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Organization of the  
United Nations**



**World Food Programme**

## **SPECIAL REPORT**

# **FAO/WFP CROP AND FOOD SECURITY ASSESSMENT – SIERRA LEONE**

**17 December 2014**

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### **HIGHLIGHTS**

- The Ebola Virus Disease (EVD) outbreak resulted in a serious shock to the agriculture and food sectors in 2014. The epidemic started spreading when crops were being planted and expanded during the crop maintenance and the critical harvesting period for the staple crops rice, maize and cassava.
- Nationally, the aggregate food crop production is estimated at about 2.09 million tonnes, about five percent lower than 2013. Milled rice production, accounting for about 85 percent of the cereal production, is estimated at 770 000 tonnes, about 8 percent below last year. However, the modest decline at the national level masks the significant harvest declines at sub-national levels of up to 17 percent.
- Cereal import requirements in 2015 are therefore estimated at 300 000 tonnes, slightly up from last year. Rice import requirements account for about 215 000 tonnes of the total.
- With commercial imports estimated at 285 000 tonnes the uncovered gap is estimated at about 55 000 tonnes for which additional resources and international assistance is required. The significant impact of Ebola on export earnings is expected to have compromised the country's ability to import more.
- Border closures, quarantine measures and other restrictions have seriously disrupted marketing of goods including agricultural commodities. Trade activities have declined significantly, particularly in quarantined districts.
- About 450 000 people, or 7.5 percent of the population, are estimated to be severely food insecure as of December 2014. The impact of EVD accounts for more than a quarter of the food insecure. The number of food insecure is projected to increase to 610 000 by March 2015, 280 000 of which are attributed to EVD. About 76 percent of the Ebola related food insecure individuals live in rural areas. The most food insecure households include food crop producers; fishermen and hunters; and unskilled labourers.
- The analysis indicates that different type of food assistance will be required. In addition to covering the import gap, cash/voucher transfers where appropriate can assure food access for people whose main livelihood is not agriculture. Given reductions in trader activity, local purchase in surplus areas can assure that surpluses are being redistributed.
- Frequent food security monitoring activities must continue as the situation is highly fragile and could further flare up at any time. The loss of livelihoods coupled with this market uncertainties means that there is a need for flexibility both in the type and scale of intervention that will be needed in 2015.

### **OVERVIEW**

Since the beginning of the year Sierra Leone has been one of the three most affected countries by the Ebola Virus Disease (EVD) epidemic in West Africa. According to the World Health Organization (WHO), Sierra Leone has as of December the highest number of reported cases of the three intense-transmission countries. At 10 December 2014, 7 897 cases were reported. The epidemic started to spread when crops were being planted and grew during the crop maintenance period and expanded rapidly during the critical harvesting period for the staple crops rice, maize and cassava.

FAO and WFP, in collaboration with the Government and other partners has been actively carrying out field level rapid assessments to assess the impact of the EVD crisis on food production, supply situation and the overall food security. In addition, FAO/GIEWS has developed a Disease Impact on Agriculture – Simulation (DIAS) Model to provide estimates of the impact of EVD on crop production, while WFP has developed a framework to estimate the current and future number of food insecure people due to EVD and a light version of a shock impact simulation model (SISMod-Light). The main objective of the this report is to provide the synthesis of the results based on the models and the rapid assessments and other relevant sources of information on 2014 food production market dynamics and household food security for the coming marketing year 2015.

Based on the DIAS Model estimates of production loss due to Ebola, adjusted to take into account the findings of the limited Rapid Assessments carried out in the field, the aggregate food crop production in 2014 is estimated at 2.09 million tonnes (including cassava in cereal equivalent and rice in milled terms), which is five percent lower than the record harvest of 2013. Of this total, milled rice production

(using the milling rate of 66.7 percent) is estimated at 770 000 tonnes, 8 percent lower than the year before and accounts for about 85 percent of the cereal production. Total coarse grains (maize, sorghum, millets and other small grains) and cassava in cereal equivalent (32 percent of fresh weight) are estimated applying 4 percent and 3 percent reduction factors, resulting in 136 600 tonnes and 1.183 million tonnes of production, respectively.

Given that the weather pattern and the use of other inputs of production during 2014 agricultural season were not significantly different from those during 2013, the reduction in harvest this year can be attributed to the farm labour and associated material inputs reduction due to the direct and behavioural effects of Ebola epidemic in the country.

At the estimated level of cereal production, and assuming some stock build up to cope with natural disasters, cereal import requirement in the marketing year 2015 (calendar year) is set at 300 000 tonnes of cereals, of which rice requirements account for the bulk, at 215 000 tonnes. This total cereal import requirement is slightly higher than the estimated imports during this year.

Given the forecast for lower GDP growth and significant drop in cash crop export earnings, the commercial imports of rice (at 200 000 tonnes) and wheat and maize (at 45 000 tonnes) are anticipated to be slightly below the level of 2014.

The assumed level of commercial imports during 2015 leaves about 55 000 tonnes of uncovered gap to be covered with international food assistance and/or additional budgetary allocation by the Government. The significant impact of Ebola on the country's export earnings is likely to compromise its ability to pay for the increase in cereal import requirements.

Based on the WFP model, the number of severely food insecure is estimated to 440 000 individuals in December 2014 – 120 000 of these are food insecure because of EVD. The number of individuals vulnerable to food insecurity is estimated to be 2.1 million. In March 2015, 610 000 individuals are estimated to be severely food insecure; the EVD effect accounts for 280 000. In addition, 2 million people are estimated to be vulnerable to food insecurity. The estimates are based on the infection rates at province level (and their projections), combined with pre-crisis data on food insecurity, household market dependency and livelihoods from Comprehensive Food Security and Vulnerability Assessments. The model is adjusted to take into account information from recent assessments.

## **1. ECONOMIC BACKGROUND**

### **1.1 Overall economic performance**

The GDP of Sierra Leone increased at very high rates during 2012 and 2013 (15 and 20 percent), after a mediocre growth for the preceding few years (See Table 1). According to the EIU, before the Ebola epidemic, Sierra Leone was expected to have the 4<sup>th</sup> fastest economic growth worldwide in 2014<sup>1</sup>, largely attributed to the commencement of iron ore production. Despite the rapid economic growth in recent years, poverty is widespread with 53 percent of the population (66 percent in the rural areas) below the poverty line (2011<sup>2</sup> estimates). The GDP per capita adjusted for the Purchasing Power Parity was USD 1 927 (slightly below USD 2 000 average for Sub-Saharan Africa) in 2013. According to the United Nations Development Programme's (UNDP) Human Development Index (HDI)<sup>3</sup>, the country is ranked one of the bottom 10 (177<sup>th</sup>) out of 187 countries.

Rich in minerals, Sierra Leone depends heavily on the mining sector for its economic base; particularly on iron ore and diamonds. The country has the biggest iron ore deposit in Africa and the third largest in the world<sup>4</sup>. According to the National Resource Governance Institute, mining accounted for almost 60 percent of export revenues in 2010, including USD 132 million for diamonds, USD 33 million for rutile (titanium dioxide) and USD 31 million for bauxite<sup>5</sup>.

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<sup>1</sup> EIU: Top Growers, 18th November 2013.

<sup>2</sup> World Bank: The Economic Impact of the 2014 Ebola Epidemic, 17 November 2014.

<sup>3</sup> UNDP: 2014 Human Development Report.

<sup>4</sup> Wikipedia: Tonkolilli district, 2014.

<sup>5</sup> National Resource Governance Institute: Sierra Leone | Extractive industries, 2010.

**Table 1: Sierra Leone - Key economic indicators, 2009 to 2013**

	2009	2010	2011	2012	2013
<b>Overall GDP</b>					
GDP (million USD)	2 021	2 131	2 259	2 603	3 126
GDP growth (annual %)	3	5	6	15	20
GDP per capita, PPP (USD)	1 262	1 320	1 400	1 610	1 927
GDP per capita growth (annual %)	1	3	4	13	18
<b>Agriculture sector</b>					
Value added (million USD)	1 086	1 124	1 176	-	-
Value added (annual % growth)	4	4	5	-	-
Value added (% of GDP)	58	56	57	-	-
<b>Trade</b>					
Imports of goods and services (million USD)	583	762	1 247	-	-
Exports of goods and services (million USD)	289	338	331	-	-
Trade balance: deficit(-)/surplus(+)	-294	-424	-917	-	-
Current account balance (million USD)	-327	-585	-1 914	-1 102	-

Source: Economist Intelligence Unit (EIU), November 2014 Country Report and earlier issues; World Bank, November 2014.

The Ebola epidemic has led to the quarantining of the most affected districts, restrictions of internal population movement, as well as closure of markets. The World Bank has estimated the growth rate to drop from 11.3 percent to 4 percent<sup>6</sup>. The agriculture sector and the services sector have the biggest shares in the economy (50 percent and 30 percent, respectively) and are also among the most disrupted by the Ebola crisis.

## 1.2 Agriculture

Agriculture is the largest employer in the country by sector; two thirds of the population is reliant on subsistence agriculture. The share of agriculture in GDP has been gradually declining from 58 percent in 2009 to a forecast level of 50 percent in 2014. Furthermore the annual growth of agriculture has remained at about 4 to 5 percent (see Table 1).

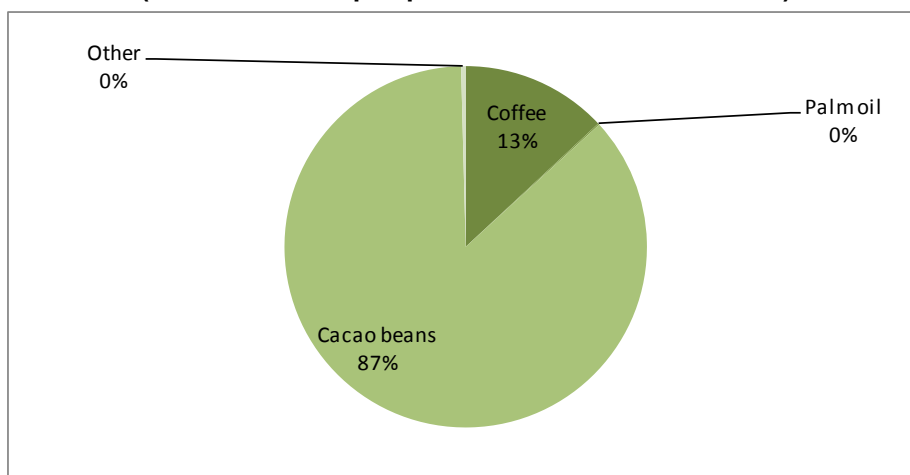
**Table 2: Sierra Leone – Cash crop commodity exports, quantity and value, 2011**

	Quantity (tonnes)	Value (million USD)
Coffee	2 168	5
Palm oil	53	0.05
Cacao beans	11 063	30
Other	633	0.1

Source: FAOSTAT.

<sup>6</sup> World Bank: Update on the Economic impact of the Ebola epidemic on Liberia, Sierra Leone and Guinea, 2 December 2014.

**Figure 1: Sierra Leone - Share of commodity exports  
(in total cash crop export of USD 35 million in 2011)**



Source: FAOSTAT.

Sierra Leone grows cash crops; particularly cacao beans and coffee which make up the bulk of the country's agricultural exports. Cacao beans are by far at the top of the export list at about 87 percent of total cash crop exports (using 2011 data) followed by coffee at 13 percent (Figure 1 and Table 2). Rice is by far the most significant food crop and it is grown on about 88 percent of all cereal cropped area. Other food crops include Cassava and Maize. Food commodities, mainly rice make up the bulk of agricultural commercial imports at import levels of about 256 000 tonnes and 6 000 tonnes (2013 estimates), respectively.

## **2. CROP PRODUCTION IN AGRICULTURAL SEASON 2013/14**

### **2.1 Impact of Ebola on crop production**

There are direct and indirect or behavioural effects of Ebola epidemic on the farm families and farm labour. Quantitatively, the direct impact in terms of the number people infected in relation to the size of the population of the area is very small. Much of the impact observed has been of the behavioural type due to due to quarantines, border closures, restrictions/ban on people movement, people fleeing the area, reluctance to work in usual labour groups, breakdown of the traditional labour system (group/team work), etc.

#### ***How does EVD affect agriculture?***

The epidemic started to spread when crops were being planted and grew during the crop maintenance period and expanded rapidly during the critical harvesting period of staple crops rice, maize and cassava. There are two ways in which farm operations, inputs and then harvest is affected. One is through reduced farm labour. The disrupted/reduced farm labour affects land preparation/planting, crop maintenance/growth (weeding, fencing, application of chemicals, etc.), and harvesting. Secondly, through the labour associated non-labour inputs - reduced use of material inputs such as applied quantities of fertilizer, irrigation, chemicals, etc. Depending on their use and the relative impact these changes affect crop output.

##### **2.1.1 Field observations and rapid assessments**

The Rapid Assessment was conducted from 11-18 September 2014 in all the 13 rural districts of the country by trained staff from FAO, WFP, the Ministry of Agriculture's Statistics Division and partner NGOs namely; Deutsche Welthungerhilfe (DWHH), Action Contre la Faim (ACF), and Concern. From each of the district, three chiefdoms were selected purposively based on the statistics on severity and disease prevalence of Ebola outbreak. Three villages were randomly selected from each chief-dom using the list of villages where the farming communities formed agricultural Farmer Based Organizations (FBOs). These FBOs are part of the national structures of Agricultural Business Centres (ABCs) spread all over the country providing a range of services to the farmers. From each village 6 households were randomly selected to participate in the assessment.

Within the primary sampling units (village level) used in the assessment, 702 households were interviewed using a detailed household semi-structured questionnaire. In addition 351 community leaders were interviewed, using a qualitative questionnaire. The rapid food security assessment assisted in establishing the changes in livelihoods, household food security situation, existing coping mechanisms, and providing food security outlook of the population in Sierra Leone.

The findings of the RA indicated that Ebola Virus Disease (EVD) was affecting agriculture and food security in Sierra Leone:

- In communities affected by Ebola, labour shortages were being experienced. The reason for this included the ban on gatherings, which is enforced in rural areas by Government and unwillingness of people to work in groups due to fear of contracting the EVD. Thus farmers cannot mobilize enough labour for activities such as weeding, harvesting, crop protection, and even harvesting. About 47 percent of the respondents claimed that Ebola was having considerable adverse effects on farming activities. There were reports that a few families have abandoned their farms and moved to areas perceived as 'safe' from EVD.
- Quarantine measures and restrictions have disrupted marketing of goods including agricultural produce. Travel restrictions and suspension of operations of periodic markets (popularly known as Lumas) have disrupted trade flows of food commodities and other necessities.

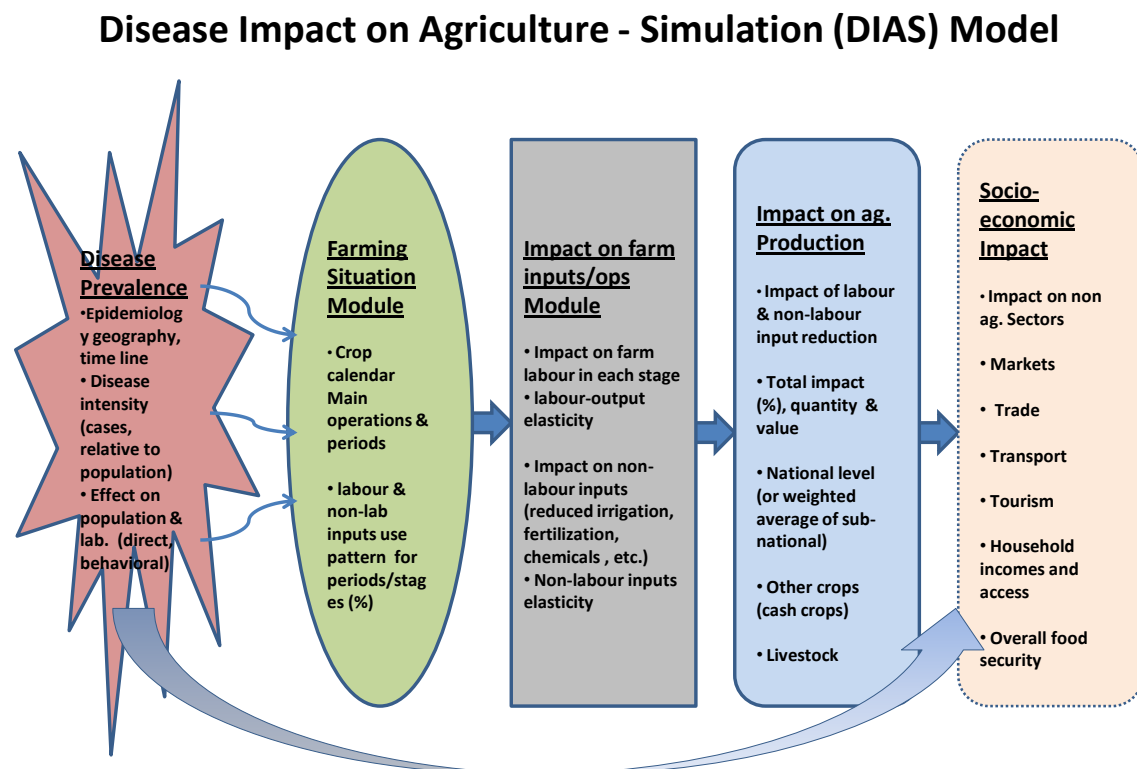
#### 2.2.2 The Disease Impact on Agriculture Simulation (DIAS) Model

To simulate theoretical impact of EVD an Excel based model is developed which takes into account the following five components (see schematic flow chart below).

Of the two crucial technical steps, the first one has to do with the conversion of the relative cases of EVD infection into the impact on farm labour. Based on the logic that as the number of cases of infection rises, the impact is low at low number of cases but rises rapidly and then flattens out at some point. The impact is measured by using a logistic function representing the S-Curve and the actual cases per 100 000 were converted to a percentage of population (and thereby farm labour) that may be considered affected.



Figure 2: Sierra Leone - Schematic of EVD Impact on Agricultural Production Simulation



The second most critical set of information is about farm input elasticities and input use patterns. For example, the labour elasticities of production (0.5 for rice, 0.47 for maize and 0.3 for cassava) and the labour use pattern (38:38:24 for rice, 59:35:6 for maize and 28:46:26 corresponding to three equal periods from planting to the end of harvesting, respectively) are taken from the empirical scientific literature relevant for the crops and the countries in the region. Similarly, assuming that the reduction in farm labour would also reduce the use of other non-labour material inputs such as fertilizer, chemicals, irrigation, etc., the EVD would also impact agriculture through non-labour input reduction. Using the implicit constant unitary elasticity of production such as the one used in the Cobb-Douglas production function, the other than labour input elasticities are calculated as one minus the labour elasticities. The other input use pattern is assumed to be 50:50:0 for rice and maize. Cassava production does not involve much use of these other inputs, hence only labour impact is calculated.

Using these parameter values, the DIAS Model shows the potential impact of Ebola crisis on cereal production. The results, shown in Table 3, show that the decline in production would be about 8 percent for rice and 4 percent maize. Reduction in potential production of cassava due to Ebola per se should be much less, estimated in the order of 1 percent in the model, however, given that cassava tubers can remain in the ground unaffected, the actual harvest of the crop this year may be affected more significantly as a result of Ebola in different parts of the country.

#### 2.1.3 Results from the Model

The results of the DIAS Model indicate that in Sierra Leone, the production of the main staple crop rice would be lower by 8 percent from the without Ebola scenario (see Table 3). As explained in the sections below, the 2013/14 agricultural season, by and large, was similar to the agricultural season of the year before; the harvest of 2012/13 can be used as a proxy for without Ebola production this year. Thus, the potential paddy harvest for this year is estimated at 1.977 million tonnes, with a potential loss of about 77 000 tonnes of paddy.

The relatively low level of impact at the national level masks the sub-national production and food security impacts. For example, impact on county rice production is estimated as high as -17 percent in Kailahun.

The impact on other food crop harvests is expected to be significantly less compared to that on rice both at the national level and subnational level. Moreover, reduction in cassava production is estimated to be the least of Sierra Leones main food crops at -3 percent at the national level and ranging from 1 percent in Bonthe district to -6 percent in Kailahun district of the country.

It should be noted that the Ebola impact results are useful as they show the extent of potential losses of agricultural production due to the crisis and can serve as a guide for the type of and the areas for response interventions.

**Table 3: Sierra Leone - Impact of Ebola on 2014 crop production (tonnes)**

	2013 Production (tonnes)	FAO/GIEWS Simulation Model <u>1/</u> (percent)	2014 Production estimate (tonnes)
Rice (Paddy)	1 255 559	-8.0	1 155 114
Cassava	3 810 418	-3.0	3 696,105
Maize	40 022	-4.0	38 421
Sorghum, millet, other crops	102 300	-4.0	98 208

1/ Based on average of low (no new cases) projections and WFP's high cases projections scenarios (for weeks 45 to 52).

2/ The sum of the county production may slightly differ from the national total due to the differences in population data sources at national and sub-national level in the model.

## 2.2 Weather and other agricultural production factors

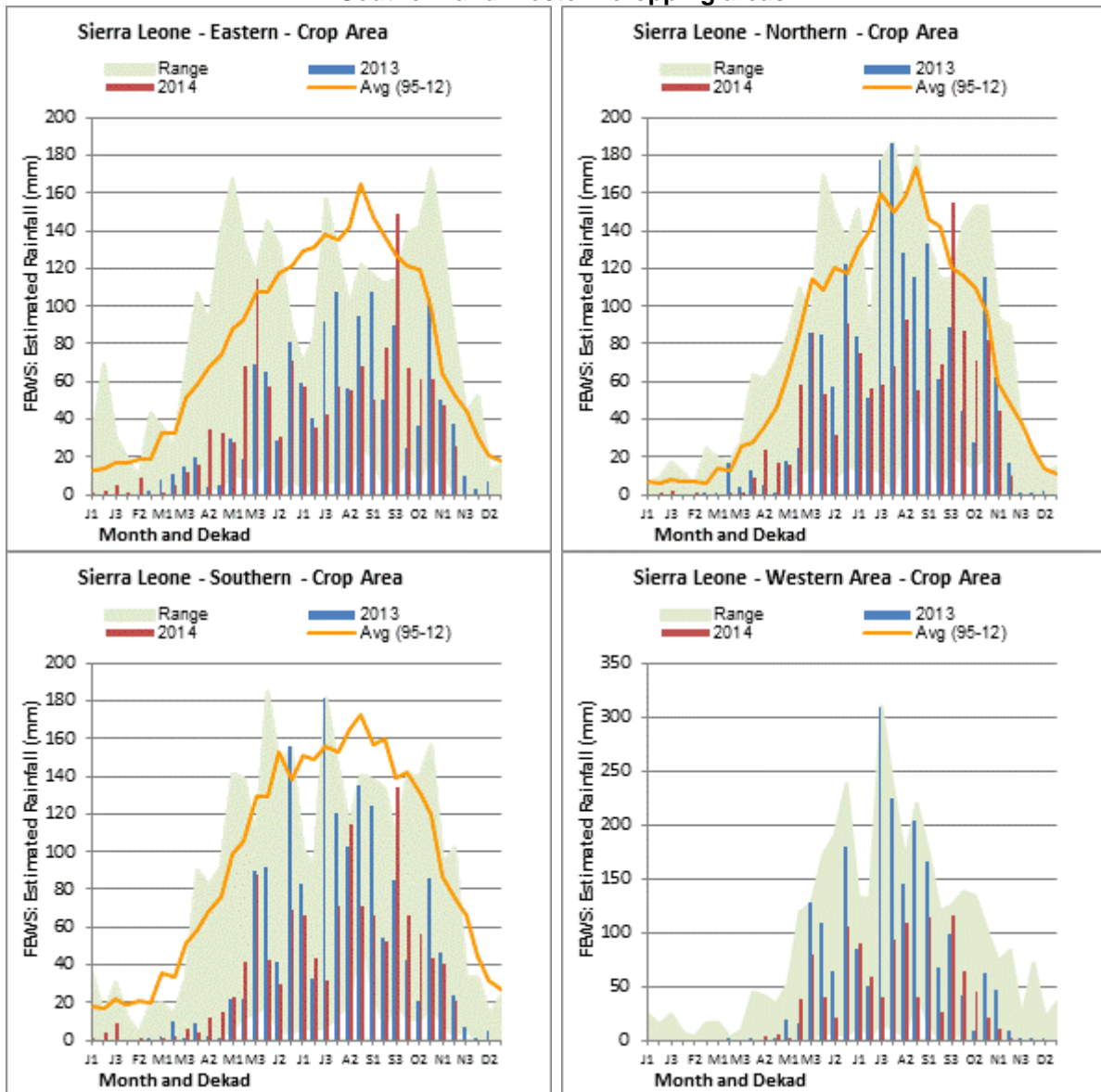
In order to estimate the production during the season, it is also necessary to assess the impact of changes in factors other than the Ebola epidemic, namely weather and other key factors of production.

### ***Weather***

Sierra Leone, like other countries of the Mano River Union, normally enjoys abundant rainfall and does not suffer from drought like in the Sahel countries. "It is not just that rainfall in the country is far higher than anywhere in the Sahelian ecologies; it is that inter-annual variations are far less acute, at least in their effect on crops"<sup>7</sup>. As in recent years, rainfall in 2014 was adequate for normal crop development. Figure 3 shows that estimated rainfall has remained below last year's for most dekads, except in late September when precipitation jumped to above-average levels across the country. The heavy rains of early September did raise concerns about both crop yield and quality. However it should be noted that heavier rains were recorded in 2013 in August and early September in most parts of the country.

<sup>7</sup> FEWSNet, 2010. Livelihoods zoning "plus" activity in Sierra Leone, a special report by FEWSNet.

**Figure 3: Sierra Leone - Estimated rainfall in Eastern, Northern, Southern and Western cropping areas**



### Inputs

Like in other Mano River Union's countries, Sierra Leonean farmers commonly use their own seed saved from the previous year's harvest as well as recycled seeds from previous harvests. The use of commercial inputs is limited; fewer than five percent of the households have access to fertilizers, insecticides, herbicides and basic machinery which are resources that could help enhance rice production<sup>8</sup>. This year is no exception. Overall seed availability was adequate following the 2013 good harvest.

Labour shortage is the main factor that affected crop production in 2014. Movement restrictions and migrations to other areas have disrupted important farming activities including crop maintenance (weeding, fencing, application of chemicals, etc.) and harvesting with negative impact on yield. In years with good rainfall like 2014, weeds grow faster and their control becomes more challenging, requiring more labor. Transport restrictions have been imposed in additional districts in Sierra Leone

<sup>8</sup> Coalition for African Rice Development (CARD), 2009. Sierra Leone: National Rice Development Strategy (NRDS). [http://www.jica.go.jp/english/our\\_work/thematic\\_issues/agricultural/pdf/sierraleone\\_en.pdf](http://www.jica.go.jp/english/our_work/thematic_issues/agricultural/pdf/sierraleone_en.pdf)

recently, following the continuous spread of EVD to new areas. According to the International growth Centre (IGC), districts of Bombali, Port Loko, and Moyamba are all under cordon as is Waterloo in Western Area Rural (Waterloo is an important transport hub linking Freetown to the rest of the country) in October. In most of Sierra Leone, planted area for the main season of 2014 was not significantly affected due to the timing of the outbreak.

### 2.3 Conclusions

**Table 4: Sierra Leone - Estimated impact of Ebola on national production of the main food crops**

County	Reduction in production due to Ebola ('000 tonnes)	Value of production loss (million USD) <sup>1/</sup>
Rice (milled) <sup>2/</sup>	100	43
Maize	2	0.3
Cassava in cereal equivalent <sup>3/</sup>	37	4
Small grains	4	0
<b>Total</b>	<b>143</b>	<b>47</b>

<sup>1/</sup> Using international equivalent prices: Thai 100% broken rice at USD 425/tonne; US yellow maize at USD 175/tonne; average local price of cassava from Liberia and Sierra Leone, approximately USD 100/tonne; small grains (sorghum, millets, others) approximately USD 100/tonne.

<sup>2/</sup> Milling rate of 66.7 percent.

<sup>3/</sup> Cereal equivalent factor of 32 percent.

### 2.4 Impact on other cash crops

The Ebola epidemic has also affected the key cash/export commodities. It has led to closure of ports, borders, and high restrictions of international movement of West African commodities. These factors have decreased trade flows and also caused the transportation costs to double. In Sierra Leone the epicentre of the epidemic is in the Kailahun and Kenema districts. The respective districts are both home to more than 17.6 percent of the population as well as the most productive areas in producing both the food and cash crops. Although 2014 cocoa production is estimated to be normal, exports have fallen by 30 percent, according to a new report by Welt Hunger Hilfe. The estimated drop in exports was driven by reduced cross-border trade and limited commodity inflow from neighbouring countries.

### 2.5 Livestock

Raising livestock is normally an important source of income for the majority of the rural population, and the sale of ruminant is a fundamental hedge against misfortune. The Rapid Assessment indicated that 92 percent of the farming households are engaged in livestock activities (mainly poultry and ruminants) for both home consumption and commercial purposes. However, there is a minority population of herding specialists, Fulani who raise cattle especially (but also goats and sheep) and may take on the husbandry of cattle belonging to ordinary farmers too. Fulani are based in villages, sometimes as satellites to main farming villages, but men take cattle seasonally to far grazing areas, sometimes across national frontiers. In Sierra Leone it is not possible to identify a zone which is dominated by cattle herding; but Koinadugu offers especially extensive grasslands for grazing of cattle<sup>9</sup>. The table below shows the production trend for the last three years.

<sup>9</sup> FEWSNet, 2010. Livelihoods zoning “plus” activity in Sierra Leone, a special report by FEWSNet.

**Table 5: Sierra Leone - Livestock type and number of heads**

Year	Cattle	Sheep	Goats	Chicken	Ducks	Rabbit	Pigs
2011	568 700	750 200	883 300	10 406 000	882 768	13 416	52 100
2012	625 570	825 220	971 630	11 446 800	971 044	14 757	57 310
2013	688 127	907 742	1 068 793	12 591 260	1 068 147	16 233	63 041

Source: Ministry of Agriculture, Forestry and Food Security.

The Rapid Assessment found that the numbers of cattle transported from Koinadugu to other major markets including Freetown, Kenema and Makeni, have dropped significantly due mostly to the quarantine that limits transport. The number of animals sent to other districts dropped by over 60 percent according to cattle herders interviewed in Koinadugu.

Many farmers also depend of wild animals as a source of animal protein and for sale to generate income. The most widely hunted and consumed animals include rodents, monkeys, primates and other. Over 94 percent of the respondents reported that they are no longer hunting due to the by-laws and restrictions to curb EVD. This has greatly impacted on the amount of animal protein consumed at household level as well as their income.

### 3. ANALYSIS OF FOOD SUPPLY AND DEMAND

#### 3.1 Food Supply/Demand Balance for 2015

A national food supply/demand balance sheet, including cereals, milled rice and cereal equivalent of cassava for the 2015, is presented in Table 6. In preparing the balance sheet, the following assumptions are made:

- a. **Population:** The total national population in 2013 was 6.092 million (UN Population Division estimates cited in FAO/CCBS). Using the implicit annual growth rate of 1.9 percent from the same source, 2015 population is estimated at 6.326 million for the purpose of this report.
- b. **Food consumption:** Based on the recent trend of consumption pattern from the FAO/CCBS, the annual per capita consumption of 154 kg of cereals, including 125 kg of milled rice, 8 kg of maize, 7 kg of wheat, and 14 kg of sorghum, millets and other cereals is assumed to be the level of consumption during 2015. In addition, given that cassava forms an important part of the national diet, 25 percent of production of cassava (i.e. about 47 kg of cereal equivalent) per person per year is assumed. The remaining energy and other nutrients required are assumed to be derived from the limited quantities of available poultry, fish, sweet potatoes, vegetables, fruits, and other items.
- c. **Feed use:** Use of grain for feeding animals is very limited in the country. Although given the rising importance of poultry in the country small quantity of coarse grains and substantial amount of cassava is assumed to be used as animal feed. Hence, 10 percent of maize, 5 percent of small grains and 50 percent of cassava is assumed to be used as animal feed.
- d. **Seed requirements:** These are calculated by using the most commonly used per hectare seed rates of 65 kg for rice, 30 kg for maize and 10 of small grains, together with the projected areas to be planted based on the trend of past five years.
- e. **Post-harvest losses and waste:** Based on the standard rates of the post-harvest losses in the region or typically for developing countries, a rate of 15 percent for rice and maize, 10 percent for small grains and 25 percent for cassava of production including handling and storage losses are used.
- f. **Opening and Closing Stocks:** It is assumed that there will be no significant differences in the beginning and the ending stock levels. A small amount of cereal stock build-up, equivalent of about two weeks' worth of domestic utilization use is assumed.

**Table 6: Sierra Leone - Food balance sheet for marketing year 2015 ('000 tonnes)**

	Rice (milled) <sup>1/</sup>	Maize	Sorghum, millet, others	Wheat	Total cereals	Cassava C.E. <sup>2/</sup>	Total cereal equivalent
<b>Domestic availability <sup>3/</sup></b>	<b>770</b>	<b>38</b>	<b>98</b>	<b>0</b>	<b>907</b>	<b>1 183</b>	<b>2 090</b>
Production	770	38	98	0	907	1 183	2 090
<b>Total utilization</b>	<b>985</b>	<b>66</b>	<b>104</b>	<b>52</b>	<b>1 208</b>	<b>1 183</b>	<b>2 390</b>
Food use	791	51	89	44	974	296	1 270
Feed use	0	4	5	0	9	591	600
Seed requirement	43	1	1	0	45	0	45
Post-harvest losses and waste	116	6	10	0	131	296	427
Stock build-up (+)/draw-down(-)	36	5	0	8	49	0	49
<b>Import requirements</b>	<b>215</b>	<b>28</b>	<b>6</b>	<b>52</b>	<b>300</b>	<b>0</b>	<b>300</b>
Anticipate commercial imports	200	15	0	30	245	0	245
Uncovered deficit	15	13	6	22	55	0	55

1/ Using the milling rate of 67 percent.

2/ In cereal equivalent using 32 percent conversion rate based on the caloric content.

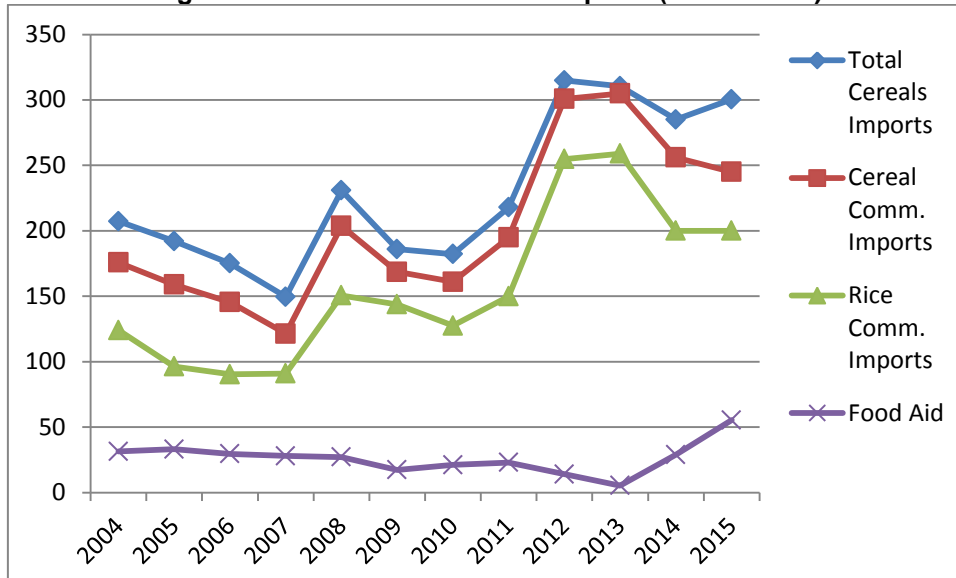
3/ Not including opening stocks, as only yearly net stock changes are included under Utilization section of this balance sheet.

With the above mentioned assumptions, total production for the coming marketing year (2015) is estimated at 2.09 million tonnes of cereals (including rice in milled and cassava in cereal equivalent terms). The total utilization is estimated at 2.39 million tonnes, leaving an import requirement of 300 000 tonnes of cereals, including 215 000 tonnes of rice and 52 000 tonnes of wheat and 34 000 tonnes of coarse grains. At this level the total cereal import requirements are slightly higher than the quantity imported during 2014.

The impact of Ebola on the country's export earnings is likely to be significant. This together with the significant depreciation of the local currency since the beginning of the Ebola crisis, will compromise the ability of the country to pay for the increase in cereal import requirements. Given the forecast for lower GDP growth down by 3.3 percentage points (from 11.3 percent to 4.0 percent, according to a World Bank study<sup>10</sup>) and a significant drop in cash crop export earnings, the commercial imports of rice (at 200 000 tonnes), wheat (at 30 000 tonnes) and maize (at 15 000 tonnes) are anticipated to be slightly below the level of 2014 but above the five-year level.

<sup>10</sup> World Bank: Update on the Economic impact of the Ebola epidemic on Liberia, Sierra Leone and Guinea, 2 December 2014.

**Figure 4: Sierra Leone – Cereal imports ('000 tonnes)**



Source: 2004 to 2014 FAO/GIEWS CCBS, 2015 CFSA.

Historically, the total cereal import requirement is met through commercial imports and some food aid (see Figure 4). The assumed level of commercial import level, leaves about 55 000 tonnes of uncovered gap to be filled with international food assistance and/or additional budgetary allocation by the Government. This level of food assistance is almost double the level received in the country in 2014 and higher than the historical high of food aid was 33 000 tonnes in 2005. This would be, especially aimed at providing food assistance to the most vulnerable people affected by Ebola crisis as detailed in the following sections.

#### 4. **MARKET ANALYSIS**

##### 4.1 Prices and trader activity

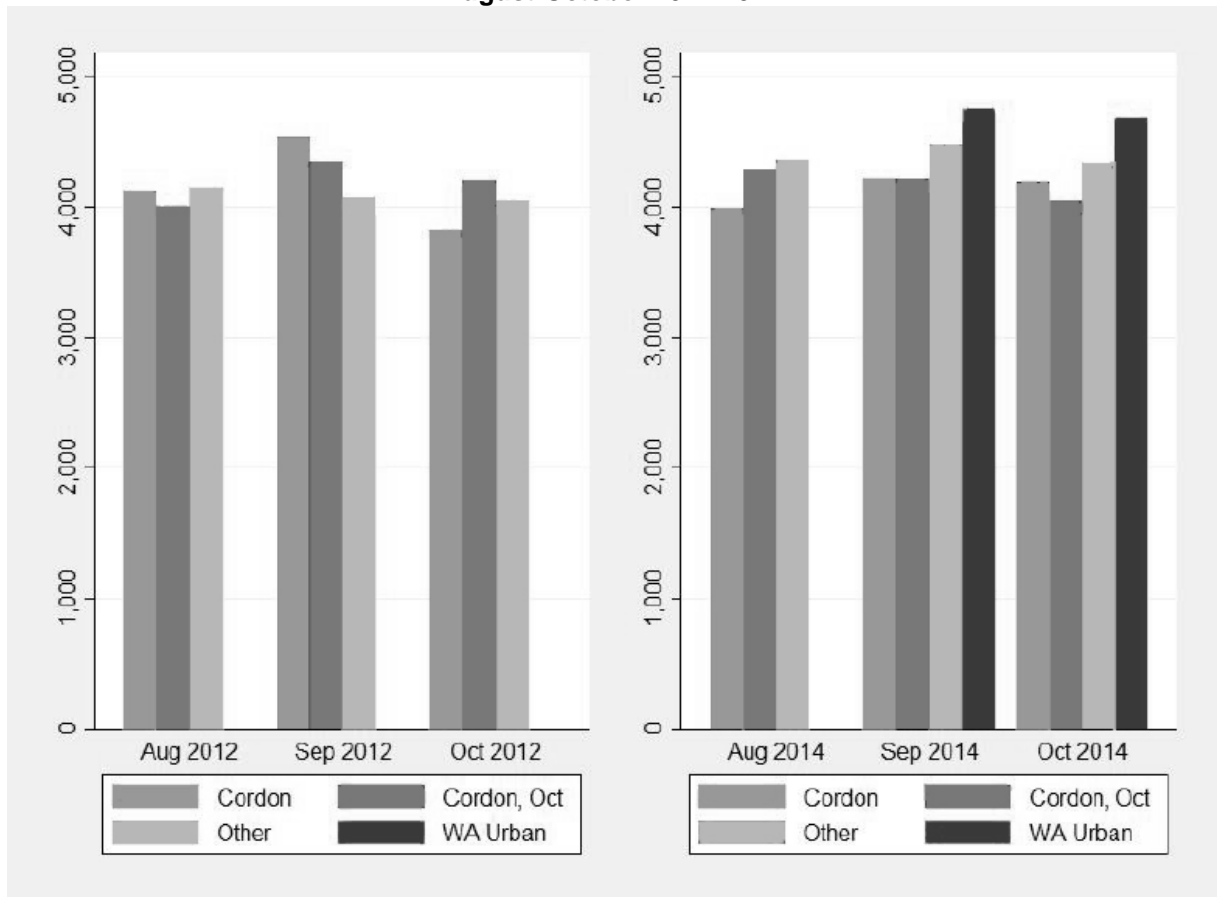
According to the International Growth Centre<sup>11</sup>, market prices for domestic rice, cassava, and palm oil continued to be fairly stable in August-October 2014 throughout Sierra Leone. These results are based on a survey of 166 randomly selected markets, including both cordon and non-cordon districts (Figure 5)<sup>12</sup>. There are no large changes over the months, nor compared to 2012<sup>13</sup>. While this is the case, there are more outliers in 2014. The 12 (out of 166) markets where the prices are exceptionally high in 2014 are to be found in both high and low EVD districts in the Southern and Northern province of Sierra Leone. Price spikes in the south are likely driven by trade disruptions with Liberia.

<sup>11</sup> International Growth Centre (2014). The implications of the Ebola outbreak on markets, traders and food security in Sierra Leone, November 2014.

<sup>12</sup> A cordon district is a district where trade and movement restrictions have been put up because of EVD.

<sup>13</sup> Data was not collected in 2013.

**Figure 5: Sierra Leone - Domestic rice prices in cordon and non-cordon districts, August-October 2012-2014**



Source: International Growth Centre (2014). The implications of the Ebola outbreak on markets, traders and food security in Sierra Leone, November 2014.

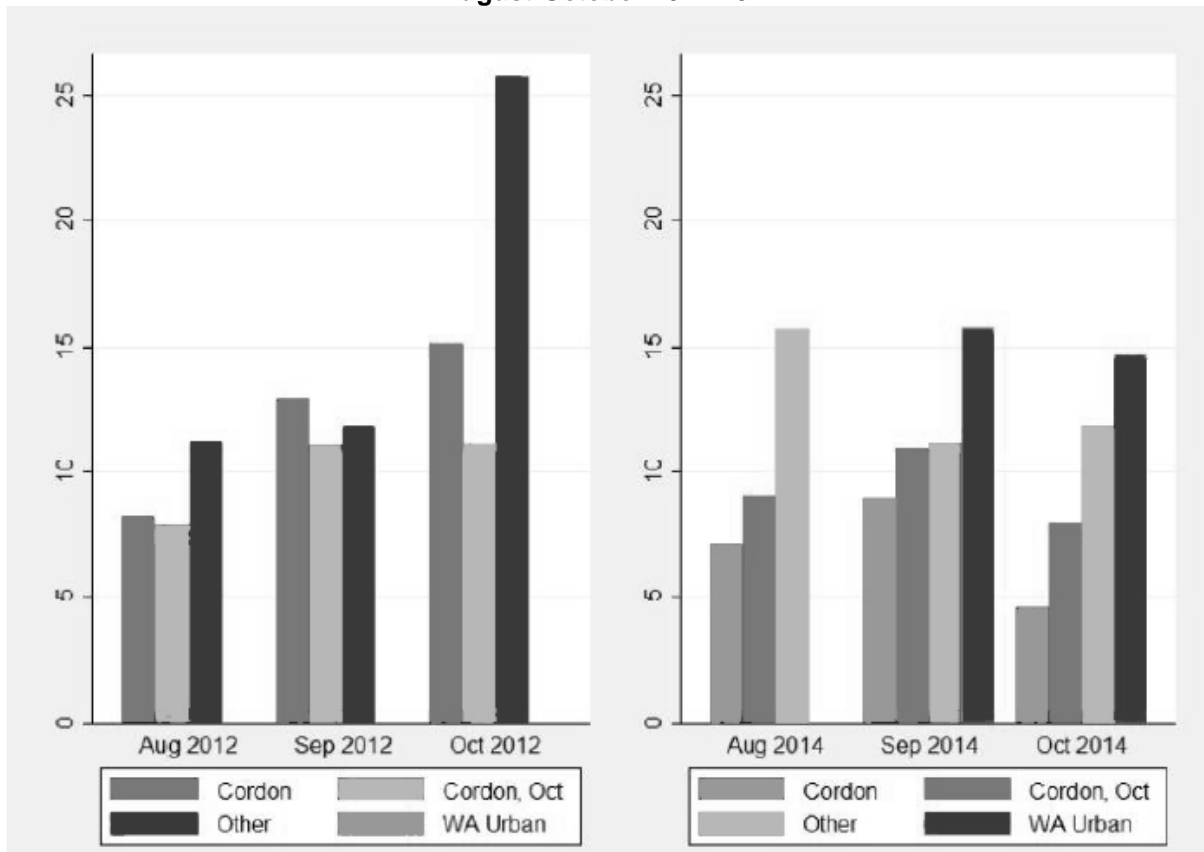
While prices at large do not show any abnormal patterns, there is a substantial decline in trader activity. This depressed demand is likely to hinder the prices from increasing. Despite the fact that the rice harvest had started in approximately half of the markets in early October, the number of domestic rice traders decreased in cordon areas (Figure 6). Compared to 2012, there are 69 percent fewer domestic rice traders in Kailahun and Kenema, the first districts to be cordoned. In newly cordoned areas there are 29 percent less rice traders<sup>14</sup>. This is exceptional since the start of the harvest normally is accompanied by a large increase in the number of traders. While only a small proportion of rice farmers (20 percent) sell their surplus, reduction in trader activity will be particularly harmful for farmers relying on cash crops such as cocoa and coffee. The decline in trader activity may also be an indication of reduced economic activity outside agriculture because of the fear of infection.

The ban of periodic markets has compromised access to markets for sparsely populated areas. This also contributes to reduced trade of agricultural products.

<sup>14</sup> There is not information as to whether the volumes of trade have changed.



**Figure 6: Sierra Leone - Number of domestic rice traders per market, August-October 2012-2014**



Source: International Growth Centre (2014). The implications of the Ebola outbreak on markets, traders and food security in Sierra Leone, November 2014.

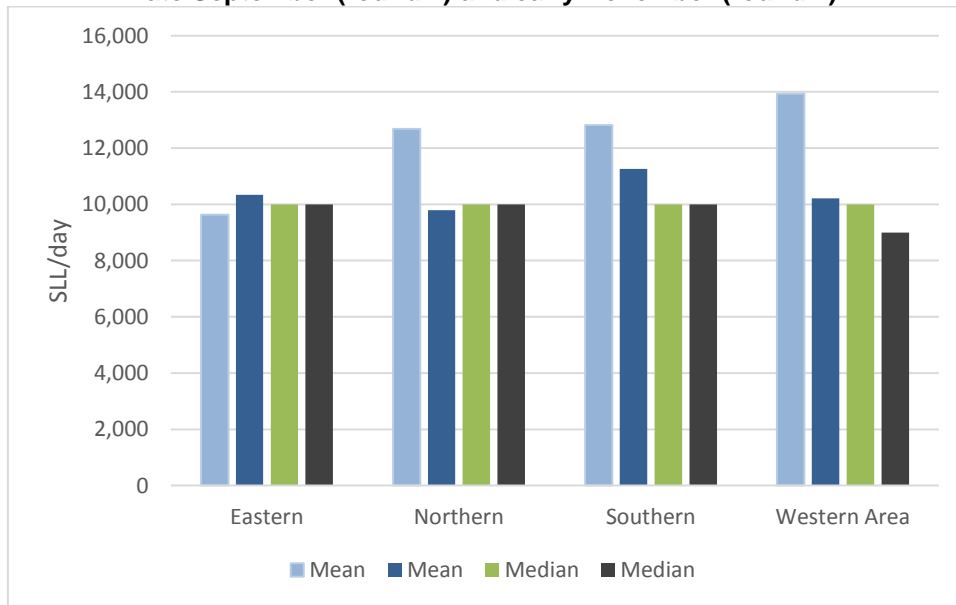
#### 4.2 Incomes, purchasing power and livelihoods

Findings from remote surveys under-taken by WFP (mVAM)<sup>15</sup> do not give a clear indication as to how the wage rates have developed in the provinces between late September and early November 2014 (Figure 7). While the average wage rates have fallen in three of the provinces between September and November, the differences are not statistically significant between the two rounds. This can partly be explained by small sample sizes on province level. While the mean wages show some movements, the medians and standard deviations follow a very similar pattern between the two rounds indicating that if anything, the skewedness of the wages might have increased. There is some indication of this pattern in the Western and Northern provinces, which include newly cordoned-off districts. In Western Area – where a large number of new EVD cases were registered in October and unemployment is reported to be high – average wage rates stood at 14 000 SLL/day in October to 10 000 SLL/day in November. A similar pattern is found in the Northern Area in November, a zone that includes the districts of Port Loko and Bombali that have seen a high increase in infection rates during the last months. The Eastern province, where wages remained stable measured by all indicators, is the province where agriculture is the main source of wage labour. With the harvest under way, it is therefore not surprising that wages remained stable.

Since prices have remained fairly stable, the purchasing power of households shows a very similar pattern as the wage rates between October and November (Figure 8).

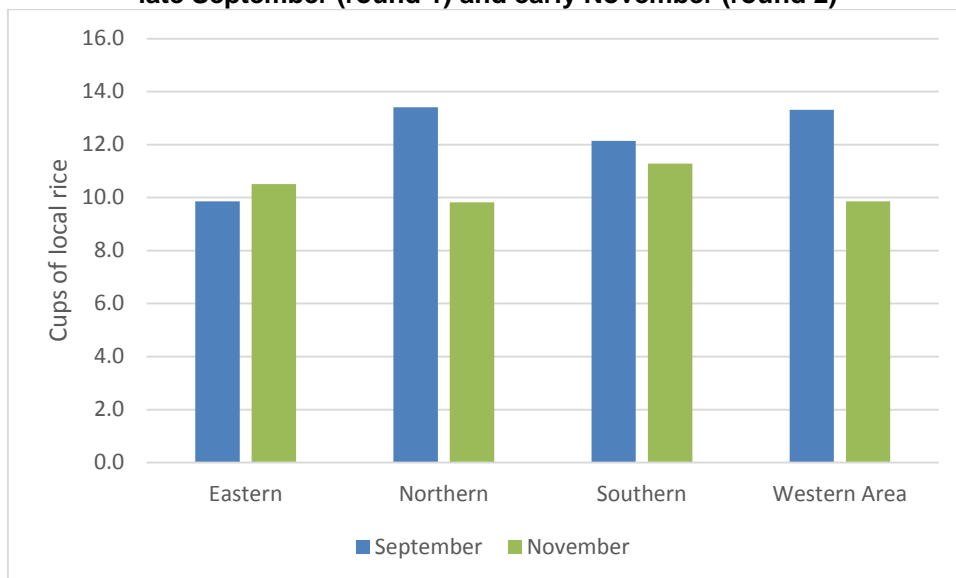
<sup>15</sup> Since September 2014, WFP has been collecting basic food security data remotely through mobile phones in Ebola-affected countries in West Africa. Each month, mVAM (mobile Vulnerability Analysis and Mapping) surveys are sent to randomly selected panels of households in Sierra Leone, Guinea and Liberia through text message and Interactive Voice Response technology. The sample size in Sierra Leone was 800 respondents. The first round was collected in late September and the second round in early November.

**Figure 7: Sierra Leone - Wage rates SLL/day manual labour, late September (round 1) and early November (round 2)**



Source: WFP mVAM.

**Figure 8: Sierra Leone - Wage-to-local rice terms of trade, late September (round 1) and early November (round 2)**



Source: WFP mVAM.

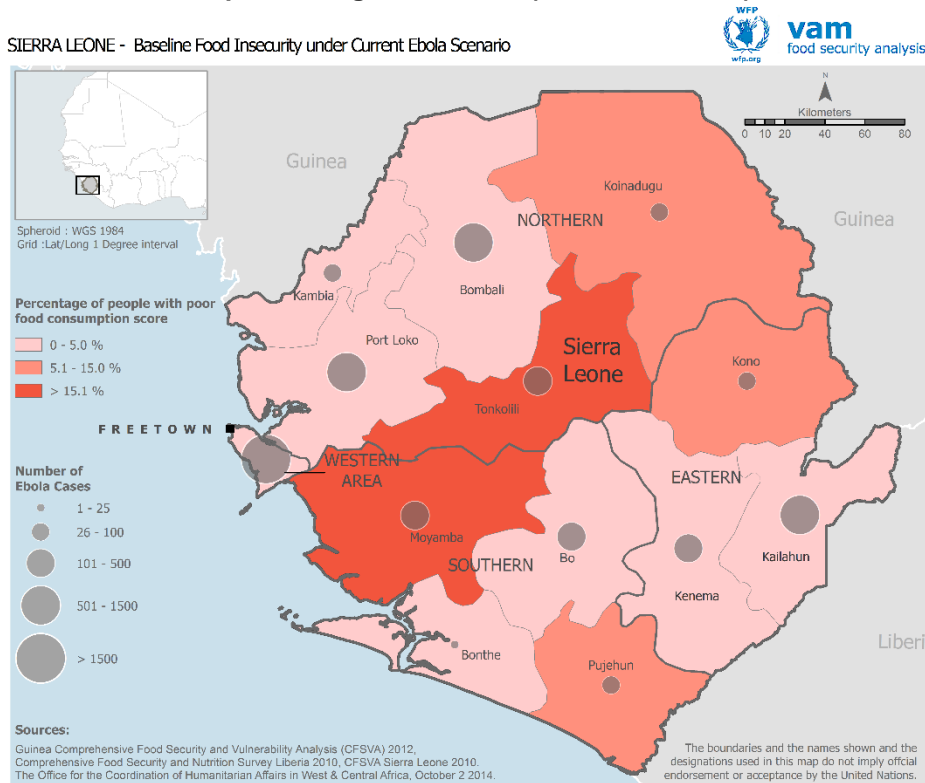
The economic slow-down captured by the reduction in the number of traders is not yet clearly picked up by the remote survey data. This could partly be explained by the fact that the harvest is under way, partly by the small samples sizes making it difficult to detect changes. While this is the case, the production estimates presented in crop production in the agricultural season 2013/14 section and the analysis above suggests that the impact on food security of the Ebola outbreak is not predominantly driven by food availability but rather by food access. The food access problem appears to be driven by reduction in economic activity despite of stable prices; this has an effect on households' purchasing power. The ban of periodic markets adds to the food access problem. The findings suggest that the main impact will be on wage labourers, self-employed and cash-crop producing households while those relying on food crops will be less affected.

## 5. FOOD SECURITY

### 5.1 Pre-crisis food insecurity

Figure 9 shows a map overlaying the food insecurity situation before Ebola with the number of current infections by province/district. The food security data is based on Comprehensive Food Security and Vulnerability Analysis Surveys from 2010. The pre-crisis food insecurity is measured as the percentage of households with a poor food consumption score. The data shows that many of the worst-affected areas were relatively food secure prior to the outbreak.

**Figure 9: Sierra Leone - Pre-crisis food insecurity overlaid with Ebola cases in epidemiological week 46 (10-16 November)**



**Sources:** Comprehensive Food Security and Vulnerability Assessment 2010, Office for the Coordination of Humanitarian Affairs in West and Central Africa.

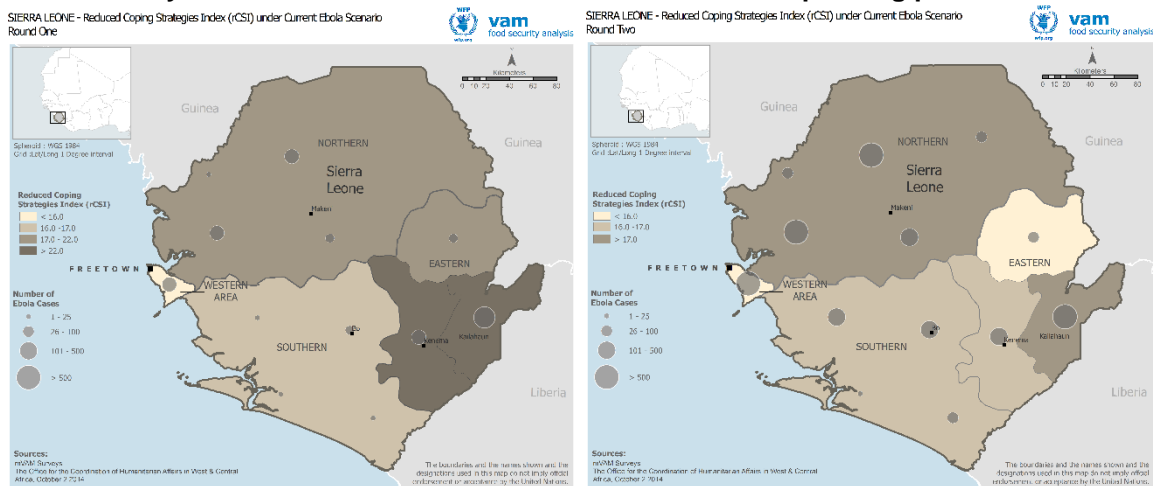
### 5.2 The impact of Ebola on food insecurity

#### 5.2.1 Results from recent assessments

Findings from mVAM surveys indicate a slight improvement in the food security situation between October and November for Sierra Leone, in line with seasonal trends (Figure 6). The food security situation is assessed using the reduced coping strategy index (rCSI) – an indicator that is suitable for remote surveys. The rCSI measures the frequency and severity of the behaviours households engage in when faced with food shortages. A high rCSI reflects greater vulnerability to food insecurity. The mean rCSI has decreased from 18.0 to 16.2 in Sierra Leone between later September and early November. As a comparison, the average rCSI was 17.8 in Liberia and 22.9 in Guinea in November.

In November the most severe coping strategies are prevalent in the EVD-affected district of Kailahun (rCSI=19.0) in Eastern Province, but even here, the situation has improved from an rCSI of 22.1 last month. Also in Kenema the situation has improved substantially, with the rCSI dropping from 22.0 in September to 16.1 in October. Consuming less expensive and less preferred food remains the most frequently used strategy, employed by 87 percent of households in Kailahun and 79 percent in Kenema. In November, the lowest coping levels are observed in Western Area (rCSI=14.6), which includes the capital Freetown.

**Figure 10: Sierra Leone - Food insecurity in September and October as measured by the rCSI overlaid with Ebola cases for the corresponding periods**



Sources: WFP mVAM surveys, The Office for the Coordination of Humanitarian Affairs in West and Central Africa.

### 5.2.2 Estimated food insecurity

While the remote assessment data is helpful to understand some general dynamics of food insecurity because of the EVD, it cannot be used to estimate the number of food insecure people. To do this, the Food Security Analysis Service of the World Food Programme (WFP) has developed a model to estimate the current and future number of food insecure people.

The model is designed to estimate the number of food-insecure people who are directly or indirectly affected by Ebola both currently and under possible future scenarios. It recognises that mostly indirect channels will be responsible for driving people into food insecurity because of the Ebola outbreak<sup>16</sup>.

First the number of people directly affected by Ebola is estimated based on the Ebola spread data by province. It is assumed that if a household member is affected by Ebola, the whole household becomes food insecure. However, impact is scaled down if children or the elderly are affected as opposed to adults, who are likely to be the breadwinners<sup>17</sup>. The number of *directly food insecure* is derived by taking into account the population distribution of those affected, the average number of adults in a household and the dependency ratio in a given province. The estimates of indirectly food insecure are based on the infection rates at province level (and their projections), combined with pre-crisis data on food insecurity as measured by the food consumption score (FCS) in a Comprehensive Food Security and Vulnerability Assessment, household market dependency and livelihoods. The models allow transitions from borderline to poor FCS and from adequate to borderline (see Annex 1 for details on the model).

Table 7 reports the estimated number of food insecure by province in December 2014. The directly affected are about 21,700 individuals. The number of food insecure (poor FCS) is estimated to 450 000 individuals, 120 000 because of Ebola. The number of individual vulnerable to food insecurity (borderline FCS) is 2.1 million. According to these estimates, most of the food insecure will be in the Northern Province. Table 8 reports the estimated number of food insecure in March 2015. An important assumption behind the estimates for March 2015 is that the disease continues to spread at the average rate observed in December and then begins to slow down substantially by January 2015. In March 2015, the directly affected amounts to 56 000 individuals; 610 000 are estimated to be food insecure and 2 million vulnerable to food insecurity. Of the 610 000 food insecure, 280 000 are driven by Ebola.

<sup>16</sup> The World Bank notes in a report on Ebola that 80–90 percent of the economic impacts from pandemics are due to behavioural changes. See World Bank. 2014. *The Economic Impact of the 2014 Ebola Epidemic: Short and Medium Term Estimates for Guinea, Liberia, and Sierra Leone*, 17 September.

<sup>17</sup> The equivalence scale that we use gives the weight 0.5 to a child (aged 0–15) and 0.7 to an elderly person (aged 60+).

**Table 7: Sierra Leone - Estimated number of food insecure by province in December 2014 <sup>1/</sup>**

	EVD cases	Directly affected (estimated)	FCS poor		FCS borderline	
			Baseline	December 2014	Baseline	December 2014
Eastern	1 435	4 303	43 066	64 993	341 022	359 089
Northern	2 762	9 685	166 104	208 653	983 332	905 527
Southern	656	2 083	70 788	96 002	588 784	551 891
Western Area	2 682	5 638	51 838	79 384	269 332	296 722
<b>Total</b>	<b>7 535</b>	<b>21 709</b>	<b>331 796</b>	<b>449 032</b>	<b>2 182 470</b>	<b>2 113 319</b>

Source: WFP estimates.

<sup>1/</sup> Note that the province level numbers are a bit lower than the national ones. Some of the EVD cases are reported with no geographical origin attached.

**Table 8: Sierra Leone - Estimated number of food insecure by province in March 2015**

	EVD cases	Directly affected (estimated)	FCS poor		FCS borderline	
			Baseline	March 2015	Baseline	March 2015
Eastern	2 044	6 017	43 066	74 997	341 022	369 741
Northern	7 606	26 807	166 104	291 455	983 332	835 542
Southern	1 607	5 093	70 788	115 038	588 784	550 634
Western Area	8 908	18 724	51 838	132 493	269 332	331 918
<b>Total</b>	<b>20 165</b>	<b>56 641</b>	<b>331 796</b>	<b>613 983</b>	<b>2 182 470</b>	<b>2 087 835</b>

Source: WFP estimates.

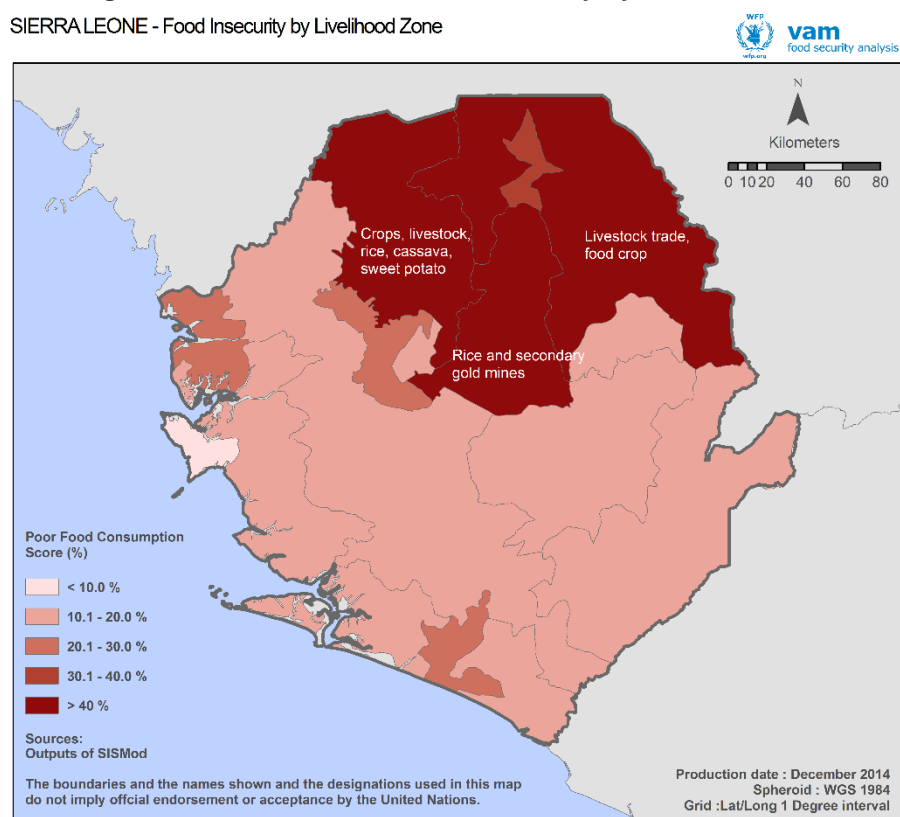
Table 9 and Figure 11 show the direction of food insecurity (as measured by a poor FCS) by main source of income based on estimates of the light version of the Shock Impact Simulation Model (SISMod – Light)<sup>18</sup>. All income groups, except the peri-urban Freetown areas, show an increase in food insecurity due to Ebola. According to the estimates, the livelihoods in the Northern Province will be hardest hit.

<sup>18</sup> WFP has developed a light version of the Shock Impact Simulation Model (SISMod-Light) to provide the most likely situations of the shock impacts on household food security. SISMod is an economic model based on the classical Agricultural Household Model (Singh 1986), in addition, covered a broader income generation module and a two-stage demand system – Linear Expenditure System (Stone 1954) and Linear Almost Ideal Demand System (Deaton 1986) to simulation household food consumption under the income effects and price effects. The detailed methodology can be found in the FAO/WFP 2014. Food price volatility and natural hazards in Pakistan: <http://www.fao.org/documents/card/en/c/9bbe0876-770b-4c97-8b52-c296ee94207d/>.

**Table 9: Sierra Leone - Estimated number of food insecure (percent of poor FCS of group total) by main source of income, end of 2014**

Main income source	Pre-crisis food insecurity (%)	Ebola driven food insecurity (%)
Cash crop, food crop, trade	<10	10-20
Crops, livestock, rice, cassava, sweet potato	<10	>40
Degradation, short cycle, root crops, trade, cassava, yam	<10	10-20
Fish and food crop	<10	10-20
Freetown Peri-urban	<10	<10
Livestock trade, food crop	20-30	>40
Rice and bowl area	<10	20-30
Rice and secondary gold mines	20-30	>40
Rice and trees	<10	10-20
Vegetable production area	10-20	30-40

**Figure 11: Sierra Leone - Food insecurity by livelihood zone**



Source: WFP SISMod-light.

## 6. RECOMMENDATIONS

### 6.1 Agriculture

Although the national level production impact of Ebola on food production is relatively small it masks the sub-national production and food security impacts. For example, impact at the district level production as high as -17 percent in Kailahun, the most affected district. Within that, some areas are likely to be harder hit than the others. Thus a targeted effort to re-establish farming system with provision of key farm inputs such as seed, fertilizer, and assistance for adoption of improved technologies, with stakeholder consultation and participation would be required to rebuild the community resilience. Awareness raising campaigns could contribute to reducing labour shortages due to fears of contagion. The Food Security and Livelihood Working Group of Sierra Leone

recommended that appropriate measures be taken to ease transportation of food commodities to markets and to re-open key periodic markets under safe healthy conditions.

## 6.2 Food insecurity

The analysis indicates that different type of food assistance will be required. In addition to covering the import gap, cash/voucher transfers can assure food access for people whose main livelihood is not agriculture. Given reductions in trader activity, local purchase in surplus areas can assure that surpluses are being redistributed.

### **Approach for estimating the number of food insecure, by province**

The model described below is designed to estimate the number of food-insecure people who are directly or indirectly affected by Ebola both currently and under possible future scenarios. It recognises that mostly indirect channels will be responsible for driving people into food insecurity because of the Ebola outbreak<sup>19</sup>. Indirect effects come about due to people's fear of contagion and the decisions of governments and private actors to close borders, seaports, airports and businesses. Behavioural changes and actions taken to reduce the spread of the virus have an impact on the movement of goods and people and will affect the availability and the prices of food in the markets. They also affect labour markets and people's livelihoods and, as a consequence, earnings. In other words, both food availability and food access can be subject to indirect effects. To this end, the model relies on data on the infection rate at province level, or their future projections, combined with pre-crisis data on food insecurity, market dependency and livelihoods.

Our projections are based on the historical spread of the disease in each province/district<sup>20</sup>. If a province has had no new cases in the last 42 days (two incubation periods), the situation is considered stable and inactive. It is assumed that the *average* rate of the weekly spread observed in the previous 42 days will continue until the end of the year in a given province. The infection rate is assumed to slow down considerably by January 2015. The date of the turning point is based on goals set up by the UN mission for Ebola Emergency response<sup>21</sup>. These plans are aligned with estimates by Centres of Disease Control and Prevention (CDC) on how rapidly the disease will start to reverse once efforts to control it are put in place. We also use the *rates* of decrease as estimated by CDC once the turning point is reached. According to these estimates, the reduction in the number of cases per week is around 13 percent once 60 percent of Ebola patients are hospitalized or in effective home isolation (by January–February in our model) and 24 percent once 70 percent are in such care (by March)<sup>22</sup>. Modifications to these assumptions do not significantly change our estimates of food insecurity caused by Ebola.

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<sup>19</sup> The World Bank notes in a report on Ebola that 80–90 percent of the economic impacts from pandemics are due to behavioural changes. See World Bank. 2014. *The Economic Impact of the 2014 Ebola Epidemic: Short and Medium Term Estimates for Guinea, Liberia, and Sierra Leone*, 17 September.

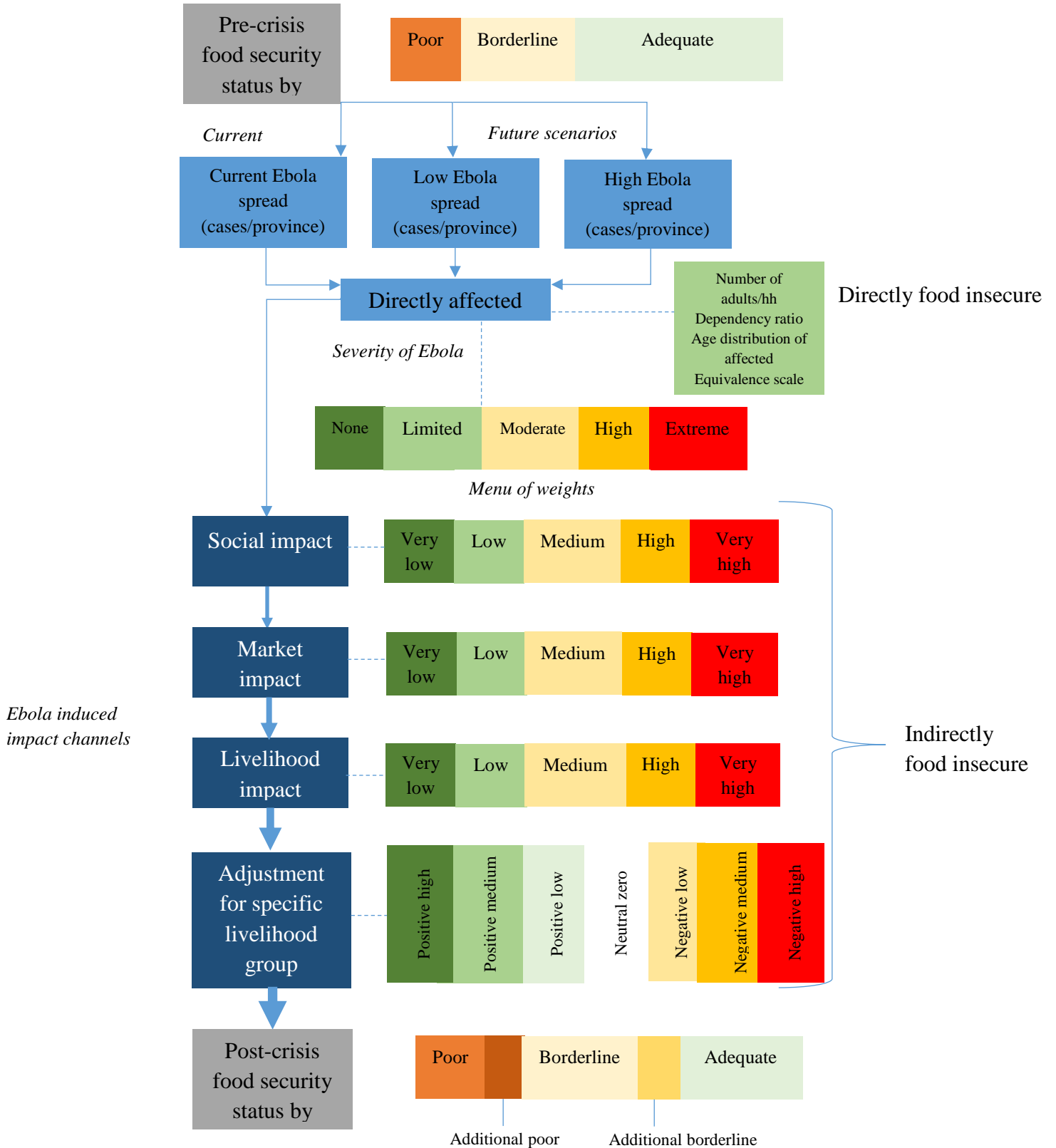
<sup>20</sup> The CDC has estimated the future spread. However, to be used for our purposes, information on hospitalization/isolation of Ebola patients on provincial/district levels would be required. See [http://www.cdc.gov/mmwr/preview/mmwrhtml/su6303a1.htm?s\\_cid=su6303a1\\_w](http://www.cdc.gov/mmwr/preview/mmwrhtml/su6303a1.htm?s_cid=su6303a1_w)

<sup>21</sup> See for example [www.un.org/ebolareponse/pdf/CNN\\_Nabarro.pdf](http://www.un.org/ebolareponse/pdf/CNN_Nabarro.pdf)

<sup>22</sup> The epidemic curve is likely to reach its peak when a lower number of patients are in effective care. However, the rate of decrease is slow (1.8 percent) as long as only half of patients are in effective care.



**Figure 12: Sierra Leone - Model for estimating food insecurity under Ebola**



**Estimating the directly food insecure**

We first estimate the number of people directly affected by Ebola. We use Ebola spread data by province under the current, low and high scenario projections. We assume that if a household member

is affected by Ebola, the whole household becomes food insecure. However, impact is scaled down if children or the elderly are affected as opposed to adults, who are likely to be the breadwinners<sup>23</sup>. We derive the number of directly food insecure by taking into account the population distribution of those affected, the average number of adults in a household and the dependency ratio in a given province.

***Estimating the indirectly food insecure***

The key components for estimating the number of indirectly food insecure people are described in the table below.

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<sup>23</sup> The equivalence scale that we use gives the weight 0.5 to a child (aged 0–15) and 0.7 to an elderly person (aged 60+).

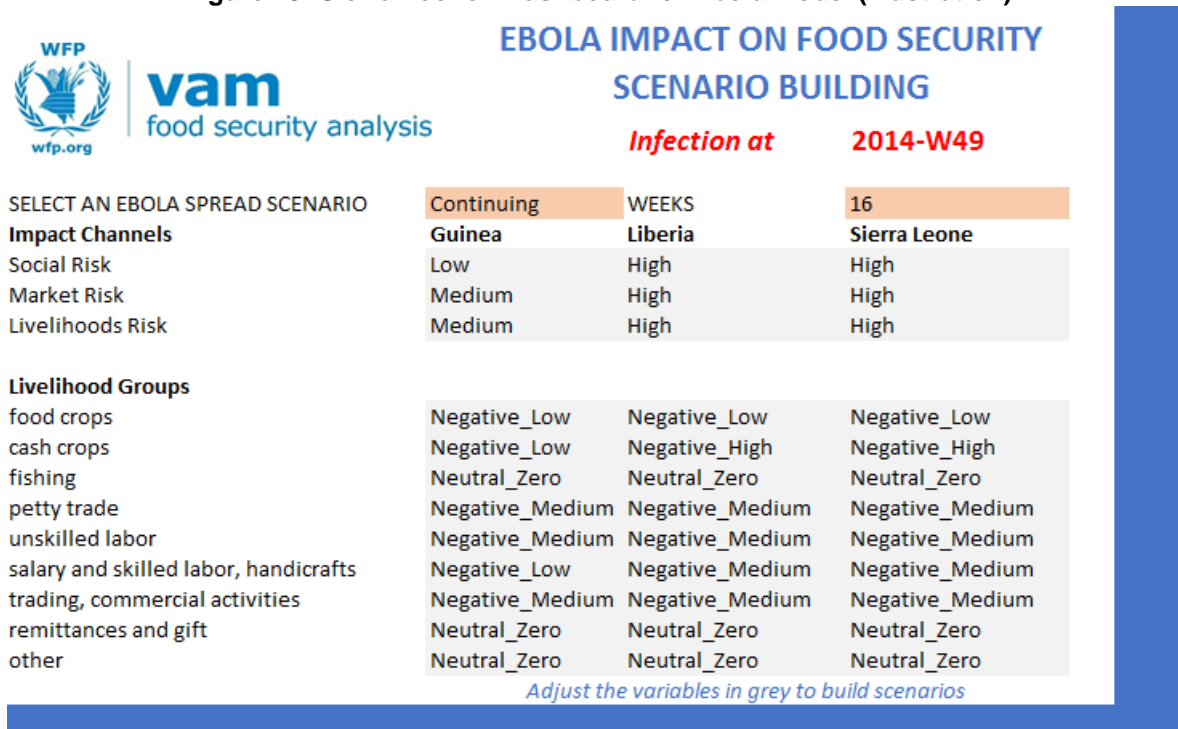
**Table 9: Sierra Leone - Key components for estimating the number of indirectly food insecure people**

Driving Factors	Description	Purpose
<b>Pre-crisis food insecurity</b>	The pre-crisis food insecurity as determined by the Food Consumption Score (FCS). For the purpose of the analysis, those with <i>poor</i> (as opposed to <i>borderline</i> or <i>acceptable</i> ) FCS are defined as food insecure.	The model allows transitions of this variable from <i>FCS borderline</i> to <i>FCS poor</i> and from <i>FCS adequate</i> to <i>FCS borderline</i> because of the Ebola crisis.
<b>Social impact</b>	The social impact is quantified by the infection rate at province/district level.	This is the first impact channel in the model and captures risk stemming from socio-behavioural changes caused by Ebola. The weights for social risk are combined with a growth factor depending on the severity of Ebola in a given province. The infection rate in a province provides a proxy for this impact – the higher the infection rate, the higher the social disruption.
<b>Market impact</b>	The percentage of households dependent on the market for cassava: while rice is the main staple, households use <i>gari</i> (cassava flour) as a substitute. When households run out of cassava, they have to rely on the market for their main staples.	With this variable, we capture the market impact of Ebola. Market dependency on cassava indirectly also takes into account the development of price patterns. Households who are dependent on markets for their food consumption are more affected by market disruptions. Market dependency varies depending on the season. This is the second impact channel in the model. The weights for the market impact are combined with a growth factor depending on the severity of Ebola in a given province.
<b>Livelihood impact</b>	The livelihood profile of the household. Nine livelihood profiles are defined: <i>food crops</i> <i>cash crops</i> <i>fishing</i> <i>petty trade</i> <i>unskilled labour</i> <i>salary and skilled labour, handicrafts</i> <i>trading, commercial activities</i> <i>remittances and gifts</i> <i>other</i>	This gives the livelihood impact for specific livelihood groups and is the third impact channel in the model.

A menu of impact weights, ranging from very low (1) to very high (5), are attached to each impact channel (Figure 12). These weights are then used to determine what proportion of people will shift from *FCS borderline* to *FCS poor* and from *FCS adequate* to *FCS borderline*. The impact weights for social risk reflect the severity of Ebola. The market risk is combined with social risk through another set of weights, not only taking into account the Ebola spread, but also the level of market dependency. If harvest failure or market disruptions lead to increasing food prices, this is reflected by a higher

weight attached to this impact channel. If such disruptions have a particular impact on some livelihood groups, the adjustment factors for those livelihood groups will be increased. For each livelihood group, adjustment factors ranging from *negative high (1)* to *positive high (7)* are used. The adjustment factor can also be *neutral zero*, which indicates that the livelihood groups are not affected by the Ebola outbreak. One such livelihood group could be households who depend on remittances. The dashboard where the weights can be selected is shown below.

**Figure 13: Sierra Leone - Dashboard for Ebola Model (illustration)**



**Limitations of the model**

The data-model has a few limitations: 1) the impact weights are subjective; 2) the data on food security was collected in June–July (Guinea, Sierra Leone) and May–August (Liberia) when, because of seasonality, relatively more people are food insecure; and 3) the baseline data on the level of food security is a few years old, so there may have been some changes in the food security profiles of the populations.