S P E C I A L   R E P O R T

FAO/WFP CROP AND FOOD SECURITY

ASSESSMENT - LIBERIA

17 December 2014

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HIGHLIGHTS

- The Ebola Virus Disease (EVD) outbreak, which has severely affected the country since the beginning of 2014, has seriously impacted on the agriculture and food sectors. The relatively high level of impact on food production, compared to Guinea and Sierra Leone, is primarily due to the much higher intensity of the disease transmission during critical periods of the crop cycle. The infections grew rapidly during the crop growth and harvesting periods.

- The aggregate food crop production in 2014 is estimated at 323 000 tonnes, about 8 percent lower than 2013, including 174 000 tonnes of milled rice production, about 12 percent below 2013.

- The sub-national level impact, such as in Lofa and Margibi counties hit hard by the disease, is much more severe , where losses of paddy crop are estimated as high as 25 percent.

- Liberia normally depends heavily (up to 80 percent) on food imports and at the estimated level of cereal production, the cereal import requirement in 2015 is set at 445 000 tonnes of cereals, about 24 percent more than the average of the previous five years Rice import requirements account for about 350 000 tonnes of the total.

- Commercial imports of cereals are anticipated to remain at average levels of 380 000 tonnes, leaving an uncovered gap of about 90 000 tonnes for which urgent additional resources and international assistance is required. The significant impact of Ebola on the country's export earnings is likely to compromise its ability to cover the country's cereal gap.

- Trade activities have slowed significantly across the country with about 77 percent of traders interviewed during the Rapid Assessment (from late September to mid-October) reporting that traded volumes were significantly lower compared to 2013. Border closures, quarantine measures and other restrictions have seriously disrupted marketing of goods including agricultural commodities. However, trading activities have shown some signs of recovery in late November/December with the reopening of some weekly markets as reports of disease incidence rates decreased.

- The price of imported rice in Liberia has increased during several consecutive months, spiking well above usual seasonal patterns. Prices stabilized in November 2014 but remained higher than a year earlier in most markets. Prices of imported rice have also increased due mainly to exchange rate depreciation.

- EVD has had a substantial impact on employment activities throughout the country on all livelihood groups while at the same time not being disproportionally worse in high EVD counties. While this is the case, findings from remote surveys undertaken by WFP (mVAM) suggest that the lowest wage rates are to be found in Lofa, one of the first areas to be affected by EVD in Liberia. The wage-to-local rice terms of trade is also lower in Lofa compared to rest of the country.

- In November 2014, about 630 000 people, or 14 percent of the population, are estimated to be severely food insecure of which the EVD impacts account for 170 000 people. The number of food insecure is projected to increase to 750 000 by March 2015, of which 290 000 people are due to EVD. Rural areas account for about 76 percent of the EVD related food insecurity. Among income groups, food crop producing households, fishermen, hunters and unskilled labourers are the most food insecure.

- The analysis indicates that varying types of assistance will be required in addition to covering the uncovered food import gap, including cash/voucher transfers where appropriate to assure food access for people whose main livelihood is not agriculture.

- Although the incidence of disease has declined in recent months, food security monitoring activities must continue as there is still a risk of a flareup.

OVERVIEW

Liberia has been one of the most affected country by the Ebola Virus Disease (EVD) epidemic. The infection rates started at fairly low level but grew rapidly. The epidemic started to spread when crops were being planted and expanded during the crop maintenance period and expanded rapidly during the critical harvesting period for the staple crops rice, maize and cassava. According to the World Health Organization (WHO) the incidence rate is now decreasing. As of 12 December 2014, the number of cumulative cases of disease transmission has reached 7 719 cases with 3 177 reported deaths.

FAO and WFP, in collaboration with the Government and other partners have 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 primarily through rapid assessment. 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, and the analysis of 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 323 000 tonnes (including cassava in cereal equivalent and rice in milled terms), about 8 percent lower than the harvest of 2013. Of this total, milled rice production (using the milling rate of 66.7 percent) estimated at 174 000 tonnes, about 12 percent below the level year before, accounts for bulk of the cereal production. Cassava production in cereal equivalent (32 percent of fresh weight) is estimated by applying 4 percent reduction factor, resulting in 149 000 tonnes.

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.

Liberia is a highly import dependent country. At the estimated level of cereal production, and assuming some small stock build up, cereal import requirement in the marketing year 2015 (calendar year) is set at 445 000 tonnes of cereals including 350 000 tonnes of rice, 67 000 tonnes of wheat and 28 000 tonnes of maize based on the historical consumption preferences of the population. The total cereal import requirements are 65 000 tonnes higher than the quantities imported during 2014 and are similar to the year before.

Given the forecast drop of growth in GDP due to Ebola from 5.9 percent to 2.2 percent (World Bank study) and a significant drop in cash crop export earnings, the commercial imports of rice (at 300 000 tonnes) and wheat and maize (at 55 000 tonnes) are anticipated to remain at the average of the previous two years, leaving about 90 000 tonnes of uncovered gap to be covered with international food assistance and/or additional budgetary allocation by the Government.

EVD has affected the functionality and access to markets, notably in severely affected counties. However, trade activities show signs of recovery. Weekly markets are reopening: in a survey of 600 traders across Liberia, 90 percent reported that weekly markets were open during the week of November 17; still almost 40 percent at a reduced level.

The price of imported rice in Liberia has increased during several consecutive months, spiking well above usual seasonal increases. In October 2014, the increase reached around 40 percent compared to the beginning of the year.

EVD has had a substantial impact on employment activities throughout the country on all livelihood groups while at the same time not being disproportionally worse in high EVD counties. While this is the case, findings from remote surveys undertaken by WFP (mVAM) suggest that the lowest wage rates are to be found in Lofa, one of the first areas to be affected by EVD in Liberia. The wage-to-local rice terms of trade is also lower in Lofa compared to rest of the country.

Based on the WFP model, the number of severely food insecure is estimated at 630,000 individuals in November 2014 – 170 000 of these are food insecure because of EVD. The number of individuals vulnerable to food insecurity is estimated to be 1.1 million. In March 2015, 750 000 individuals are estimated to be severely food insecure; the EVD effect accounts for 290 000. In addition, 1 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 Liberia has been steadily increasing at high rates of 11 to 14 percent (See Table 1) since 2007. This steady growth has been largely attributed to the growth in the mining and rubber industries which have been rejuvenated after the end of the second Liberian civil war, 1999-2003. However, the GDP per capita in 2013, adjusted for the Purchasing Power Parity was low at USD 878 as compared to about USD 2 000 average for the Sub-Saharan Africa, making Liberia one of the poorest countries in the world. In 2013, the country was ranked nearly at the bottom (175th) out of 187 countries on the United Nations Development Programme's (UNDP) Human Development Index[1].

Historically, the Liberian economy has depended heavily on foreign direct investments including foreign aid and exports of natural resources. According to the African Development Bank, foreign direct investment in mine construction and exports are expected to contribute to even faster GDP growth in the near future. In the past five years, Liberia has been one of the 20 fastest growing economies in the world[2]. However, like most sub-Saharan economies, its exports are dominated by raw materials rather than value added or processed commodities. The principle exports include iron ore, rubber, gold, as well as timber.

Table 1: Liberia - Key economic indicators, 2009 to 2013

	2009	2010	2011	2012	2013
Overall GDP	**866**	**960**	**1 048**	**1 155**	**1 286**
GDP (million USD)	14	11	9	10	11
GDP growth (annual %)	623	675	729	796	878
GDP per capita, PPP (USD)	9	7	6	7	9
GDP per capita growth (annual %)	-	-	-	-	-
Agriculture sector	**564**	**611**	**642**	**666**	**-**
Value added (million USD)	14	8	5	4	-
Value added (annual % growth)	58	45	45	39	-
Value added (% of GDP)	-	-	-	-	-
Trade	**562**	**631**	**676**	**714**	**-**
Imports of goods and services (million USD)	163	172	177	182	-
Exports of goods and services (million USD)	-399	-458	-499	-532	-
Trade balance: deficit(-)/surplus(+)	-277	-415	-756	-	-
Current account balance (million USD)	866	960	1 048	1 155	1 286

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

The Ebola outbreak escalated the fastest in Liberia and led to a sharp disruption of economic activities mainly based on changes of behaviour due to fear. In 2014, the foreign direct investments slowed down due to the Ebola outbreak and the GDP is expected to suffer. The World Bank has estimated the growth rate to drop from 5.9 percent to 2.2 percent[3]. All sectors have been affected especially the agriculture and the services which are the two largest contributors to the economy.

1.2 Agriculture

Majority of the population is reliant on subsistence agriculture and while the country is richly endowed with water, mineral resources, forests, and a climate favourable to agriculture, it lags in productivity compared to other countries due to poor human capital, infrastructure, and instability. The population is mostly urban as many farmers deserted rural areas during the civil war. This along with a high specialisation in export crops, has contributed to Liberia's heavy reliance on imported food. The

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[1] UNDP: 2014 Human Development Report.
[2] IMF: Country Report No. 10/373, December 2010.
[3] World Bank: Update on the Economic impact of the Ebola epidemic on Liberia, Sierra Leone and Guinea, 2 December 2014.

country relies on imports over domestic utilization is an alarming 73 percent). Food commodities, mainly, rice, and wheat at import levels of about 365 000 tonnes and 56 000 tonnes (2013 estimates), respectively, make up the bulk of agricultural imports. The share of agriculture in GDP has been steadily falling at high rates of 58 - 39 percent furthermore the annual growth of agriculture has been falling significantly i.e. 14–4 percent (see Table 1.). The shrinking of the agriculture sector could be partially attributed to the country's largely urban population who are increasingly engaging in the services sector (trade and hotels, Government services, real estate, transport and communication, and construction[4]).

Table 2: Liberia – Cash crop commodity exports, quantity and value, 2011

	Quantity (tonnes)	Value (million USD)
Coffee	449	1
Palm oil	1 847	2
Rubber	70 339	273
Cacao beans	13 791	37
Other	1 972	1

**Figure 1: Liberia - Share of commodity exports
(in total cash crop export of USD 313 million in 2011)**
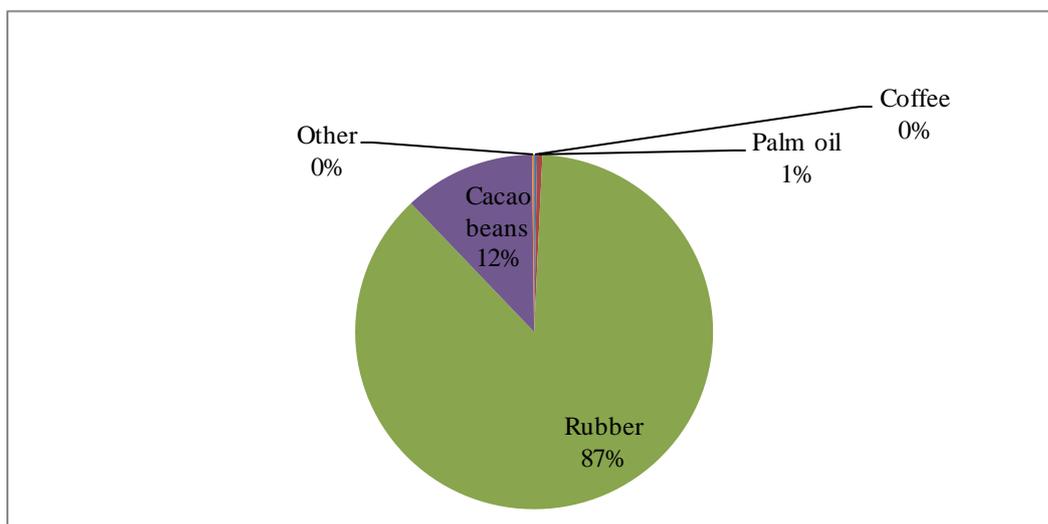
Source: FAOSTAT, 2011.

Rice is by far the most significant crop and it is grown on more than 90 percent of all cereal cropped area. Cassava is also grown and is the major substitute. In addition Liberia also grows cash crops, particularly cacao beans, coffee and rubber which make up the bulk of the country's agricultural exports. Rubber exports are by far at the top of the list at about 87 percent of total cash crop exports (using 2011 data) followed by cacao beans at 12 percent (Table 2 and Figure 1).

2.   CROP PRODUCTION IN AGRICULTURAL SEASON 2013/14

2.1   Impact of Ebola on crop production

There are direct and indirect as well as bevioural 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 kuu system (group/team work), etc.

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[4] African Development Bank Group: Liberia Country Strategy Paper 2013-2017, June 2013.

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 Liberia Joint Rapid Food Security Assessment was conducted in the 15 counties of the country by the Government of Liberia (LISGIS, MoA), FAO, WFP, and ACF, between the 27th September and 12th October 2014. Sites visited were selected based on their level of affection and a control area was used as reference (non-affected). Information was gathered through focus group discussions using key informants (community leaders, women, youth, traders, local administration, CAC, DAO, Food Security NGOs, Producers groups, Agriculture Associations and local Ebola Task Force. Key informants were selected based on their potential knowledge on assessment subjects.

The assessment interviewed a total of 301 key informants and 298 market informants. This limited sample does not make the assessment representative but provides a solid indication of trends and dynamics of the current situation and the impact of EVD, and can therefore guide the response option discussion for relevant stakeholders.

In counties severely affected by EVD: Lofa, Margibi, Bomi, Bong, Nimba, and Grand Cape Mount and Grand Bassa:

- These counties are situated in the North and Central area of the country where the main planting season for rice goes from April to June and the main harvest starts in October. Despite good weather conditions, preliminary estimates indicate that rice production is below normal levels, with a decrease of up to 25 percent in most affected districts in Lofa and Margibi. This was caused mainly by the limited maintenance of the fields (weeding and fencing) during the growing season, because of quarantine measures and restrictions on group work, called "Kuu". The "Kuu" system was however used for the planting season before the peak of the outbreak, and is being used with caution for the harvest currently under way. Cassava production is slightly below normal but less affected.
- Communities in most affected counties have been quarantined for nearly eight weeks, but this measure has been progressively released since mid-September. Household incomes have decreased as border closure, quarantines and market disruptions have affected sale of agricultural products, while sale of bush meat was banned, and affected petty trade and commerce as well. Financial capital of women savings and loans groups have also been drastically affected as members were not able to pay back their loans. Most of the vegetable production for sale takes place in these counties as they are well connected to Monrovia, but because of road blockades the sale prices dropped, resulting in loss of income. Communities report reduced portion and frequency of meals as coping strategies. Households are also affected by health issues such as malaria as all personnel was deployed for EVD treatment.
- Livestock was affected by the closure of the border through lack of feeding and limited restocking.
- These counties are mainly supplied by Monrovia for imported goods, but cross-border trade is also important for both purchase and sale. International borders have been closed since late July and weekly markets have been closed for nearly ten weeks in most affected counties. These counties also indicated to suffer from quarantines measures (e.g. road blocks), which limited supply and increased transportation costs. Prices of food items have slightly increased, including imported rice, which can also partially be attributed to the depreciation of exchange rate between the Liberian Dollar and the USD. Household financial access to food was further limited due to the loss of income.

In counties less affected by EVD: Gbarpolu, Grand Gedeh, Grand Kru, Maryland, River Gee, River Cess, Sinoe:

- These counties are situated in the East and Southern area where the main harvest for rice starts earlier as in the North, in August, and the lean season is slightly longer. The harvest was almost completed at the time of the survey and the Kuu had not been disrupted. However communities expected lower than usual production, because of bad weather conditions with heavy rains, which affected both farming and fishing.
- There were no quarantine measures implemented in these counties, but starting from early August they have been affected by border closure as most of their exchanges take place with Côte d'Ivoire. This has limited market outlets for farmers resulting in loss of income, together with income from trade activities and sale of bush meat. Households have also been indirectly affected by disruption of health systems as all personal was deployed for EVD treatment.
- The market system has been highly affected by indirect effects of EVD combined to structural issues. The Southern counties are not well connected to Monrovia, with no paved road as of Grand Gedeh County, which isolates them further from Monrovia during the rainy season, starting in June-July. With the border with Ivory Coast closing in August, market supply became limited as quarantines and road blockades were implemented on the first part of the road from Monrovia, and then trucks remained swamped in the mud starting in Grand Gedeh, and as a result prices rose together with transportation costs. In Maryland and Sinoe, some price increases were observed, both for food (rice) and non-food (gasoline, diesel and cement) items5. Household access to food was further limited by loss of income.

2.1.2   The Disease Impact on Agriculture Simulation (DIAS) Model

To simulate theoretical impact of EVD an Excel based model is developed. The model takes into account the following five components, as described in the 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, the actual cases per 100 000 were converted to a percentage of population (and thereby farm labour) that may be considered affected.

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

Disease Impact on Agriculture - Simulation (DIAS) Model
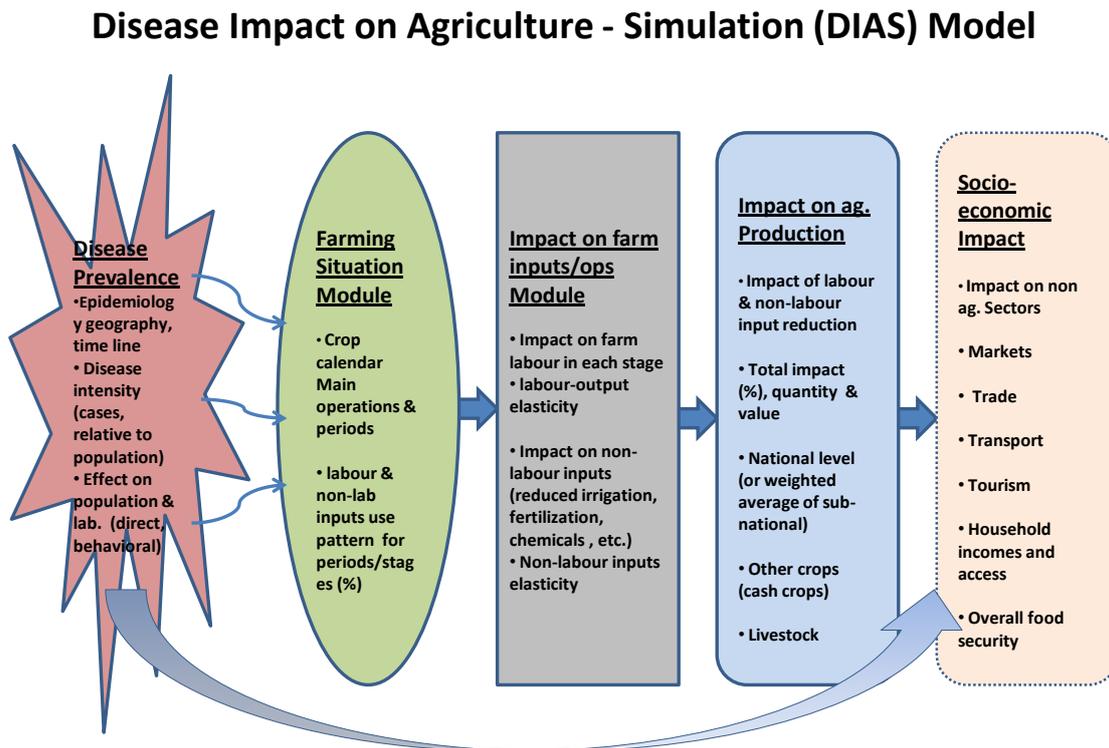
The second most critical set of information is about farm input elasticies and input use patterns. For example, the labour elastcities of production (0.5 for rice, 0.47 for maize and 0.3 for cassava) and the labour use pattern (38:38:24 for rice, 59:35:6 for maize and 28:46:26 corresponding to three 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 elesticities. 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 11.6 percent for rice and 4.7 percent for Cassava. 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 Liberia, the production of the main staple crop rice would be lower by 12 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 harvest paddy for this year is estimated at 262 570 tonnes, with a potential loss of about 34 620 tonnes of paddy.

The relatively high level of impact as compared to the other two countries affected by EVD, namely Guinea and Sierra Leone, is primarily due to the much higher intensity of the disease transmission. The infections grew rapidly during the crop growth and harvesting periods of the crop cycle.

The sub-national level impact is even much higher in the counties hit hard by the disease, such as Lofa and Margibi, where losses of paddy crop are estimated in the order of 20 percent and three others, Bomi, Bong, Monte Serrado, above national average.

Cassava being much less labour and input intensive crop, the impact on its harvest is estimated to be lower at 5 percent at the national level, ranging from 1 percent in Grand Gadeh to over 7 percent in Lofa and Margibi counties. It should be noted, however, that cassava roots can remain under ground and can be harvested as and when needed, hence the reduced harvest this year should not, necessarily be equated with the potential production of the commodity.

Although the model produces results of with Ebola situation compared to without Ebola situation, the results are still 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: Liberia - Impact of Ebola on 2014 crop production

County	2012 Production (tonnes)	Simulation Model 1/ (percent)	2014 Production estimate (tonnes)
Rice (Paddy)			
Bomi	7 570	-12.0	6 661
Bong	62 370	-12.8	54 372
Gbarpolu	16 140	-3.4	15 588
Grand Bassa	15 500	-7.6	14 329
Grand Cape Mount	9 140	-4.4	8 741
Grand Gedeh	13 000	-3.1	12 601
Grand Kru	10 420	-6.2	9 771
Lofa	52 660	-20.0	42 130
Margibi	7 710	-19.6	6 203
Maryland	9 200	-3.2	8 906
Monteserrado	7 570	-16.8	6 295
Nimba	63 080	-7.8	58 188
River Ghee	5 230	-5.6	4 939
River Cess	9 100	-5.2	8 623
Sinoe	8 500	-3.9	8 165
National production 2/	**297 190**	**-11.6**	**262 570**
Cassava			
Bomi	14 530	-4.9	13 818
Bong	71 660	-4.7	68 263
Gbarpolu	14 050	-1.1	13 901
Grand Bassa	37 080	-3.1	35 949
Grand Cape Mount	17 910	-1.5	17 642
Grand Gedeh	20 400	-0.9	20 210
Grand Kru	28 500	-2.0	27 920
Lofa	39 300	-7.3	36 422
Margibi	21 440	-7.3	19 870
Maryland	32 450	-1.0	32 133
Monteserrado	21 440	-6.5	20 056
Nimba	103 860	-3.2	100 582
River Ghee	20 340	-2.4	19 862
River Cess	20 500	-2.3	20 037
Sinoe	21 730	-1.3	21 438
National production 2/	**485 190**	**-4.7**	**462 584**

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 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.

2.2.1   Rainfall

In comparison to the dramatic ecological differences within other countries, Liberia has only moderate variation in ecology, rainfall patterns and hazards across its various agro-ecological zones. The country normally enjoys abundant rainfall and does not suffer from drought like in Sahel countries. As in recent years, rainfall in 2014 was adequate for normal crop development. Figure 3 shows estimated rainfall for Nimba, Lofa, Bong and Sinoe counties which together contribute about 60 percent of national rice production. Estimated rainfall exceeded or is similar to last year's level for most dekads. Rainfall was also similar to average in general. However, above-average precipitation was recorded in parts in September and early October, the beginning of the harvesting period, raising concerns about both crop yield and quality. Rains were particularly abundant in Lofa and Bong counties.

Figure 3: Liberia - Estimated rainfall in Nimba, Lofa, Bong and Sinoe cropping areas
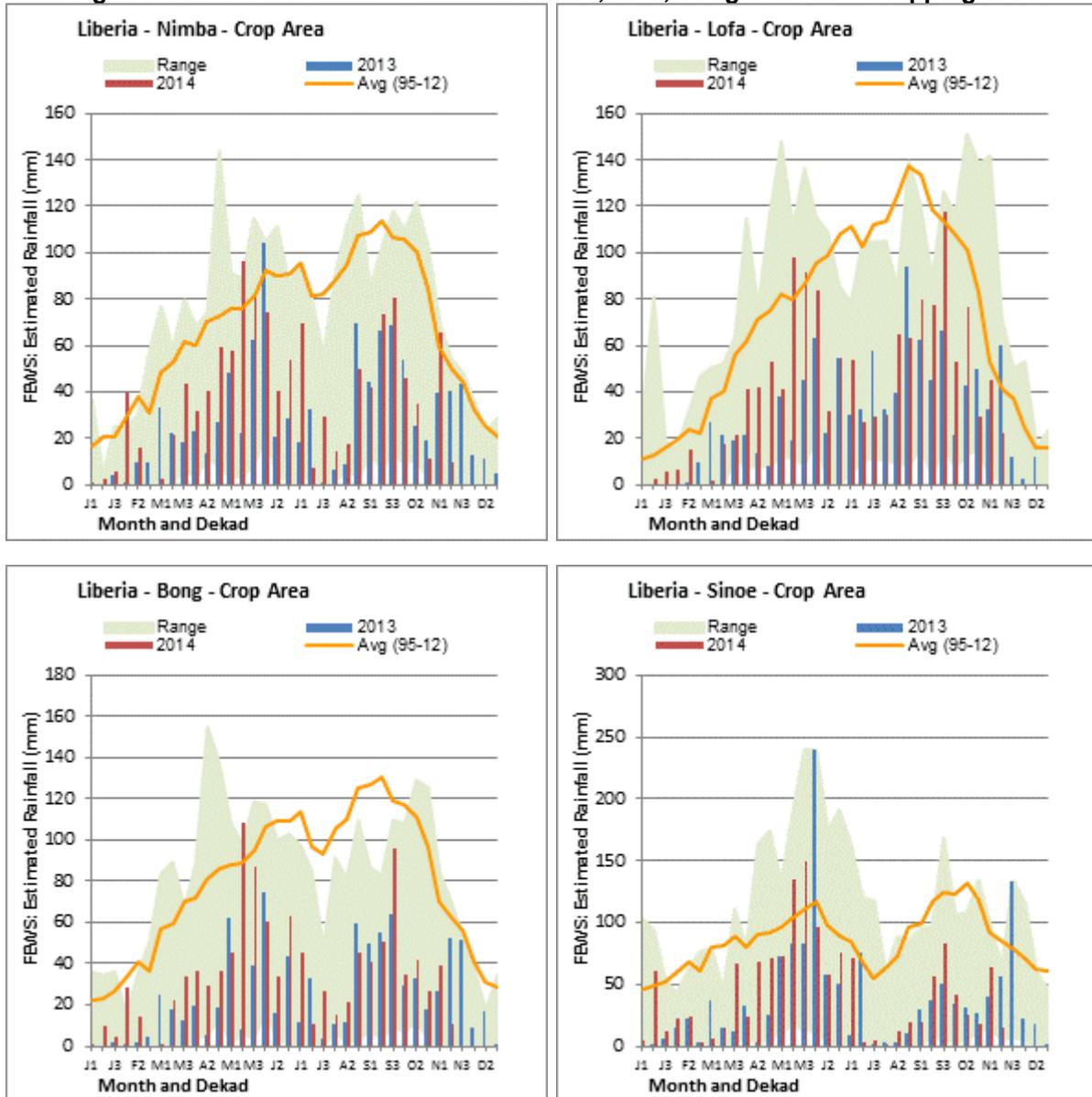
2.2.2   Seeds and other inputs

Liberian farmers commonly use their own seed saved from the previous year's harvest and use of commercial fertilizers, pesticides or herbicides is limited. This year is no exception. Overall seed availability was adequate following the 2013 average harvest. Labor 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. Planted area was not affected due to the timing of the outbreak.

2.3   Conclusions

Table 4: Liberia - 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) 1/
Rice (milled) 2/	36	15
Cassava in cereal equivalent 3/	19	2
Total	**55**	**17**

1/ 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, approx. USD 100/tonne; small grains (sorghum, millets, others) approx. USD 100/tonne.
2/ Milling rate of 66.7 percent.
3/ 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 borders and high restrictions of international movement of commodities. These aforementioned factors have decreased trade flows and also caused the cost in transportation to double. Rubber makes up for a significant part of export commodities and were initially expected to be about USD 148 million in 2014 but are estimated to drop by 20 percent[5]due to the impact of the epidemic. 20 percent is an estimated loss of roughly 30 million which is a substantial amount for a country with a low GDP such as Liberia. Palm-oil cross-border trade has been affected and large investments in palm oil planting have also been scaled down and this is likewise most likely to result in lower palm oil production in 2014.

Prior to the epidemic, Liberian exports have been steadily increasing from 163 million to 182 million but as evidenced from the impact on cash crops particularly rubber exports the total exports in 2014 are likely to fall significantly.

2.5   Livestock

Key informants from Bong, Nimba, Margibi, and River Cess reported that poultry farming has been affected by the closure of borders. This can be explained by the impossibility for Rural Liberian poultry farmers to import feeds. For example the Rural Women structure in Melekie, Bong County has a poultry that cannot be restocked presently due to border closure (major source of feeds and chicks comes from Ivory Coast). This situation requires close monitoring as the ability for poultry value chain to recover does not seemed to have an alternative if border remains closed indefinitely.

Veterinary technical staff are not present in most counties, many farmers administer vaccines to their livestock based on the advised of vaccine dealers. The few Veterinarian technical staff of the MoA stopped routine vaccine activities long before EVD outbreak. The outbreak further exacerbated the situation when quarantined measures and travel restrictions were placed on many communities thus preventing the technical staff to perform as usual. This may result in higher mortality for the cattle over the next months if situation remains the same.

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 5. In preparing the balance sheet, the following assumptions are made:
a. **Population:** The total national population in 2013 was 4.294 million (UN Population Division estimates cited in FAO/CCBS). Using the implicit annual growth rate of 2.4 percent from the same source, 2015 population is estimated at 4.503 million for the purpose of this report.

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[5] World Bank: The Economic Impact of the 2014 Ebola Epidemic, 17 November 2014.

b. **Food consumption:** Based on the last five year average from the FAO/CCBS, the annual per capita consumption of 125 kg of cereals, including 106 kg of milled rice, 14 kg of wheat and 5 kg of maize is assumed to be the level of consumption during 2015. In addition, given that cassava forms an important part of the national diet, 75 percent of production of cassava (i.e. about 25 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 oil and oil seeds, pulses, sweet potatoes, vegetables, fruits, poultry, meat,and other items.

c. **Feed use:** There is no reliable information on the use of grain for feeding animals and reportedly grain use for this purpose is limited.

d. **Seed requirements:** These are calculated by using the most commonly used per hectare seed rates of 65 kg for rice together with the projected areas to be planted based on the trend of past five years. No significant amount of cultivation of other crops is reported.

e. **Post-harvest losses and waste:** There is no country specific information on the losses. Hence, 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 25 percent for cassava of production including handling and storage losses are used.

f. **Opening and Closing Stocks –** For lack of the reliable data on stock levels, it is assumed that there will be no significant differences in the beginning and the ending stock levels.

Table 5: Liberia - Food balance sheet for marketing year 2015 ('000 tonnes)

	Rice (milled) 1/	Maize	Wheat	Total cereals	Cassava C.E. 2/	Total cereal equivalent
Domestic availability 3/	**174**	**0**	**0**	**174**	**149**	**323**
Production	174	0	0	174	149	323
Total utilization	**524**	**28**	**67**	**619**	**149**	**768**
Food use	477	23	63	563	112	675
Seed requirement	15	0	0	15	0	15
Post-harvest losses and waste	26	0	0	26	37	63
Stock build-up (+)/draw-down(-)	**6**	**5**	**4**	**15**	**0**	**15**
Import requirements	**350**	**28**	**67**	**445**	**0**	**445**
Anticipate commercial imports	300	15	40	355	0	355
Uncovered deficit	50	13	27	90	0	90

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 323 000 tonnes of cereals (including rice in milled and cassava in cereal equivalent terms). The total utilization is estimated at 768 000 tonnes, leaving an import requirement of 445 000 tonnes of cereals, including 350 000 tonnes of rice, 67 000 tonnes of wheat and 28 000 tonnes of maize based on the historical consumption preferences of the population. The total cereal import requirements are 65 000 tonnes higher than the quantities imported during 2014 and are similar to the year before.

The impact of Ebola on the country's export earnings is likely to be significant, compromising the ability of the country to pay for the increase in cereal import requirements. Given the forecast for lower GDP growth down by 3.7 percentage points (from 5.9percent to 2.2 percent, according to a World Bank study[6]) and a significant drop in cash crop export earnings, the commercial imports of rice (at 300 000 tonnes) and wheat and maize (at 55 000 tonnes) are anticipated to remain at the average of the previous two years.

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[6] World Bank: Update on the Economic impact of the Ebola epidemic on Liberia, Sierra Leone and Guinea, 2 December 2014

Figure 4: Liberia – Cereal imports ('000 tonnes)
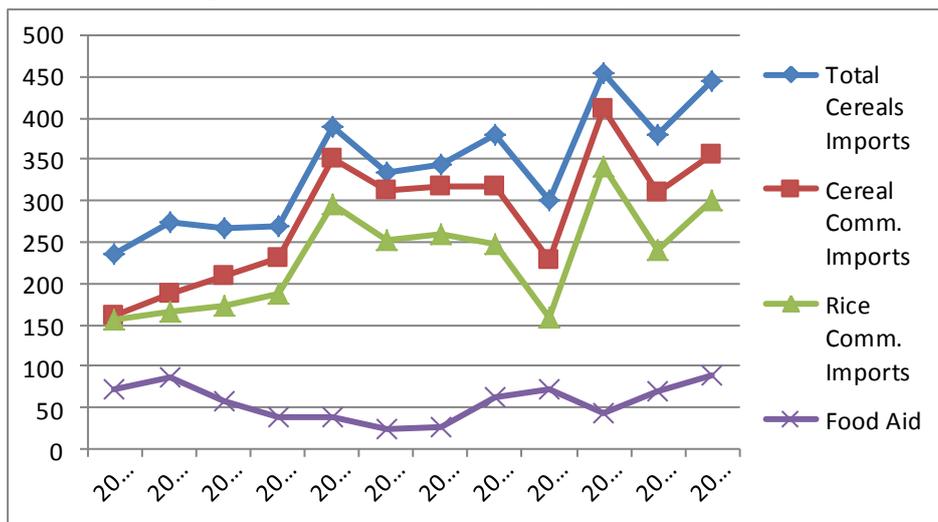
Historically, the total cereal import requirement is met through commercial imports and some food aid (see Figure 4). The assumed level of commercial import level, leaves about 90 000 tonnes of uncovered gap to be filled with international food assistance and/or additional budgetary allocation by the Government. This level of food assistance is about 20 000 tonnes higher than in 2014 and almost at the level of a historical high food aid 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. MARKETS

4.1 Prices and trader activity

The price of imported rice in Liberia has increased during several consecutive months, spiking well above usual seasonal increases (Figure 5). Prices on imported rice have been influenced by exchange rate depreciation. There is significant spatial price variation; prices are statistically significantly lower in Monrovia compared to the rest of the country and higher in the eastern counties. Prices are highest in Lofa, where the EVD outbreak started[7].

Many weekly district markets in border areas used to be officially closed, including Foya market in Lofa, Ganta Market in Nimba and Bo-waterside in Grand Cape mount[8]. Because of the stabilization of the situation some of these have reopened. Based on a survey of 600 traders across Liberia, FEWSNET reports that over 90 percent of traders stated that weekly markets were open during the week of 17 November[9]. However, almost 40 percent of these reported that weekly markets operated at reduced levels In Lofa, as many as 57 percent of the traders reported reduced market activities. More than 40 per cent of the traders also reported lower than normal stock levels in four counties on the border to Guinea or Sierra Leone (Lofa, Bong, Nimba and Gbapolu) and in one county in the south (Grand Kru). Restricted movement and transportations costs were cited as the most frequent trade barriers.

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[7] World Bank, LISGIS, Gallup 2014. The socio-economic impacts of Ebola in Liberia. Results from a high-frequency cell phone survey, 19 November 2014.
[8] WFP 2014. West and Central Africa Markets Update: Special Issue on the Ebola Outbreak, 29 September 2014.
[9] FEWSNet. Liberia Market Bulletin, 9 December 2014.

Figure 5: Liberia - Prices for imported rice 2014 compared to the four-year average and 2013

Imported Rice - Montserrado (Red Light)

Imported Rice - Lofa (Foya)

Imported Rice - Nimba (Saclepea)

Imported Rice - Grand Bassa (Buchanan)
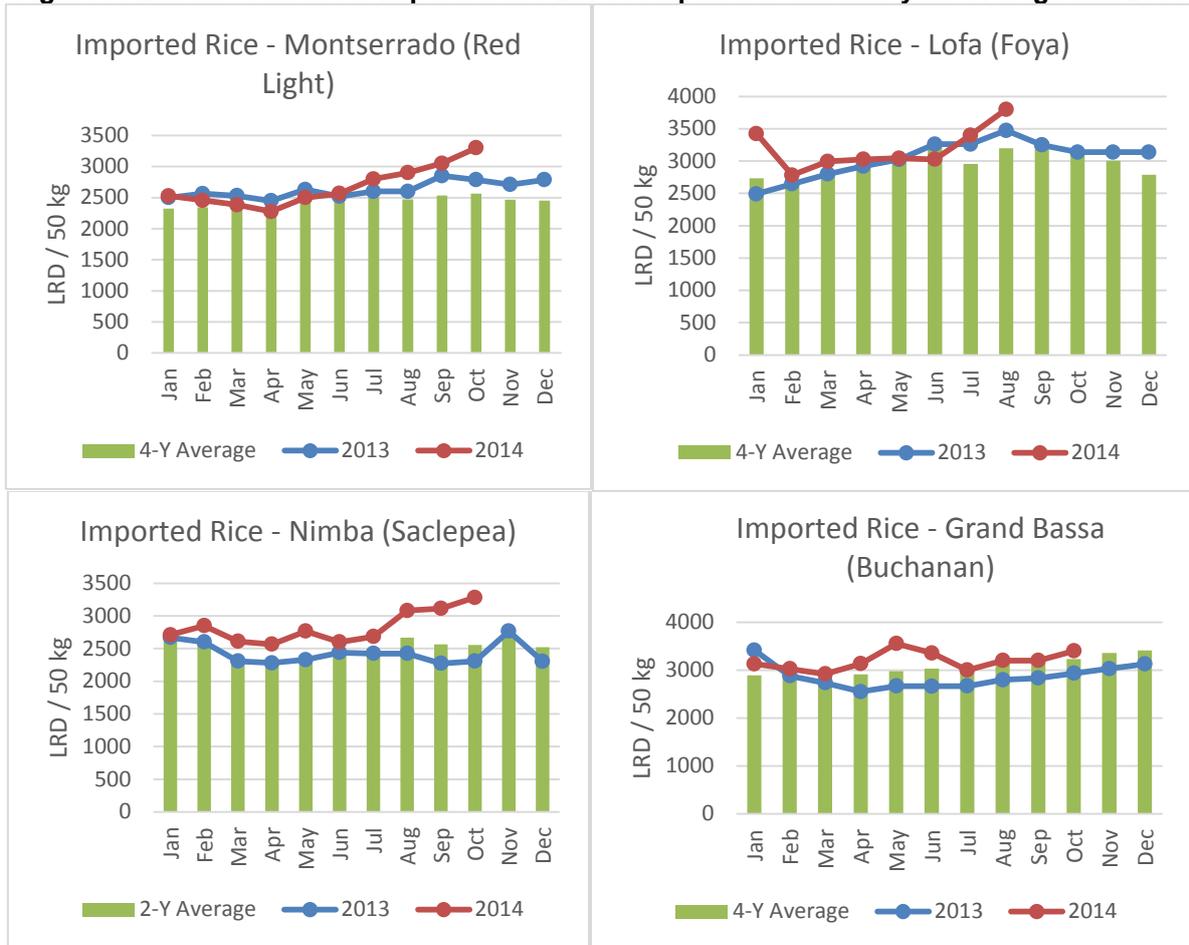
Source: WFP.

4.2   Incomes, purchasing power and livelihoods

EVD has had a substantial impact on employment activities throughout the country while at the same time not being disproportionally worse in high EVD counties. These findings are based on two rounds of a mobile-phone survey in October and November 2014 carried out by the World Bank, the Liberian Institute of Statistics and Geo-information Services (LISGIS) and the Gallup Organization to study the socio economic impacts of EVD in Liberia[10]. The survey used the same sample as the LISGIS Household Income and Expenditure Survey and was compared to baseline data collected from February to August. Closures imposed by the government and other policies to contain and reverse the spread of EVD are in place across the country, impacting most areas. In urban areas, of those working at the baseline stage, as many as 45 percent in the first round and 53 percent in the second round reported that they were not working anymore. The impact was seen both among wage employees and self-employed people. The self-employed experienced the largest decline in work with the closure of markets in which they operate.

In rural areas the impact in October was seen in all broad sectors: wage, self-employment and agriculture. In November, rural areas saw a substantial return to farming as this round coincided with the beginning of the harvest for many areas. When all employment groups are taken together, 36 percent of those working at baseline did not work in round 1. The corresponding number for round 2 was 31 percent. Of those working in agriculture at the baseline stage, 15 percent reported that they were not working in November. However, 80 percent of these indicated that someone in the household was farming, suggesting that generally farms have not been abandoned by households.

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[10] World Bank, LISGIS, Gallup 2014. The socio-economic impacts of Ebola in Liberia. Results from a high-frequency cell phone survey, 19 November 2014. This survey was carried out based on the nationally representative Household Income and Expenditure Survey implemented from February to August 2014 by the Liberian Institute of Statistics and Geo-information Services (LISGIS).

Figure 6 shows transitions in and out of work for the two survey rounds, indicating that overall the job loss was greatest for the self-employed and wage labourers.

Figure 6: Liberia - Transitions in and out of employment by sector in October and November 2014
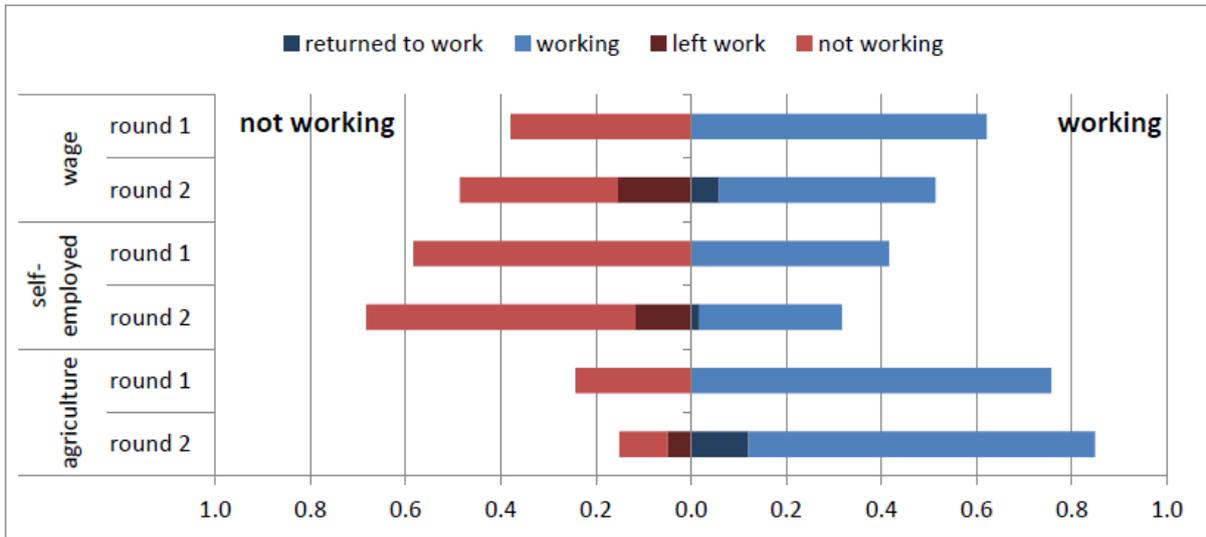
Source: World Bank, LISGIS, Gallup 2014. The socio-economic impacts of Ebola in Liberia. Results from a high-frequency cell phone survey, 19 November 19 2014.

Findings from remote surveys under-taken by WFP (mVAM)[11] suggest that the lowest wage rates are to be found in Lofa, one of the first areas to be affected by EVD in Liberia (Figure 7). With the exception of the Western Area, the wage rates do not show large movements between October and November. The wage-to-local rice terms of trade show slight improvements (Figure 4), reflecting falling prices of local rice in line with seasonal trends. Also in terms-of-trade Lofa remains the poorest area in Liberia.

Figure 7: Liberia Wage rates LRD/day manual labour, October and November 2014
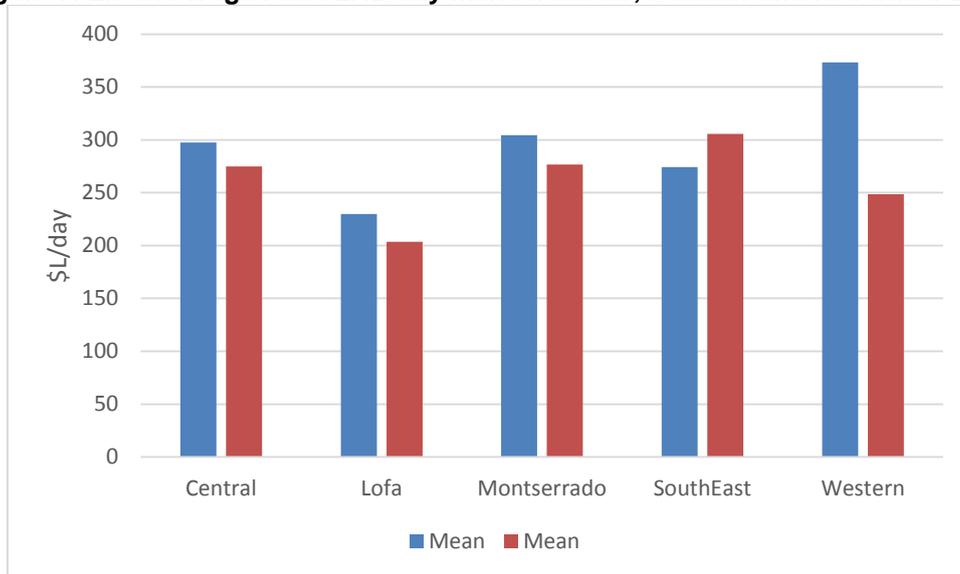
Source: WFP mVAM.

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[11] 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 Liberia was 800 respondents. The first round was collected in early October and the second round in early November.

Figure 8: Wage-to-local rice terms of trade, October and November 2014
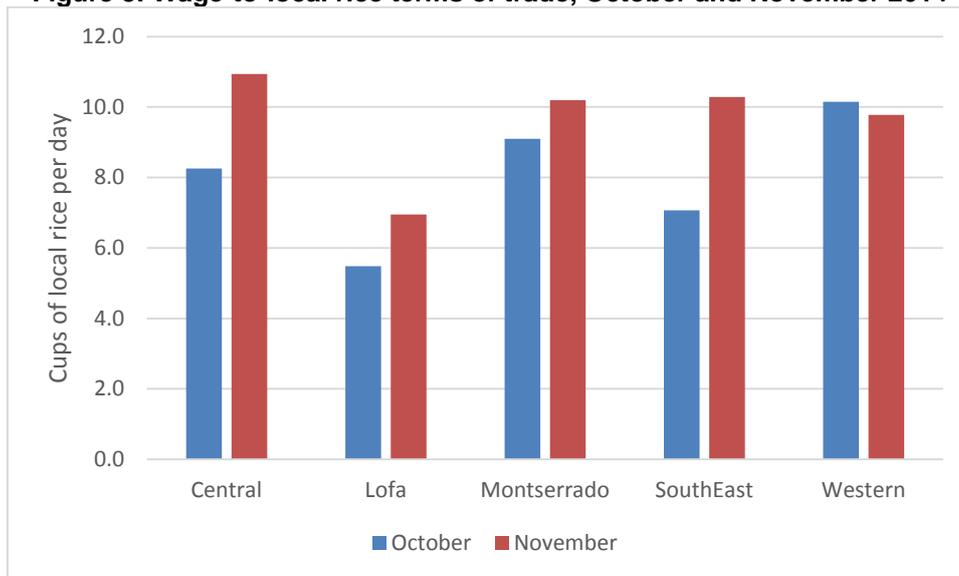
Source: WFP mVAM.

Despite high price increases for imported rice, the available data suggest that insufficient income may be a larger threat to food security than prices[12]. When households in the WB/LISGIS/Gallup survey were asked why they were unable to buy enough rice, about one quarter indicated that prices were too high while approximately 70 percent said that they did not have enough money. Availability issues were only cited by a small percentage.

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 year 2010. The pre-crisis food insecurity is measured as the percentage of households with a poor food consumption score. The data shows that the worst-affected areas were relatively food secure prior to the outbreak. Lofa county is under normal circumstances a food surplus producing area with low food insecurity. Of the highly infected counties in Liberia, Montserrado and Margibi had a moderate share of food-insecure households before Ebola; meanwhile, the highly food-insecure provinces in the south of Liberia have barely been affected by Ebola.

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[12] World Bank, LISGIS, Gallup 2014. The socio-economic impacts of Ebola in Liberia. Results from a high-frequency cell phone survey, 19 November 2014.

Figure 9: Liberia - Pre-crises food insecurity overlaid with Ebola cases in epidemiological week 46 (10-16 November)

LIBERIA - Baseline Food Insecurity under Current Ebola Scenario
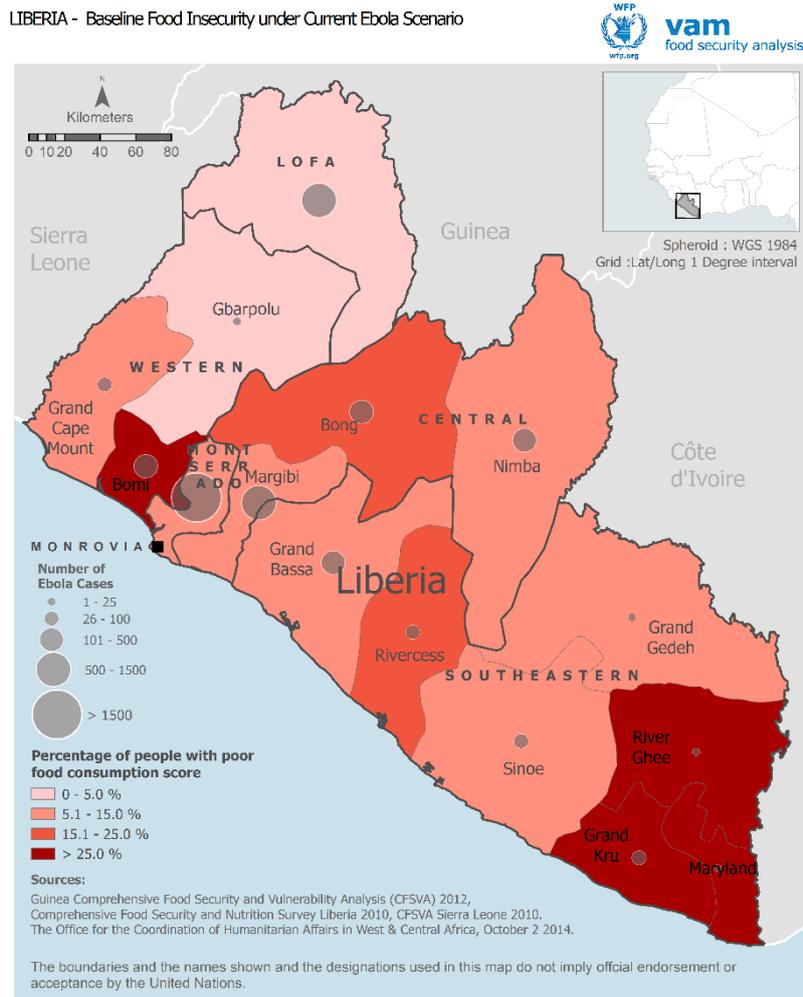
5.2   The impact of Ebola on food insecurity

Results from recent assessments

Findings from the mVAM survey in November[13] suggest that of the high EVD areas, Lofa has become vulnerable to food insecurity (Figure 10). This is despite of normally being a food surplus producing areas and the harvest period. 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 average rCSI on the country level was 17.8 in Liberia. As a comparison, the average rCSI was 16.2 in Sierra Leone and 22.9 in Guinea in November. Despite its high infection rate, Montserrado, which includes the capital Monrovia, has the lowest rCSI in the Liberia (15.9). Lofa has the highest rCSI in the country at 20.9.

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[13] mVAM data is also available for October. However, due to a change in the survey methodology the rCSI is not comparable over the two rounds.

Figure 10: Liberia - Food insecurity in November 2014 as measured by the rCSI

LIBERIA - Reduced Coping Strategies Index (rCSI) under Current Ebola Scenario Round Two
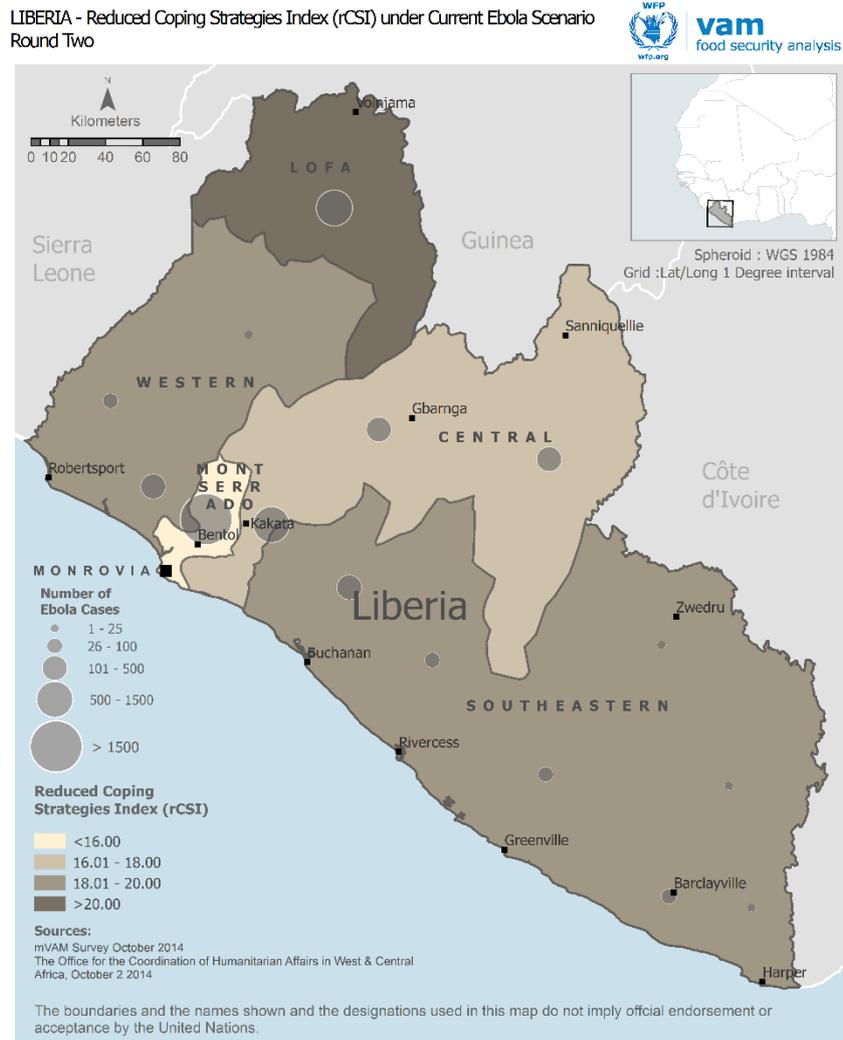
Estimated food insecurity

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[14].

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[15]. The number of directly food insecure is the 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-

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[14] 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.

[15] 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+).

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 model allows transitions from borderline to poor FCS and from adequate to borderline (see Annex 1 for details on the model).

Table 6 reports the estimated number of food insecure by province in December 2014. The directly affected are only about 25 000 individuals. The number of food insecure (poor FCS) is estimated to 630 000 individuals. The number of individual vulnerable to food insecurity (borderline FCS) is 1.1 million[16]. Table 2 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 Dectember and then begins to slow down substantially by January 2015. In March 2015, the directly affected amounts to 39 000 individuals; 750 000 are estimated to be food insecure and 1 million vulnerable to food insecurity[17].

Table 6: Liberia - Estimated number of food insecure by province in November 2014

County	EVD cases	Directly affected (estimated)	FCS poor		FCS Borderline	
			Baseline	December 2014	Baseline	December 2014
Bomi	292	706	32 638	39 428	29 273	25 444
Bong	558	1 798	54 524	70 155	124 422	114 814
Gbarpolu	38	108	3 502	4 188	26 851	26 821
Grand Bassa	146	394	14 632	18 055	60 744	62 254
Grand Cape Mount	140	416	16 583	21 664	52 050	47 433
Grand Gedeh	10	32	13 528	16 391	39 080	38 704
Grand Kru	35	103	19 459	21 544	25 829	23 837
Lofa	654	2 759	8 334	12 127	92 666	91 742
Margibi	1 256	4 212	15 135	29 790	63 103	63 302
Maryland	21	69	58 848	65 477	39 775	37 192
Montserrado	4 134	12 761	137 767	227 291	324 961	328 188
Nimba	322	1 047	42 506	56 184	107 190	117 649
River Ghee	19	51	20 101	22 853	38 887	35 187
Rivercess	44	118	10 573	11 857	25 834	24 773
Sinoe	38	129	12 307	14 000	33 861	33 214
Total	**7 707**	**24 703**	**460 437**	**631 004**	**1 084 526**	**1 070 554**

Source: WFP estimates.

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[16] Usually borderline food insecure are defined to be food insecure. In order to account for some level of uncertainty since the baseline data is from some years back, we define this group as vulnerable to food insecurity.
[17] The EVD case projections and the impact weights have been adjusted to reflect the most recent information available. For this reason the estimates differ from the ones reported in WFP 2014. Special Focus: Ebola. How can we estimate the impact of Ebola on food security in Guinea, Liberia and Sierra Leone?

Table 7: Liberia - Estimated number of food insecure by province in March 2015

County	Cases	Directly Affected	FCS poor		FCS Borderline	
			Baseline	March 2015	Baseline	March 2015
Bomi	723	1 750	32 638	49 082	29 273	19 869
Bong	1 910	6 156	54 524	98 162	124 422	99 603
Gbarpolu	172	490	3 502	5 801	26 851	26 692
Grand Bassa	220	594	14 632	23 028	60 744	63 791
Grand Cape Mount	482	1 431	16 583	31 009	52 050	40 938
Grand Gedeh	55	176	13 528	17 076	39 080	38 625
Grand Kru	65	189	19 459	24 122	25 829	21 576
Lofa	713	3 008	8 334	25 343	92 666	90 299
Margibi	1 568	5 255	15 135	34 924	63 103	63 586
Maryland	36	117	58 848	66 381	39 775	36 659
Montserrado	5 798	17 901	137 767	253 837	324 961	322 847
Nimba	441	1 432	42 506	60 545	107 190	119 344
River Ghee	19	51	20 101	23 689	38 887	34 485
Rivercess	267	712	10 573	17 678	25 834	20 878
Sinoe	68	228	12 307	16 772	33 861	32 402
Total	**12 536**	**39 490**	**460 437**	**747 449**	**1 084 526**	**1 031 594**

Source: WFP estimates.

Table 8: Liberia - Estimated number of food insecure (percentage of poor FCS of group total) by main source of income, end of 2014

Main income source	Pre-crises food insecurity (%)	Ebola driven food in-security (%)
Food crop agriculture	5-10	>20
Cash crops, palm oil and rubber tapping	<5	10-15
Fishing and hunting	5-10	15-20
Petty trade	<5	10-15
Casual labour	5-10	15-20
Skilled labour	<5	5-10
Commerce	<5	5-10
Remittances, rents and pension	<5	5-10
Mining	<5	10-15
Other sources	<5	10-15

Source: WFP SISMod–light.

Table 8 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)[18]. All income groups show an increase in food insecurity due to Ebola. This is in line with findings from the studies cited above showing that EVD has had an impact on most people and livelihoods. According to the estimates, the highest rates of food insecurity will be among those receiving their main incomes from food crops, fishing and hunting and casual labourers. These livelihood groups were more vulnerable to food insecurity already at the outset. Most of those who have become food insecure due to Ebola (76 percent) live in rural areas.

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[18] 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/ .

6. RECCOMENDATIONS

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 county level production as high as 25 percent in most affected districts of Loffa and Margibi. 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. The Food Security Cluster in Liberia has recommended that this be done through:

- Support to food production during dry season (lowland rice and vegetables) in most affected counties.
- Seed System Security Assessment (SSSA).
- Promotion of fodder/feeds production.
- Promotion of animal protein access including innovative options such as guinea pigs (fast breeding).

6.2 Food security

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.

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[19]. 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[20]. 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 by January 2015. The date of the turning point is based on goals set up by the UN mission for Ebola Emergency response[21]. These plans are aligned with estimates by Centers 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)[22]. Modifications to these assumptions do not significantly change our estimates of food insecurity caused by Ebola.

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[19] 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.
[20] 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
[21] See for example www.un.org/ebolaresponse/pdf/CNN_Nabarro.pdf
[22] 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: Liberia - Model for estimating food insecurity under Ebola
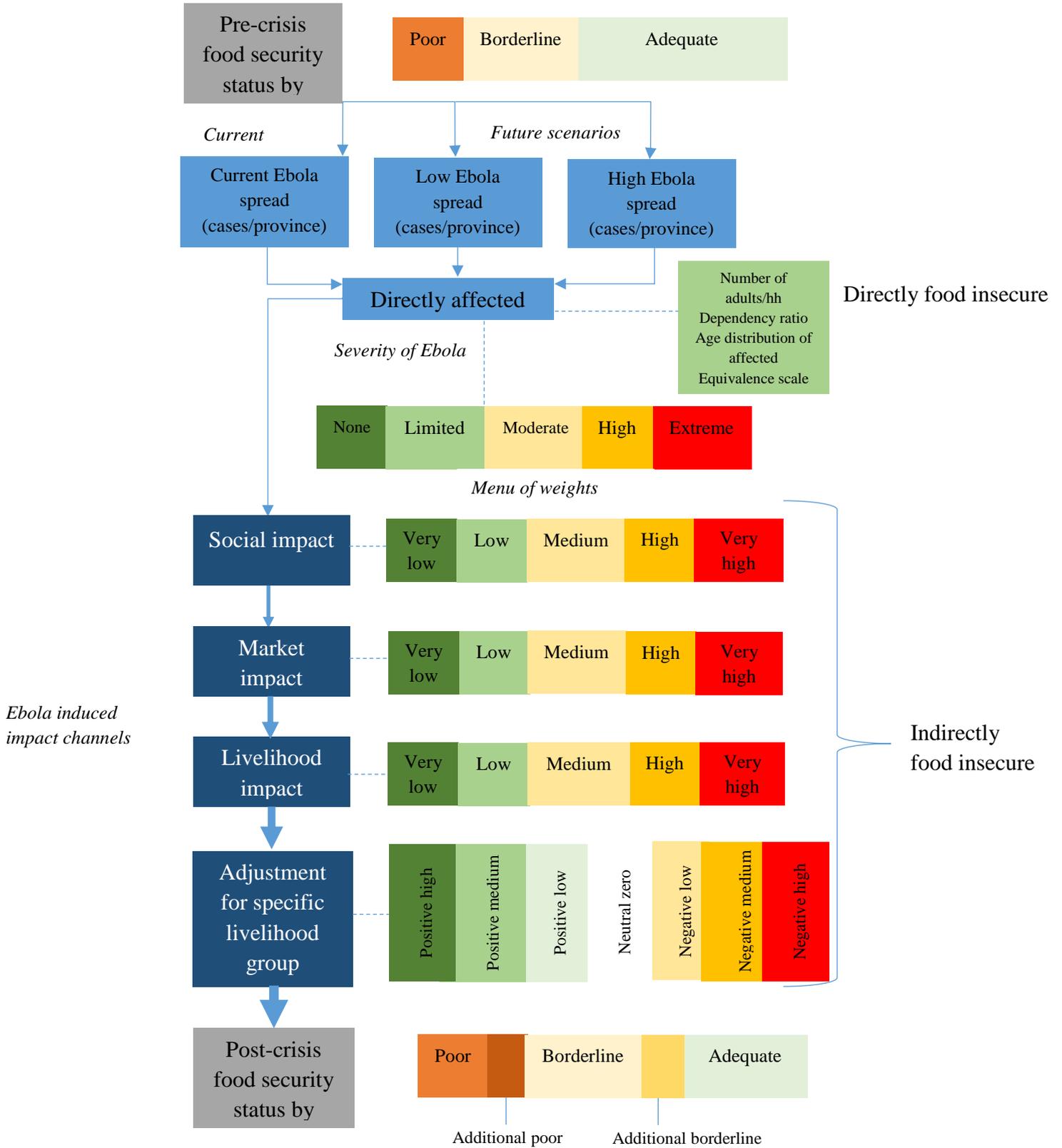
Estimating the directly food insecure

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[23]. 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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[23] 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 8: Liberia - Key components for estimating the number of indirectly food insecure people

Driving Factors	Description	Purpose
Pre-crisis food insecurity	The pre-crisis food insecurity as determined by the Food Consumption Score (FCS). For the purpose of the analysis, those with *poor* (as opposed to *borderline* or *acceptable)* FCS are defined as food insecure.	The model allows transitions of this variable from *FCS borderline* to *FCS poor* and from *FCS adequate* to *FCS borderline* because of the Ebola crisis.
Social impact	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.
Market impact	The percentage of households dependent on the market for cassava: while rice is the main staple, households use *gari* (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.
Livelihood impact	The livelihood profile of the household. Nine livelihood profiles are defined: *food crops* *cash crops* *fishing* *petty trade* *unskilled labour* *salary and skilled labour, handicrafts* *trading, commercial activities* *remittances and gifts* *other*	This gives the livelihood impact for specific livelihood groups and is the third impact channel in the model.

Market impact	The percentage of households dependent on the market for cassava: while rice is the main staple, households use *gari* (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.
Livelihood impact	The livelihood profile of the household. Nine livelihood profiles are defined: *food crops* *cash crops* *fishing* *petty trade* *unskilled labour* *salary and skilled labour, handicrafts* *trading, commercial activities* *remittances and gifts* *other*	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: Liberia - Dashboard for Ebola Model (illustration)

EBOLA IMPACT ON FOOD SECURITY SCENARIO BUILDING

Infection at 2014-W49

SELECT AN EBOLA SPREAD SCENARIO	Continuing	WEEKS	16
Impact Channels	**Guinea**	**Liberia**	**Sierra Leone**
Social Risk	Low	High	High
Market Risk	Medium	High	High
Livelihoods Risk	Medium	High	High
Livelihood Groups			
food crops	Negative_Low	Negative_Low	Negative_Low
cash crops	Negative_Low	Negative_High	Negative_High
fishing	Neutral_Zero	Neutral_Zero	Neutral_Zero
petty trade	Negative_Medium	Negative_Medium	Negative_Medium
unskilled labor	Negative_Medium	Negative_Medium	Negative_Medium
salary and skilled labor, handicrafts	Negative_Low	Negative_Medium	Negative_Medium
trading, commercial activities	Negative_Medium	Negative_Medium	Negative_Medium
remittances and gift	Neutral_Zero	Neutral_Zero	Neutral_Zero
other	Neutral_Zero	Neutral_Zero	Neutral_Zero

Adjust the variables in grey to build scenarios

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.