community participation and ii) farmers' capacity building on climate information services.
3. Strengthen the development and distribution systems for improved seed varieties (for example, drought-, pest-, and disease-tolerant crops) to help manage production-related risks.
4. Promote sustainable water management adapted to farming systems. In rain-fed farming systems, improved water control and watershed management options such as water harvesting, conservation approaches, and climate-smart agriculture practices should be promoted. In the case of high-value crops, farmer-led (private) irrigation development should be promoted, while conventional irrigation scheme development should be considered especially where the economic and social benefits outweigh costs and externalities.
5. Encourage greater private sector involvement by facilitating an enabling environment for business and strengthening public-private partnerships. This can lower production risks through the private sector's financial and technological investments in farming and develop stronger market partners in key value chains.

It should be noted that as a next step, a detailed review of ongoing investment programs should be undertaken as part of a solution assessment and gap analysis. Together with the results of this risk assessment, the outputs from these additional analyses will provide the basis for the development of a comprehensive agriculture risk management strategy.

CONCLUSIONS

This assessment evaluates key agricultural risks and their impacts from 2003–23 in Sierra Leone. Overall, Sierra Leone's agriculture sector—a major component of its GDP—is highly vulnerable to production risks, including weather events and pest and disease outbreaks. Climate-related risks pose a particular threat to Sierra Leone's main staple crops (rice, cassava, and groundnut), which combined account for 60 percent of agricultural GDP. Market risks such as price volatility and exchange rate risk also impact the sector significantly, especially for major export crops such as cocoa and palm oil. Other risks such as theft and conflict over land access also affect crop and livestock production.

Analyzing the risks discussed in this assessment and prioritizing these risks can enable the government of Sierra Leone to allocate attention and resources to a select number of key risks

that have the most detrimental effects on production yields, incomes, and overall livelihoods. Additionally, this assessment identifies and prioritizes a range of measures for enhancing agriculture risk management based on risk mitigation, transfer, and coping within Sierra Leone. Based on a risk prioritization process developed in partnership with sector leaders over two participatory workshops, several intervention areas (as detailed above) are recommended for investing in agricultural risk management, including: expanding early warning systems and climate information services; improving the delivery and type of agricultural extension services available in the country; strengthening the distribution and quality of improved seed varieties; promoting sustainable water management and other climate-smart agriculture practices; and leveraging the private sector to reduce market and enabling environment risks, strengthen agricultural value chains, and introduce more financial and technological investments into Sierra Leone's agriculture sector.

Although Sierra Leone's agriculture sector has helped drive economic growth since the end of the civil war in 2002, the sector has potential to bolster food security and drive further growth if agricultural risks could be better managed. Currently, unmanaged production risks in Sierra Leone are estimated to cost the sector approximately US\$128 million, or 3.5 percent of GDP, per year. Furthermore, irrigated agriculture is poorly developed given potential water availability in the country, while only 10 percent of total land area is used for agriculture, despite 72 percent of land being suitable for agriculture. Additionally, some of the most important groups for Sierra Leone's agriculture production and food systems—smallholder farmers, women, and various value chain players—are among the most vulnerable to significant agricultural risks, suggesting opportunities for improved targeting when developing potential risk management solutions.

The findings of this assessment were compiled with the intention to provide a more systematic understanding of Sierra Leone's agricultural risk landscape and inform the government of Sierra Leone and its partners in developing a comprehensive agriculture risk management strategy that includes concrete investments to facilitate continued sector growth, improved livelihoods, and lasting national food security.

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APPENDICES

APPENDIX A: TRADITIONAL CROPPING SYSTEMS IN AGROCLIMATIC REGIONS AND ASSOCIATED CONSTRAINTS

Agroclimatic Region	Ecology	Major crops	Cropping system and pattern	Constraints
Rainforest	Upland	Rice, cassava, sweet potato Cocoa, Coffee, oil palm, Banana, plantain, citrus	Bush fallow, Rice intercropped with cassava, maize etc; cocoa and coffee intercropped	- Declining fertility - weed infestation - Erosion
	Inland valley swamp	Rice	Annual production of rice	- Swamp development - Water control - Soil deficiencies - Iron toxicity
Transitional Rainforest	Upland	Rice, cassava, sweet potato, groundnut, maize, Banana, plantain, citrus, oil palm, mango	Bush fallow, Rice intercropped with cassava, maize etc,	- Declining fertility - weed infestation - Erosion
	Inland valley swamp	Rice, cassava, groundnut, sweet potato, maize	Sole rice during rainy season and cassava, sweet potato, groundnut and maize during dry season	- Swamp development - Water control - Soil deficiencies - Iron toxicity
	Boliland	Rice, Cassava	Rice planted sole annually	- low soil nutrients - high weed infestation
Savannah Woodland	Upland	Rice, cassava, maize, groundnut, fundi, pepper, okra, sweet potato, cashew, citrus, mango	Bush fallow, Rice intercropped with cassava, maize etc	- Declining fertility - weed infestation - Erosion
	Inland valley swamp	Rice, groundnut, sweet potato,	Sole rice during rainy season and cassava, sweet potato, groundnut and maize during dry season	- Swamp development - Water control - Soil deficiencies - Iron toxicity
	Boliland	Rice	Rice planted sole annually	- low soil nutrients - high weed infestation
Coastal plain	Upland	Rice, cassava, sweet potato maize, groundnut, oil palm	Bush fallow, Rice intercropped with cassava, maize etc	- Declining fertility - weed infestation - Erosion
	Inland valley swamp	Rice, maize, sweet potato,	Sole rice during rainy season and cassava, sweet potato, groundnut and maize during dry season	- Swamp development - Water control - Soil deficiencies - Iron toxicity
	Riverain grassland	Rice	Rice planted sole annually	- High water level
	Mangrove swamps	Rice	Rice planted sole annually	- Salinity - crabs

Source: Jalloh 2006.

APPENDIX B: COMMODITY PRODUCTION ZONES

FIGURE B.1: RICE

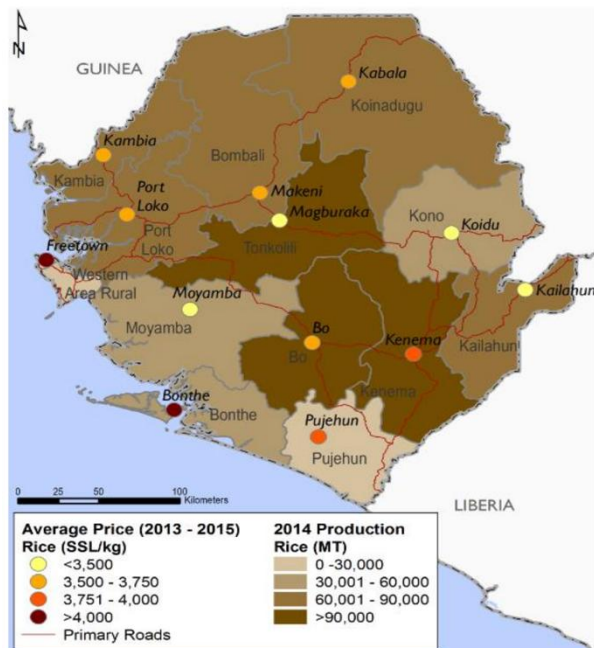


FIGURE B.2: CASSAVA

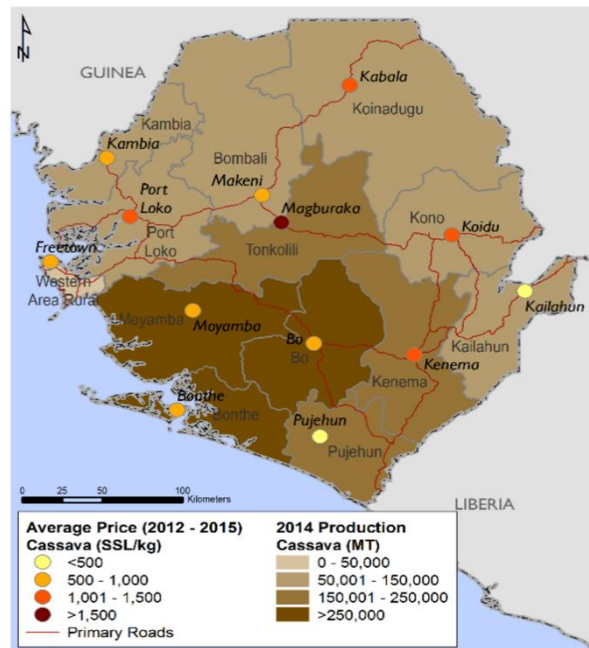


FIGURE B.3: OIL PALM

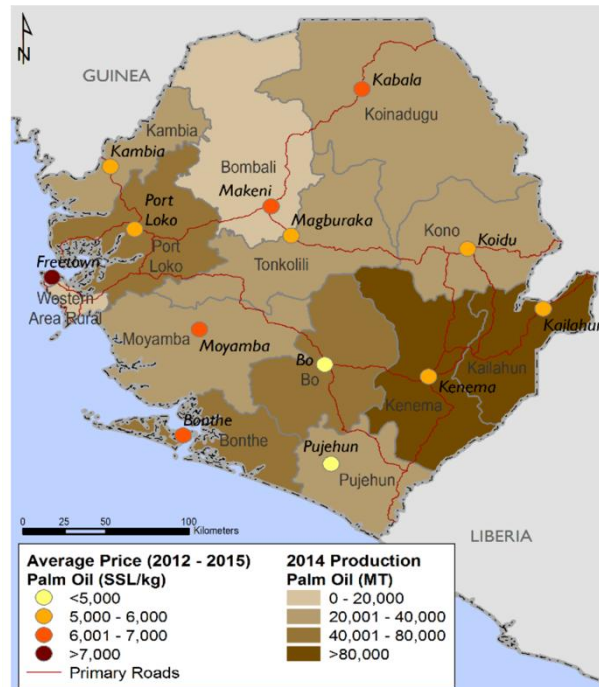
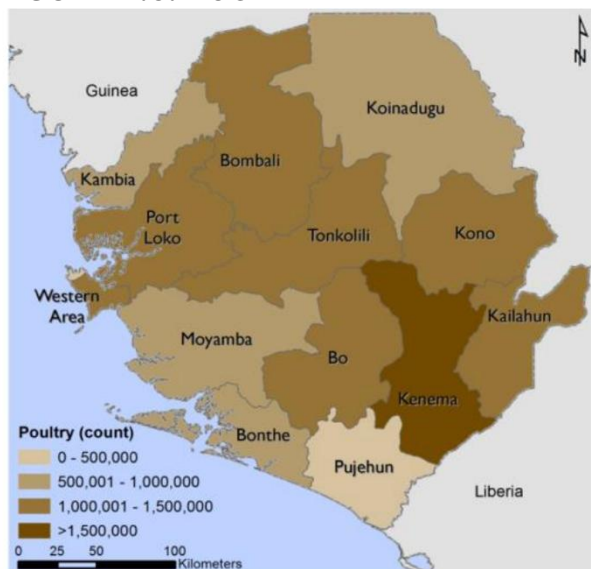
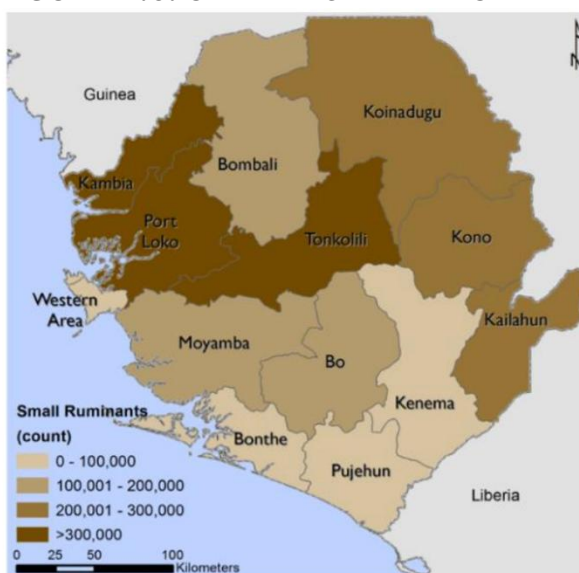


FIGURE B.4: CATTLE



FIGURE B.5: POULTRY**FIGURE B.6: SMALL RUMINANTS**

Source: FEWS NET 2017.

Note: No data available for cocoa and groundnut.

APPENDIX C: FURTHER RAINFALL AND DRY SPELL ANALYSIS

AGRICULTURAL STRESS INDEX DROUGHT AND DRY SPELL ANALYSIS

Below average rainfall in both intensity and distribution can result in droughts. However, because average precipitation is high in Sierra Leone (given that the country is in the equatorial rainforest zone, with a hot and humid tropical climate), the effect of annual variations in rainfall does not seem to translate into significant droughts.

Spatial analysis (Table C.1) shows the percentage of cropland affected by drought according to the Agricultural Stress Index (ASI), as developed by the FAO, as an average for the entire country and for each of the four agricultural zones. At a national level, between 2003–22, mild drought (10 percent of agriculture area affected) occurred four times, moderate drought (10–25 percent of agriculture area) occurred twice, and severe drought (25–50 percent of agriculture area) occurred twice.

According to regional data, the western region was most exposed to the risk of drought, with drought (more than 10 percent of the affected area) occurring 10 in 20 years. However, the western region or Freetown Peninsula covers an area of only 557 km² and comprises the capital city Freetown and its surroundings. The eastern region only experienced impacts of drought on

more than 10 percent of the agriculture area twice, while the northern and southern regions experienced it four times in the last 20 years.

TABLE C.1: NUMBER OF YEARS WHERE AREA WAS IMPACT BY DROUGHT, 2003–22

	All country	Eastern	Northern	Southern	Western
Number of years with affected agricultural area greater than 10%	4	2	4	4	10
Number of years with affected agricultural area between 10% and 25% – moderate	2	2	2	2	7
Number of years with affected agricultural area between 25% and 50% – severe	2	0	2	1	3
Number of years with affected agricultural area greater than 50% – extreme	0	0	0	1	0

Table C.2 shows the specific percentage of cropland area affected by drought in each of the four regions and nationally between 2003 and 2022. The values are relatively low, though two significant years are 2004 and 2009. Severe drought in 2004 saw 35 percent and 26 percent of the northern and southern region impacted. Extreme drought affected 52 percent and 41 percent of cropland in southern and northern regions in 2009.

TABLE C.2: PERCENTAGE OF CROPLAND AREA AFFECTED BY DROUGHT, 2003–22

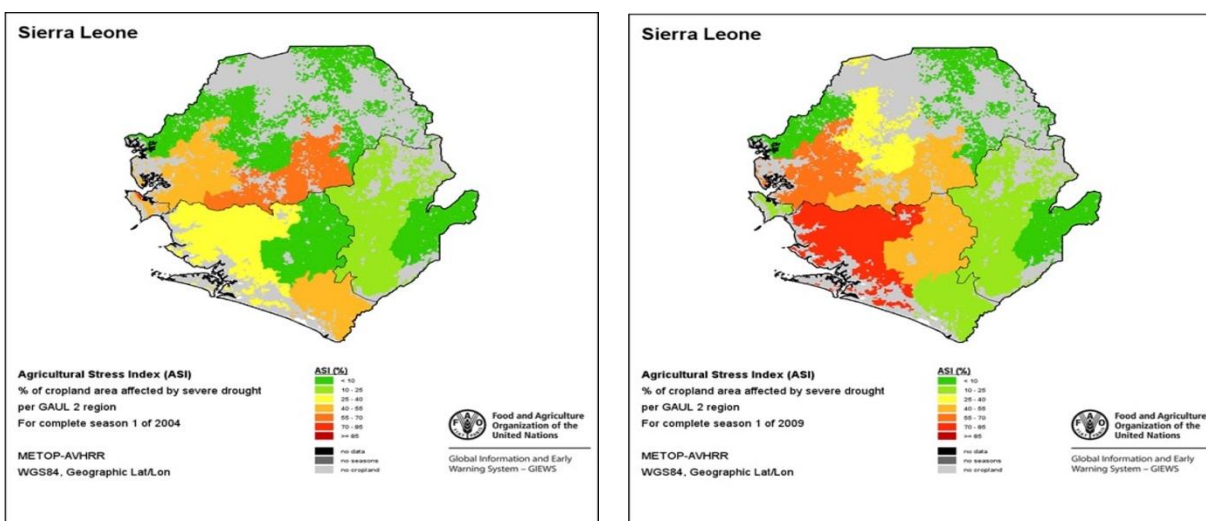
Year	% of cropland area affected by drought (all country)	% of cropland area affected by drought by region			
		Eastern	Northern	Southern	Western
2003	12.25	6.67	16.15	12.08	20.76
2004	26.16	12.58	34.65	26.33	50
2005	0.54	0	0.01	1.12	0
2006	0.08	0.02	0	0.13	3.07
2007	4.29	9.88	5.96	0.79	1.53
2008	0.40	0	0.26	0.66	0
2009	40.91	14.34	41.68	52.41	17.69
2010	0.07	0.1	0.02	0.08	0
2011	0.04	0	0.07	0.03	0.76
2012	1.67	2.92	1.1	1.47	3.07
2013	2.21	0.28	3.46	2.28	0.76
2014	2.56	1.64	2.42	3.04	3.07
2015	4.34	3.48	8.09	2.27	5.38
2016	5.33	0.45	5.86	7.08	10.76
2017	3.29	1.97	4.21	3.26	5.38
2018	13.07	0.41	22.6	12.28	27.69
2019	3.00	1.45	2.54	3.71	23.84
2020	1.35	1.19	0.91	1.43	23.43
2021	0.74	0.39	0.39	0.8	26.92
2022	1.62	0.21	1.66	1.96	21.53

Source: FAO/GIEWS.

Note: Based on the FAO/GIEWS's Annual Agricultural Stress Index (ASI). ASI depicts the percentage of arable land, within an administrative area, that has been affected by drought conditions over the entire cropping season.

The maps below (Figure C.1) offer a graphic view of the areas affected during 2004 and 2009, respectively, in which severe droughts at a national level occurred.

FIGURE C.1: PERCENTAGE OF CROPLAND AREA AFFECTED BY DROUGHT, 2004 and 2009



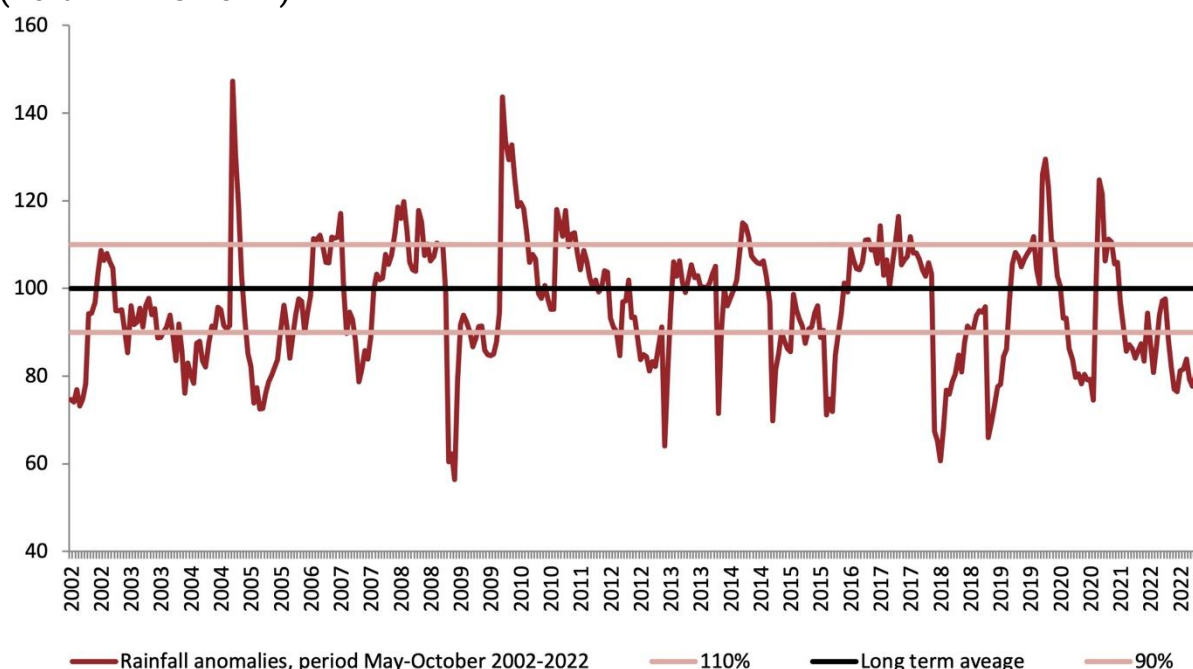
Source: FAO/GIEWS.

FLOOD ANALYSIS

In the last decade, Sierra Leone, and specifically Freetown, has experienced several disasters during the rainy season. Among these events, floods have been the most significant in terms of loss of life, followed by landslides and storms. Unlike spatial tools available for drought assessment, there is no comparable technical instrument available for estimating the flood risk to agriculture in the country.

However, when considering the annual rainfall level (in the three dekad) as a proxy, as shown in Figure C.2, it is observed that approximately 47 percent of the years exhibit levels exceeding 10 percent of the long-term trend, indicating the presence of anomalies in nearly half of the years. This suggests the presence of flooding during these years, of varying intensity in specific regions. Figure C.2 shows the year-to-year variations with respect to long-term rainfall averages between the months of May to October (the rainy season). Values between 90 percent and 110 percent are within the range of normal rainfall variability. Anomalies greater or less than 10 percent of the normal long-term average are very frequent in Sierra Leone. These anomalies suggest a record of droughts (below 90 percent) or floods (above 110 percent) of varying intensity in specific areas/regions in the country.

FIGURE C.2: THREE-MONTH RAINFALL ANOMALY IN SIERRA LEONE, 2003–22 (10% THRESHOLD)



Source: [WFP 2024](#).

APPENDIX D: GOVERNMENT PRIORITIZED ANIMAL DISEASES FOR MONITORING

Excerpt from Konteh et al. 2023:

The district’s weekly livestock disease surveillance reports contain data on the country’s top 18 priority transboundary animal and zoonotic diseases and conditions. These are Peste des petite ruminant, rinderpest, hemorrhagic septicemia, black quarter/blackleg, contagious bovine pleuropneumonia, African swine fever, trypanosomiasis, orf (ecthyma contagiosum), brucellosis, TB, infectious caprine pleuropneumonia, Avian Influenzas, Anthrax, Newcastle disease, rabies, foot and mouth disease, and Rift Valley fever. In addition, data on six country-prioritized zoonotic diseases of national importance are also collected. These are zoonotic influenza, viral hemorrhagic fevers (Ebola and Lassa fever), salmonellosis, plague, anthrax, and rabies.

APPENDIX E: FURTHER ANALYSIS OF RICE PRICE VOLATILITY

The relative variability of price in Sierra Leone can be compared to international prices using the coefficient of variation. Using the coefficient of variation to gauge the distribution of prices, it is observed that the retail price of both domestically produced and imported rice is nearly twice as

high as the international price (as shown in Table E.1 below). This highlights the heightened variability of rice prices in Sierra Leone's retail market compared to the global market. Consequently, local consumers face an increased level of risk due to fluctuations in consumer prices.

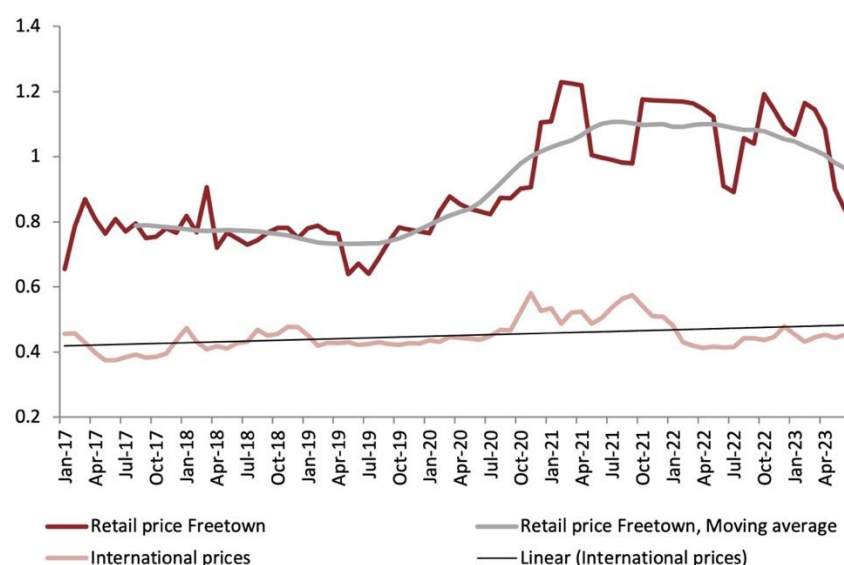
TABLE E.1: COEFFICIENT OF VARIATION FOR RICE, 2016–23

Coefficient of variation	
Rice price, Freetown (US\$/kg)	18.38%
Imported rice price, Freetown (US\$/kg)	20.07%
International prices of rice for export, Bangkok (Thailand) (US\$/kg)	10.27%

Source: [FAO/GIEWS Food Price Monitoring and Analysis 2023](#).

The moving average of domestic retail prices in Figure E.1 shows price volatility disassociated from in-year variation. The seasonality effect, which can be seen in Figure E.2, is a predictable change in price that corresponds with the harvest season. Domestic prices in August (pre-harvest) and December (post-harvest) are the times of maximum and minimal seasonal price within the year. These events are not considered risks, since they occur year after year with some level of certainty.

FIGURE E.1: RETAIL PRICE FOR RICE (US\$/kg), 2017–23

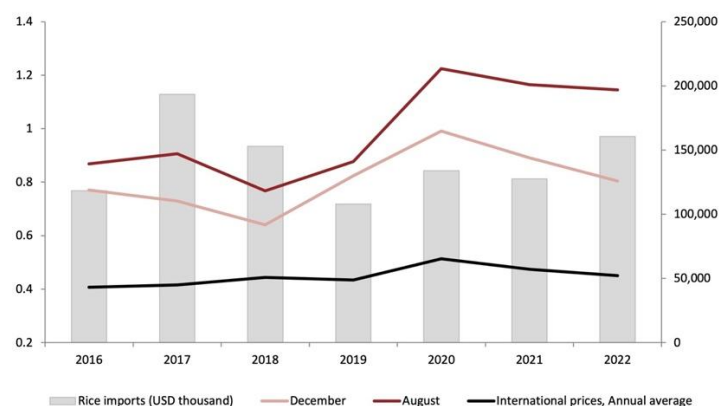


Source: [FAO/GIEWS Food Price Monitoring and Analysis 2023](#).

However, interannual variability can be seen in this data driven by two factors: the behavior of international rice prices and erratic volumes of imported rice supplies. Both factors constitute market and enabling environment risks to Sierra Leone. Figure E.2 shows a significant rise in prices between 2020–22, corresponding with an increase in international rice prices during these years as a result of the COVID-19 pandemic, depreciation of the local currency, and trade limitations.

Alternatively, the effect of erratic supply of imported rice is reflected in the reduction of the domestic price in 2018, most likely transferred to the producer. While domestic rice production remained relatively stable between 2016 and 2018 around 897,000 tons, imports varied strongly from year to year with values of US\$118 million, US\$193 million, and US\$152 million in 2016, 2017, and 2018, respectively. This results in major price fluctuations on the retail market due to changes in total supply.

FIGURE E.2: RETAIL PRICE AND IMPORT QUANTITIES FOR RICE (US\$/kg, MT), 2016–22



Source: [FAO/GIEWS Food Price Monitoring and Analysis 2023](#).

APPENDIX F: DETAILED CROP YIELD LOSS RECORDS

Anything below the loss threshold (0.33 trend line) is considered a production loss due to unmanaged risks.

FIGURE F.1: RICE, 1999–2021

Years	Loss (in MT)	Loss (US\$, millions)
2001	-41,138	-36.2
2002	-69,741	-61.3
2003	-84,468	-74.3
2004	-126,844	-111.5
2005	-89,063	-78.3
2015	-102,631	-90.3
2016	-383,266	-337.1
2017	-413,042	-363.2
2019	-103,171	-90.7

Note: MT = metric tons

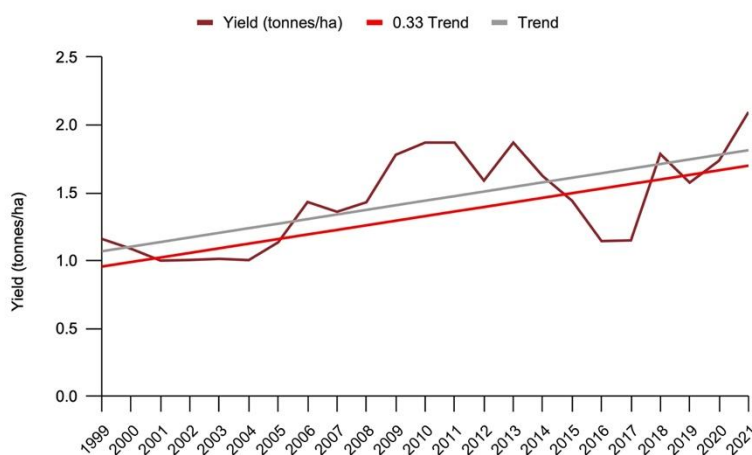


FIGURE F.2: CASSAVA, 1999–2021

Years	Loss (in MT)	Loss (US\$, millions)
2007	-517,034	-179.0
2008	-781,001	-270.4
2010	-561,353	-194.4
2011	-813,859	-281.8
2018	-242,170	-83.9

Note: MT = metric tons

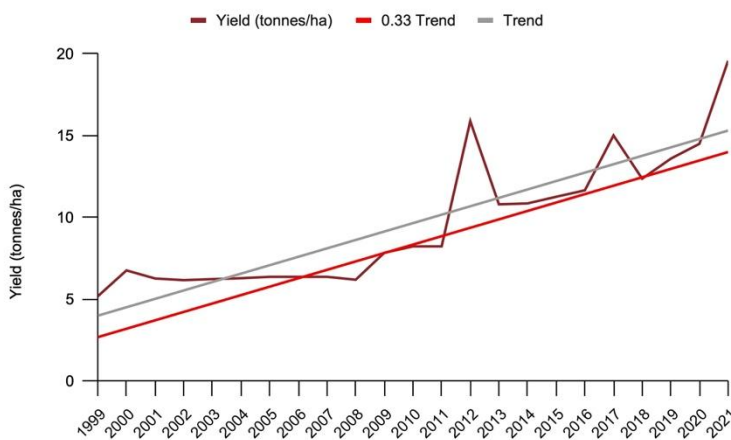


FIGURE F.3: GROUNDNUT, 1999–2021

Years	Loss (in MT)	Loss (US\$, millions)
2008	-13,682	-15.8
2009	-17,231	-19.9
2010	-17,706	-20.4
2011	-21,273	-24.6
2015	-11,448	-13.2
2016	-22,510	-26.0
2017	-24,009	-27.7
2018	-25,558	-29.5

Note: MT = metric tons

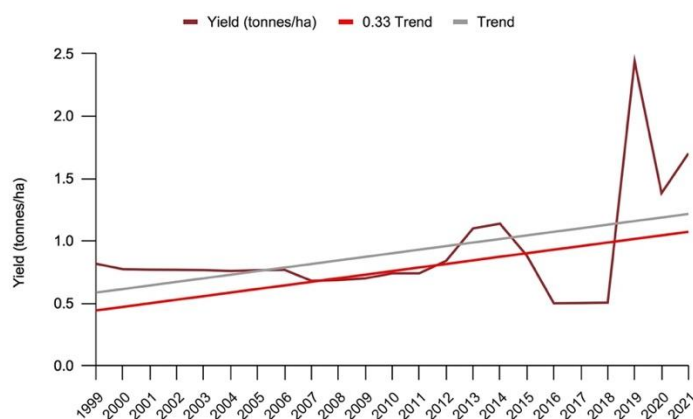


FIGURE F.4: MAIZE, 1999–2021

Years	Loss (in MT)	Loss (US\$, millions)
2006	-17,341	-15.3
2007	-8,918	-7.8
2008	-11,014	-9.7
2009	-12,190	-10.7
2014	-35,224	-31.0
2015	-39,626	-34.9
2016	-53,578	-47.1
2020	-6,388	-5.6

Note: MT = metric tons

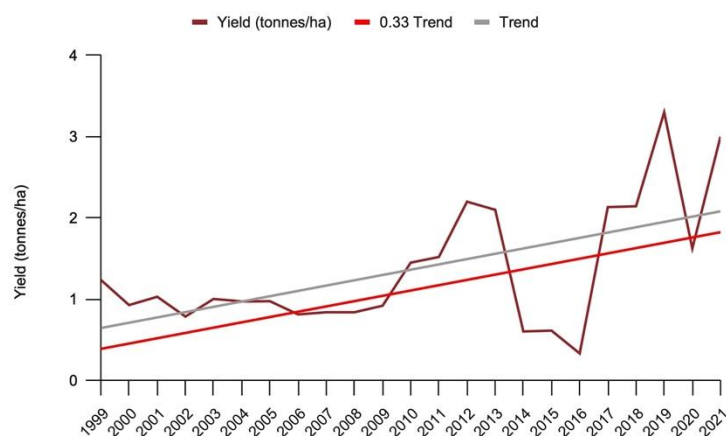


FIGURE F.5: SWEET POTATO, 1999–2021

Years	Loss (in MT)	Loss (US\$, millions)
2007	-22,011	-8.7
2008	-30,920	-12.3
2013	-129,541	-51.3
2014	-52,883	-21.0
2015	-51,771	-20.5
2016	-40,219	-15.9

Note: MT = metric tons

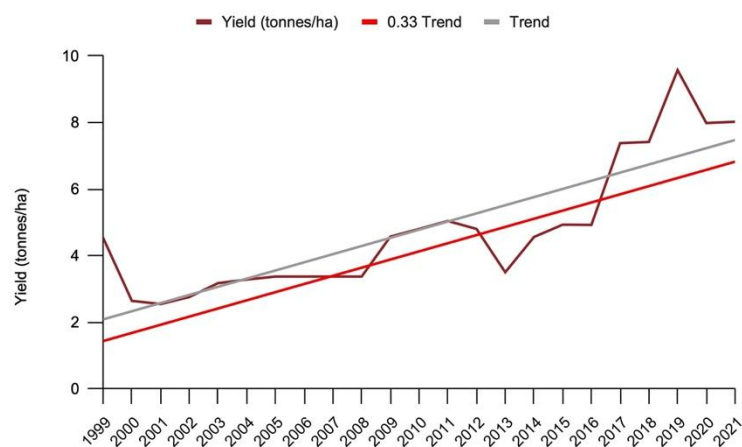


FIGURE F.6: VEGETABLES, 1999–2021

Years	Loss (in MT)	Loss (US\$, millions)
2004	-6,777	-7.7
2005	-10,160	-11.6
2006	-10,433	-11.9
2007	-9,273	-10.6
2008	-7,862	-9.0
2009	-11,557	-13.2
2021	-6,863	-7.8

Note: MT = metric tons

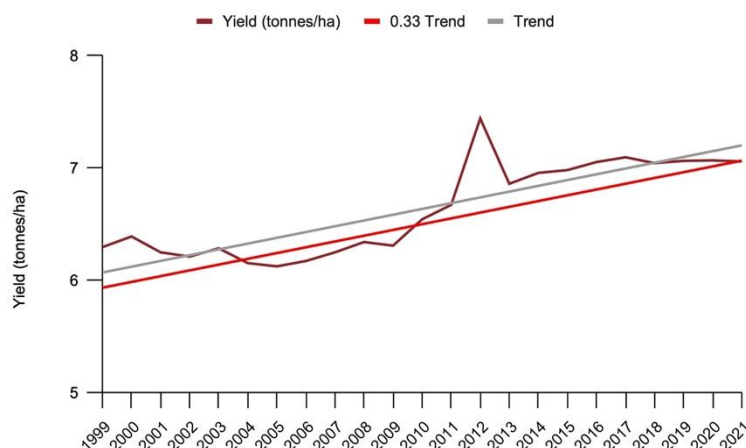


FIGURE F.7: COCOA, 1999–2021

Years	Loss (in MT)	Loss (US\$, millions)
2000	-1,775	-2.7
2001	-2,862	-4.4
2002	-1,055	-1.6
2020	-33,353	-50.8
2021	-3,602	-5.5

Note: MT = metric tons

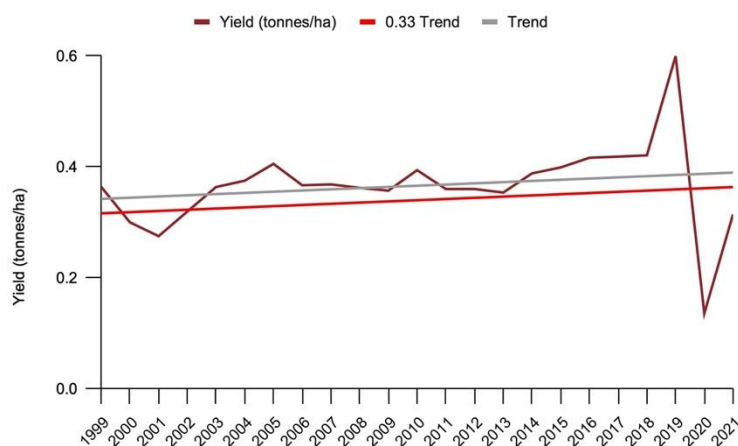


FIGURE F.8: CHILIES AND PEPPERS, 1999–2021

Years	Loss (in MT)	Loss (US\$, millions)
2005	-554	-3.9
2006	-654	-4.6
2007	-876	-6.1
2008	-1,021	-7.1
2009	-1,358	-9.5
2010	-460	-3.2

Note: MT = metric tons

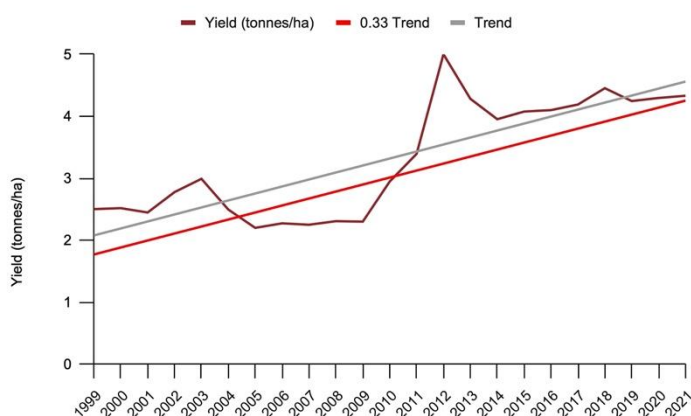
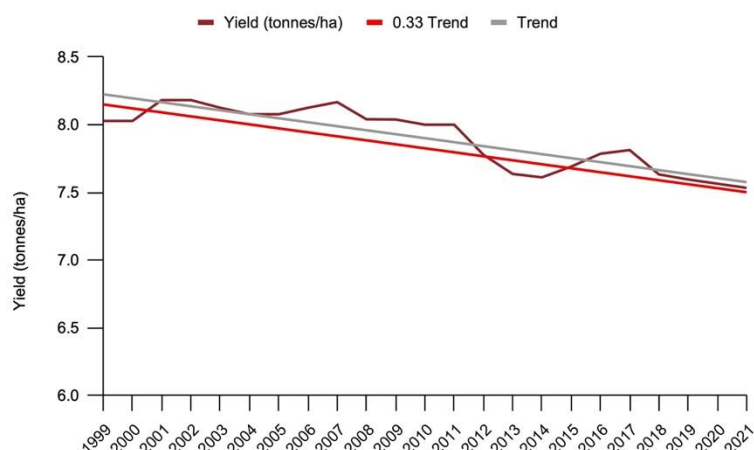


**FIGURE F.9: OIL PALM,
1999–2021**

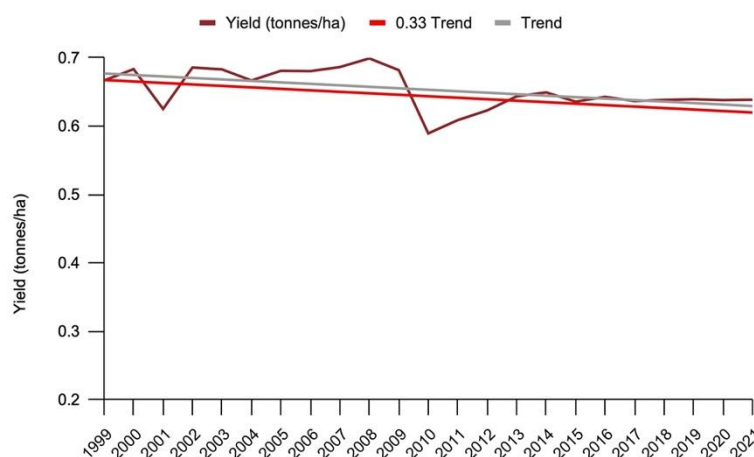
Years	Loss (in MT)	Loss (US\$, millions)
1999	-4,294	-6.5
2000	-3,651	-5.5
2013	-4,824	-7.3
2014	-4,910	-7.4



Note: MT = metric tons

**FIGURE F.10: PULSES,
1999–2021**

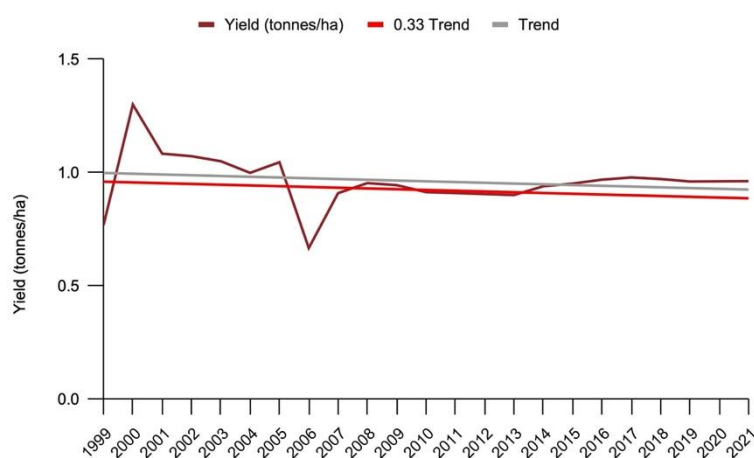
Years	Loss (in MT)	Loss (US\$, millions)
1999	-763	-0.9
2001	-3,043	-3.4
2010	-7,146	-8.1
2011	-4,858	-5.5
2012	-3,054	-3.4



Note: MT = metric tons

**FIGURE F.11: SORGHUM,
1999–2021**

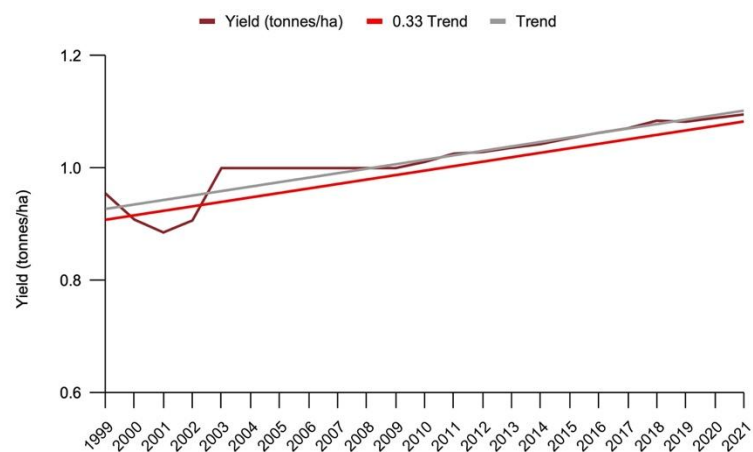
Years	Loss (in MT)	Loss (US\$, millions)
1999	-5,158	-4.7
2006	-8,319	-7.6
2007	-1,372	-1.3
2010	-1,343	-1.2
2011	-1,489	-1.4
2012	-1,647	-1.5
2013	-1,687	-1.5



Note: MT = metric tons

**FIGURE F.12: MILLET,
1999–2021**

Years	Loss (in MT)	Loss (US\$, millions)
2000	-107	-0.1
2001	-554	-0.5
2002	-515	-0.4



Note: MT = metric tons