© WFP Mali CO

# Prospects and risks for 2018:

## *Impact simulation in Mali*

WFP
World Food Programme
wfp.org

# PROSPECTS AND RISKS FOR 2018: IMPACT SIMULATION IN MALI

**Author: Valerio Giuffrida**

**November 2017**

**For additional information, please contact:**

**WFP Headquarters**

Valerio Giuffrida, *Market Analyst, Statistician*
valerio.giuffrida@wfp.org

Tobias Flämig, *Head of Economic and Market Analysis Unit*
tobias.flaemig@wfp.org

Arif Husain, *Chief Economist & Deputy Director Policy and Programme Division*
arif.husain@wfp.org

**WFP Dakar Regional Bureau**

Eric Branckaert, *Head of Vulnerability Analysis and Mapping*
eric.branckaert@wfp.org

Simon Renk, *Regional Markets Advisor*
simon.renk@wfp.org



**World Food Programme**

Via Cesare Giulio Viola, 68/70 - 00148 Rome - Italy

http://vam.wfp.org wfp.economicanalysis@wfp.org

# Contents

## INDEX OF TABLES



## INDEX OF FIGURES

## ACKNOWLEDGEMENTS

This report was prepared by Valerio Giuffrida under the guidance of Tobias Flämig, Lucia Latino and Susanna Sandstrom. The text was edited by Zoë Hallington.

The author is very grateful for the dedicated contribution of Matthieu Tockert and Simon Renk, who provided insights into the programme and compiled the data necessary for the analysis. The report benefited from discussion with Aminata Doucore, Charlotte Fontaine and Pablo Arnal. The author also wishes to thank the WFP staff in the country and sub-offices for their dedication in managing the data collection.

The views in this report and any errors or omissions are those of the author.

## ACRONYMS

| | |
|---|---|
| **ARIMA** | Auto-Regressive Integrated Moving Average |
| **BCEAO** | *Banque Centrale des Etats de l'Afrique de l'Ouest* |
| **CARI** | Consolidated Approach for Reporting Indicators of food security |
| **EMU** | European Monetary Union |
| **ENSA** | *Enquête Nationale sur la Sécurité Alimentaire et Nutritionnelle* |
| **FAO** | Food and Agriculture Organization |
| **FCS** | Food Consumption Score |
| **IMF** | International Monetary Fund |
| **INSAH** | *Institut du Sahel* |
| **LAIDS** | Linearized Almost Ideal Demand System |
| **LES** | Linear Expenditure System |
| **OCHA** | Office for the Coordination of Humanitarian Affairs |
| **OPAM** | *Office des Produits Agricoles du Mali* |
| **OPIDIN** | *Outil de Prédiction des Inondations dans la Delta Intérieur du Niger* |
| **SAP** | *Système d'Alerte Précoce* |
| **SISMOD** | Shock Impact Simulation Model |
| **TRAMO** | Time Series Regression with ARIMA Noise, Missing Observations and Outliers |
| **VAM** | Vulnerability Analysis and Mapping Unit of WFP |
| **WFP** | World Food Programme |
| **XOF** | *Communauté Financière Africaine* franc |

## Executive Summary

Humanitarian operations in Mali are underway in all regions of the country, reaching up to 989,272 beneficiaries a month (May 2017).[1] Part of the activities are seasonal and provide subsistence support to IDPs and vulnerable households.

Based on historical data, we developed a shock impact simulation model (SISMod) to estimate the effects on the household economy and food security of three separate shocks: a drought, seasonal flooding, and an increase in insecurity and violence. The results were examined by household characteristics, livelihoods and geographical disaggregation. The model yielded the findings summarized below.

The main channel for the transmission of the shocks is the market, suggesting poor market integration and difficulty in accessing markets. This finding is supported by the fact that the households most vulnerable to the different shocks are pastoralists and non-agricultural casual workers whose consumption depends on the markets, rather than those whose main activity is crop cultivation.

Data from 2017 indicate that 3,673,000 people were food insecure during the lean season; the severely food-insecure population exceeds the number of beneficiaries reached in 2016 by 738,000 people. Macroeconomic prospects for 2018 are generally positive, but the different events simulated would change regional food security. In the event of increased insecurity, 6,553,000 people would require assistance, while drought would leave 5,234,000 in need. Flooding would see the number of food-insecure individuals rise slightly from the 2017 baseline, up to 4,033,000, with significant increases in Kayes, Mopti and Timbuktu.

The picture for severely food-insecure households is expected to change in a different way: the total number is expected to be lower in all the simulated scenarios. In the event of a drought, 600,000 would be expected to face severe food insecurity, many of them in Gao. Flooding would leave 489,000 people severely food insecurity, whereas a rise in insecurity would mainly affect food security in Mopti and would leave 545,000 people severely food insecure country-wide.

Given the large population and the vulnerability of the two regions, Mopti and Kayes should be monitored closely for these kinds of events, with some anticipatory action taken to reduce risks and integrate markets into the regional commercial system, as well as keeping local markets active.

Pastoral households are among the most vulnerable, particularly because they are dependent on scarce water resources (in the northern regions) and on market prices for staple foods. Nonetheless, their activity has a regional impact, as about one third of the total commerce of herds in West Africa are exports from Mali (See 2.3, International trade and budget).

[1] WFP/Mali Country Office.

# 1 Introduction

In February 2017, under the leadership of the *Système d'Alerte Précoce* (SAP), WFP and other partners conducted an *Enquête Nationale sur la Sécurité Alimentaire et Nutritionelle* (ENSAN) survey on a sample of 9670 households in all districts[2] of Mali to inform the cycle of analysis of the *Cadre Harmonisé*.

Moving beyond the baseline analysis[3] on the ENSAN, we modelled the impact of drought, seasonal flooding and an increase in violence on household consumption to estimate how food security would be affected in different regions of the country via income and price changes. For this purpose, we used the Light Shock Impact Simulation Model (SISMod-Light[4]).

We modelled scenarios based on data, forecasts and assumptions collected or produced between June and August 2017. We did not consider the likelihood of the events when defining the scenarios, but rather replicated the occurrence of three major events similar to past incidents.

This report comprises six sections. The first section gives background information on Mali's economic trends, providing context for the three scenarios used in the simulations and help when interpreting the results of the study. Section 3 introduces the methodology used to produce the estimates and details the assumptions made. Section 4 discusses the results, giving estimates of food security and other indicators by region, livelihood, expenditure quartile, and sex and literacy status of household head. Section 5 presents the results that were derived as operationalizable figures, as estimates of metric tons of food aid and potential beneficiaries per region. The final section contains concluding remarks. Lastly, there are two Annexes: the first explains the methodology behind this particular application of SISMod, and the second includes additional tables and figures produced during the modelling.

A dataviz dashboard[5] was created and published to make the information produced with the estimates of SISMod-Light available and accessible for further analysis. This could be considered an additional Annex to this report.

---

[2] Data collection is statistically representative at the level of the 49 *cercles* (level 2 administrative areas) plus the six communes of Bamako; at the level of the eight regions and Bamako district; at the level of 17 livelihood zones; for the distinction between rural and urban environments; and finally at the national level.

[3] A summary of the results can be found on the Vulnerability Analysis and Mapping website.

[4] This paper uses a light version of SISMod, developed jointly by WFP and FAO, to overcome the limitation of missing quantities consumed. For more information on the full version of SISMod, please see Cheng, F. and Sanogo, I. 2014. *Food price volatility and natural hazards in Pakistan* FAO/WFP. At-a-glance information about SISMod is available here. For further details, visit http://faowfpmodel.wix.com/sismod or write to wfp.economicanalysis@wfp.org

[5] http://dataviz.vam.wfp.org/InteractiveReports-List

# 2 Economic context

Mali's macroeconomic prospects are optimistic even though they are subject to several risks.[6] Setbacks in restoring security could negatively affect consumer confidence, donors and investors, as well as increase spending on security at the expense of social programmes. The economy's high dependence on exports of gold and cotton exposes the balance of payments – and to a lesser extent, public finances – to fluctuations in international commodity prices. Poor management of public finances, leading to over-indebtedness, could also affect consumer confidence, businesses and international financiers, and thus slow down growth. The uneven distribution of wealth may limit how far macroeconomic improvements influence the household economy.

The secondary income[7] surplus will remain high, reflecting continued backing from external donors and financial flows[8] related to the ongoing foreign military involvement in the country. The current account[9] deficit is expected to widen from an estimated equivalent of 7.1 percent of GDP in 2016 to 7.5 percent in 2017, before contracting to 7 percent of GDP in 2018 (Table 1), mainly driven by developments in the trade balance. The deficit will be financed primarily by concessional loans, borrowing from regional markets and flows of foreign direct investment into the mining sector. Continued financial support from the international community and measures envisaged by the government as part of its programme of economic and financial reforms offer the hope of a return to the growth rates of 2000–10 (5.7 percent on average).

## 2.1 EXCHANGE RATE

The CFA franc is pegged to the euro at XOF655.96 per €1 and therefore fluctuates in line with euro/dollar movements. Forecasts of a slow appreciation of the euro against the US dollar in 2017–18 are supported by the EMU bloc's large current account surplus. In tandem with the euro, the CFA franc will gradually appreciate against the US dollar.

[6] EIU country brief, accessed on 21 August 2017.

[7] The secondary income account reports all "current transfers between residents and non-residents that directly affect the level of gross national disposable income and thus influence the economy's ability to consume goods and services." (IMF, 2014. *Balance of Payments and International Position Compilation Guide*).

[8] This refers to all flows, not just those related to the humanitarian sector.

[9] "The current account shows transactions of goods, services, primary income, and secondary income between residents and nonresidents" (IMF, 2014).

*Table 1: Summary of forecasts for main macroeconomic data*

| | 2015[a] | 2016[b] | 2017[c] | 2018[c] |
|---|---|---|---|---|
| Real GDP growth (%) | 6 | 5.3 | 5.3 | 5.2 |
| Consumer price inflation (av, %) | 1.4 | -1.8[a] | 0.8 | 1.2 |
| Lending interest rate (%) | 5.2 | 5.3 | 9 | 9 |
| Government balance (% of GDP) | -1.9[b] | -3.9 | -3.4 | -3.3 |
| Exports of goods FOB (US$ m) | 2,715.4[b] | 2,802.7 | 3,035.9 | 3,362.3 |
| Imports of goods FOB (US$ m) | 3,192.3[b] | 3,443.5 | 3,891.5 | 4,207.8 |
| Current-account balance (US$ m) | -685.1[b] | -998.2 | -1,118.20 | -1,155.30 |
| Current-account balance (% of GDP) | -5.4[b] | -7.1 | -7.5 | -7 |
| Exchange rate XOF:US$ (av) | 591.5 | 593.0[a] | 594.3 | 581.8 |
| Exchange rate XOF:€ (av) | 656 | 656 | 656 | 656 |

*Source: Economist Intelligence Unit; accessed on 21 August 2017; [a] Actual, [b] Economist Intelligence Unit estimates, [c] Economist Intelligence Unit forecasts*

## 2.2 MINING AND OTHER ECONOMIC SECTORS

An expansion of foreign investment[10] in the country's main source of revenue, gold mining, is increasing the availability of mining-related unskilled labour. The greater availability of workers is expected to keep salaries at an average level. Subdued commodity prices and a weak investment climate in infrastructure are slowing progress in other mineral resources such as oil, iron ore and bauxite.

Despite the increased efforts of regional forces, persistent security concerns are keeping private investors in other sectors at bay.

Instead, public capital spending will be a major driver of economic growth, with donors supporting the government's public investment programme. However, the full range of planned projects will not be executed, owing to bureaucratic inefficiencies, delays in disbursing aid payments and the fragile security situation.[11]

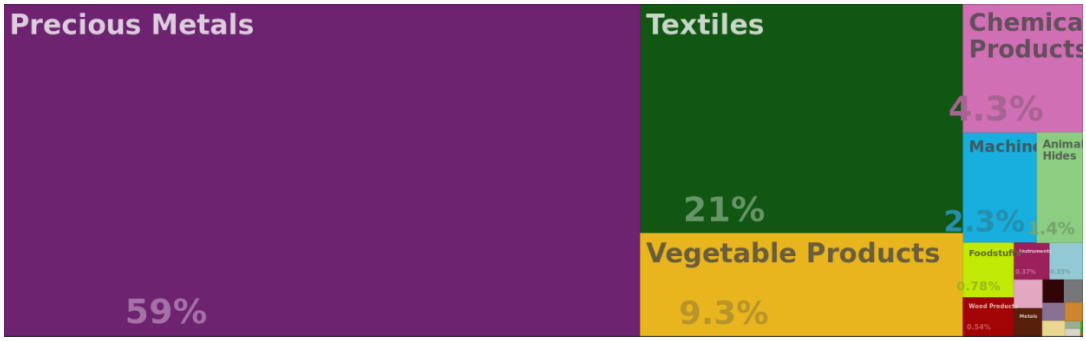
## 2.3 INTERNATIONAL TRADE AND BUDGET

Recent data on external commerce indicate that the mineral sector constitutes 59 percent of exports, with cotton production making up around 21 percent of the remaining bill (Figure 1). In 2016, mining accounted for 70 percent and cotton for 10 percent of exports as both sectors are susceptible to international price fluctuations.

Service exports will remain subdued, as the security situation continues to deter potential tourists. Cattle exports account for US$8.824.077 of the total of US$18.895.000 for West Africa[12] according to INSAH; they made up 0.8 percent of Malian exports in 2017.

[10] Seko prospect within the Dandoko project in southern Kayes, operated by the Australia-based company, Oklo Resources; Fekola project in southern Kayes, developed by the Canada-based company, B2Gold; Yanfolila facility in western Sikasso, operated by the UK company, Hummingbird Resources.
[11] African Economic Outlook, accessed on 18 August 2017 – B. Diarra, H. Dicko and A. Konate.
[12] INSAH, accessed on 21 August 2017

*Figure 1: Composition of exports by product category, 2015*



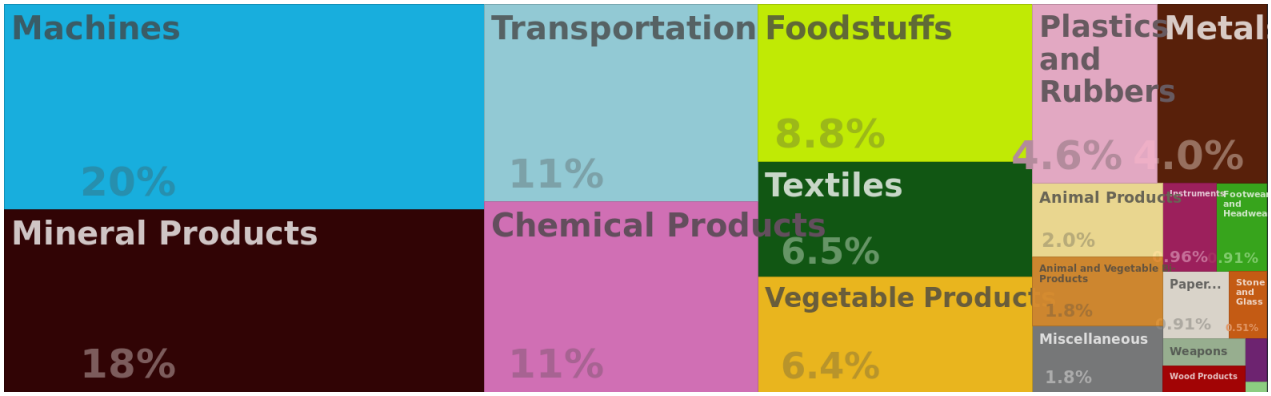

*Source: Observatory for Economic Complexity*

Mali's main commercial partners are Switzerland, India, China, Vietnam and Thailand; regional partners absorb just 7.2 percent of the exports.[13]

Machinery, mineral products and means of transportation figure among the country's main imports, largely in support of mineral production (Figure 2). Service imports will stay high as a result of the international military involvement in central and northern Mali.

According to the Economist Intelligence Unit, the import bill will expand in 2017 (Table 1), as oil and food prices stage a partial recovery and capital imports for development and reconstruction projects increase. It will then contract in 2018, as global oil prices fall back owing to weaker demand from China and the end of the OPEC deal.

*Figure 2: Composition of imports by product category, 2015*




*Source: Observatory for Economic Complexity*

With raw material prices on the low side, exports and external investments are insufficient to finance imports, leading to a primary deficit of the account balance (Table 1). As a result, the trade deficit is expected to increase to 5.7 percent of GDP in 2017, before falling back to 5.1 percent in 2018.

[13] Source: OEC export data, accessed on 23 August 2017.

## 2.4 AGRICULTURE

In 2017, seasonal events in Mali were less favourable than during a typical year (Table 2), yet primary rural activities progressed regularly: main season agriculture, off-season agriculture, pastoralism and fishing.

The 2017 rainy season was particularly erratic, especially during July and September at critical moments of plant development. There were false starts in many areas which forced farmers to sow several times and delayed the start of the cropping season. The season also ended prematurely, with an early end to rains in September which created large pockets of crop production deficits.

The provisional crop production analysis released was fairly optimistic. However, more recent data, especially the final rainfall assessment, indicate a very worrying situation in many *cercles*. It is now clear that the final crop production data may be much less optimistic than was initially announced, especially for Kayes, Koulikoro and Mopti.

Moreover, river floodwaters are unusually low, which will affect off-season production (especially rice) as well as gardening activities. The surface water level is below average, an indicator of an early lean season for pastoralists. The biomass anomaly analysis also shows a worrying situation in several areas, especially in Ansongo, Mopti, Timbuktu and Segou and in the area at the Mauritanian border.

There is a steady flow of normal return migration by migrant workers to their home areas for the new growing season.[14] Their average to above-average cash and in-kind earnings, also due to the forecast better crop production, will help strengthen household purchasing power. Yet for most households, this alone will not be sufficient to lift them out of vulnerability.

By July 2017, flooding had already damaged households and livestock in Menaka, Gourma Rharous, Goundam, Kayes and Koulikoro. Flood-prone areas and households might suffer similar damage, curtailing the production of the main harvests.

Alternating conditions of drought and flooding could result in shortages of local supplies, even though strategic stocks and subsidies should limit the effects of a supply-side availability shock.

Rainfall forecasts from the PRESASS forum[15] predicted a normal-to-late end of season, extending through the end of October in most parts of the country. This encouraged farmers to resow after the first pockets of drought in June, but the end of the rainy season actually arrived early in September, preventing crops from developing fully and resulting in a lot of lost production.

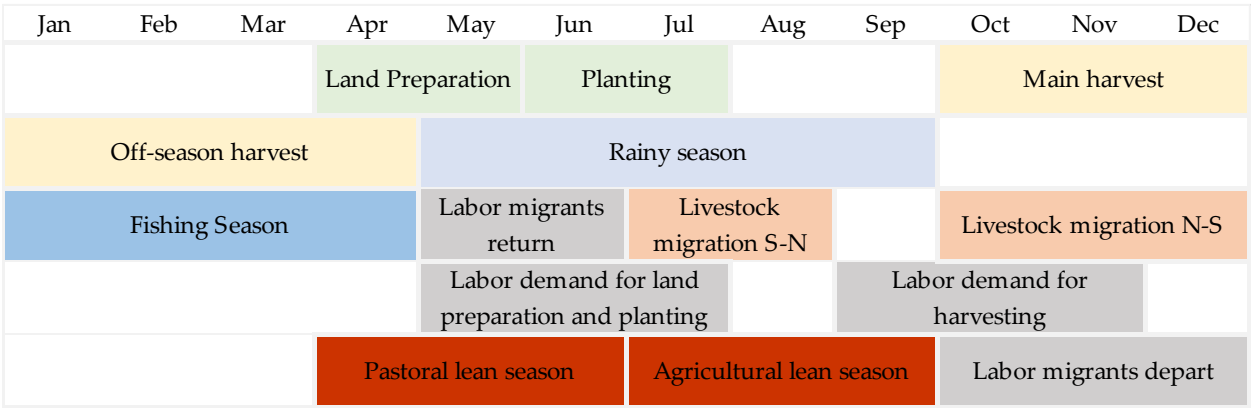
The most recent information on crop pests indicate that warning levels are low and no prevention activities will go beyond the usual areas of northern Kidal to the border with

[14] Because of difficulty in sampling those household members, the ENSAN 2017 report describes low to very low proportions of migrant workers.

[15] From the fourth edition of the forum, which examines agro-hydro-climatic seasonal forecasts in Sudano-Sahelian Africa.

Algeria. Normal presence of grain-eating birds and of caterpillars is expected, with limited crop losses.[16]

*Table 2: Seasonal calendar for a typical year*




*Source: FEWS NET[17]*

## 2.5 FOOD MARKETS

Cereal markets are fairly well stocked. Subsidized sales by OPAM (the national produce board) and the unloading of cereal crops by farmers who need funds has helped improve supplies. Ongoing food assistance programmes by the government and its humanitarian partners (distributions of free food rations and subsidized sales) in northern, high-consumption areas of Timbuktu and Gao were set to extend through September, with a buffer effect on rising food prices between June and October.

Stable or declining food prices indicate average household access to markets, except in Gao and Timbuktu where price increases between May and August 2017 reduced access. The price increases appear to be connected with security incidents harming the operation of markets and flow of trade in the central part of the country. Poor households in these areas – the Niger delta and the western Sahel – are mainly rice producers and are already using negative coping strategies.

At the end of August, prices for the most important cereal crop, millet, were up from the previous month on markets in all regional capitals (by anywhere from 3 percent in Bamako to 18 percent in Timbuktu). Sorghum prices at the end of August were above the five-year average by 5 percent in Mopti, 12 percent in Gao, and 17 percent in Timbuktu. They were near or below-average on other markets in regional capitals.

Disruption of trade routes and lower millet/sorghum cultivation has resulted in higher millet and sorghum prices compared with 2016. In October 2017, national millet prices were 31 percent above 2016 levels and up to 60 percent higher in Kayes, where crop production was badly affected by drought. National sorghum prices were 25 percent higher than the previous year and as much as 78 percent higher on some markets in Mopti. Moreover, millet prices

[16] Source: FAO, Emergency Centre for Locust Operations, accessed on 21 August 2017.

[17] Source: FEWS Net, Food Security Outlook, accessed on 16 August 2017.

were still significantly above their five-year average on markets in several regional capitals, including Mopti, Kayes, Timbuktu and Gao.

However, average to above-average prices for livestock have led to better terms of trade for pastoralists. For instance, the price of female goats was above the five-year average in Timbuktu, Gao and Mopti. The implementation of the National Response Plan and the related distribution of food aid by the Commissary for Food Security and its partners between May and October has eased food access for 820,000 beneficiaries, mainly located in Timbuktu, Gao, Ménaka, Taoundenit, Kidal and northern Mopti.

Ongoing insecurity in northern[18] and central areas is continuing to displace local populations to more secure parts. This can lead to lower local crop production and create food deficits within the country. Around 33,000 internally displaced people (IDPs) are present in the country and 18,000 returnees were expected in 2017.

## 2.6 LIVESTOCK

Supplies of livestock are average to above-average and demand is sustained by seasonal celebrations, even in neighbouring countries. Poor pastoral conditions in the western Sahel and the security situation in Timbuktu and Gao have favoured the selling of small animal herds, reducing livestock capital for poor households.

Low terms of trade against cereals also led to increased selling of animals compared with previous years, in order to maintain market access. The improvement of pastoral conditions with the above-average rains should allow prices to rebound, also driven by the better physical condition of livestock, which should drive prices back up above the five-year average.[19]

## *2.7* HUMANITARIAN OPERATIONS

The 2017 National Response Plan devised by the government and its partners provides for the delivery of food assistance to 900,000 recipients located mainly in Timbuktu and Gao, in response to the poor crop production and residual security problems in these regions, which are continuing to undermine the socioeconomic situation of local households. There will be distributions of four months' worth of free half-rations and full rations of cereals, pulses, and oil over the course of the lean season between June and September 2017. These distributions of food supplies will be paralleled by recovery and resilience-building efforts involving distributions of and/or subsidies for seeds, fertilizer and animal feed, in addition to herd rebuilding and cash transfer programmes for 2,400,000 recipients.[20]

[18] According to OCHA, as of the end of May, 22,300 residents of the Ménaka area and slightly more from central areas of the country had fled to more secure areas to escape the fighting.

[19] African Economic Outlook, 18 August 2017 – B. Diarra, H. Dicko and A. Konate.

[20] FEWS NET.

# 3 Assumptions

To estimate the impact of a spell of drought, seasonal flooding, and an increase in violence on household food security in Mali, we used the Light Shock Impact Simulation Model (SISMod-Light). SISMod-Light aims to model (i.e. replicate) the economic behaviour of households in order to simulate the impact of a shock on household consumption. A detailed methodology for this application is explained in Annex I.

## 3.1 THE SHOCKS AND SHOCK FACTORS

This study simulates how food security in Mali would change under three separate scenarios:[21] a spell of drought, seasonal flooding and an intensification of violence.

The descriptions of the scenarios below are qualitative and are intended as quick, generic summaries of the information. In the following sub-sections, we explore the construction of the scenarios and present the assumptions for each section of the household economy.

**Drought**: medium price volatility; spread in the country; medium impact on income; high impact on production.

**Flood**: medium, concentrated price volatility; low impact on income; localized impact on production.

**Insecurity**: medium, concentrated price volatility; medium impact on income; localized impact on production.

The shock factors explained in each section show the variations assumed, based on contextual information and historical data.

## 3.2 AGRICULTURE, FISHERIES AND LIVESTOCK PRODUCTION

Taking into account the increase in cultivated area,[22] cereal production for this growing season is forecast to be 35 percent above the five-year average and 11 percent above the figure for 2016.[23] This is expected to influence the demand for labour linked to productive activities, which is unlikely to trigger a rise in salaries because workers are widely available.[24] Prospects for the three scenarios remain positive given the increase in total food crop production in all regions, as shown in Table 3. Scenarios are obtained by multiplying the latest 2016/17 data by the ratio of production in the years in which drought and flooding impacted the region and the national average yearly variation of production, assuming this is the trend of the increase in productivity.

[21] Please note that, given the methodology, scenarios are not linked to a specific point in time but rather to the realization of different assumptions.

[22] Economist Intelligence Unit, 18 August 2017.

[23] FEWS NET.

[24] One of the most frequently cited issues in the country is the scarcity of employment (ENSAN, November 2016; ENSAN, February 2017).

*Table 3: Agricultural production in metric tons per season and region*

| Season | Bamako | Gao | Kayes | Kidal | Koulikoro | Mopti | Segou | Sikasso | Timbuktu |
|---|---|---|---|---|---|---|---|---|---|
| 2012/2013 | 550 | 590 | 615,370 | - | 1,002,510 | 964,770 | 1,285,320 | 1,848,860 | 51,570 |
| 2013/2014 | 580 | 67,300 | 344,650 | - | 820,020 | 979,930 | 1,870,550 | 1,766,140 | 148,270 |
| 2014/2015 | 400 | 121,330 | 566,840 | - | 1,023,930 | 1,086,550 | 1,955,950 | 2,239,660 | 114,180 |
| 2015/2016 | 390 | 155,080 | 785,690 | - | 1,512,400 | 1,238,940 | 1,938,900 | 2,440,560 | 369,100 |
| 2016/2017 | 420 | 49,530 | 660,870 | - | 1,717,090 | 1,077,950 | 2,528,850 | 2,816,560 | 335,890 |
| | | | | | | | | | |
| Drought | 420 | 49,670 | 666,590 | - | 1,744,300 | 1,093,080 | 2,580,370 | 2,877,460 | 337,090 |
| Flood | 430 | 50,070 | 683,750 | - | 1,825,940 | 1,138,500 | 2,734,960 | 3,060,150 | 340,670 |
| Insecurity | 470 | 49,530 | 733,560 | - | 1,905,970 | 1,077,950 | 2,528,850 | 3,126,380 | 335,890 |

*Source:* Direction Nationale de l'Agriculture*; Author's calculations*

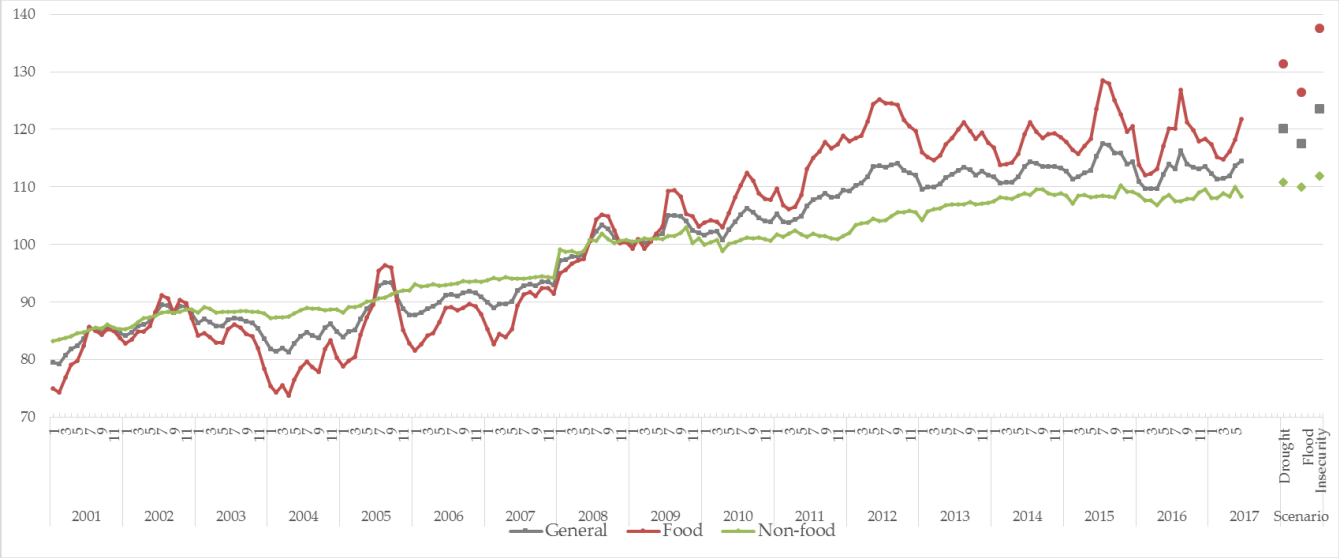

Picture: Group of women in a planting session.

## 3.3 PRICES

Headline inflation forecasts provided by the Central Bank of West African States, the Economist Intelligence Unit and the African Economic Outlook concur on a rate of 0.8 percent in 2017, up from -1.8 percent in 2016 but still well below the West African Economic and Monetary Union (UEMOA) ceiling of 3.0 percent, as global commodity prices rise for the first time since 2014.

The government is still seeking minimize the impact of supply side shocks by maintaining subsidies and price caps on staple goods. Nevertheless, prices rises are expected, following the usual seasonal pattern, which has been particularly marked in the past two years (Figure 3). The consumer price index time series also shows the values assumed for the three simulated scenarios.

*Figure 3: Consumer price index, January 2009 = 100*




*Source: BCEAO,[25] INSTAT Mali; Author's calculation*

For each of the regions, different factors were applied per commodity to the level of prices. Millet, for example, is one of the staple commodities for which prices are collected and stored in the VAM database for further dissemination. The information extracted[26] is presented in Figure 4Figure 4 together with the estimated price in the event of a shock during the next season.

In the event of a drought, prices in Bamako, Kayes, Timbuktu and Gao would increase the most, within a range of +15 to +19 percent. In other regions, prices would decrease or remain stable, between -5 and +2 percent. The estimated effect against the baseline period was

[25] BCEAO, *Données Economiques et Financières.*

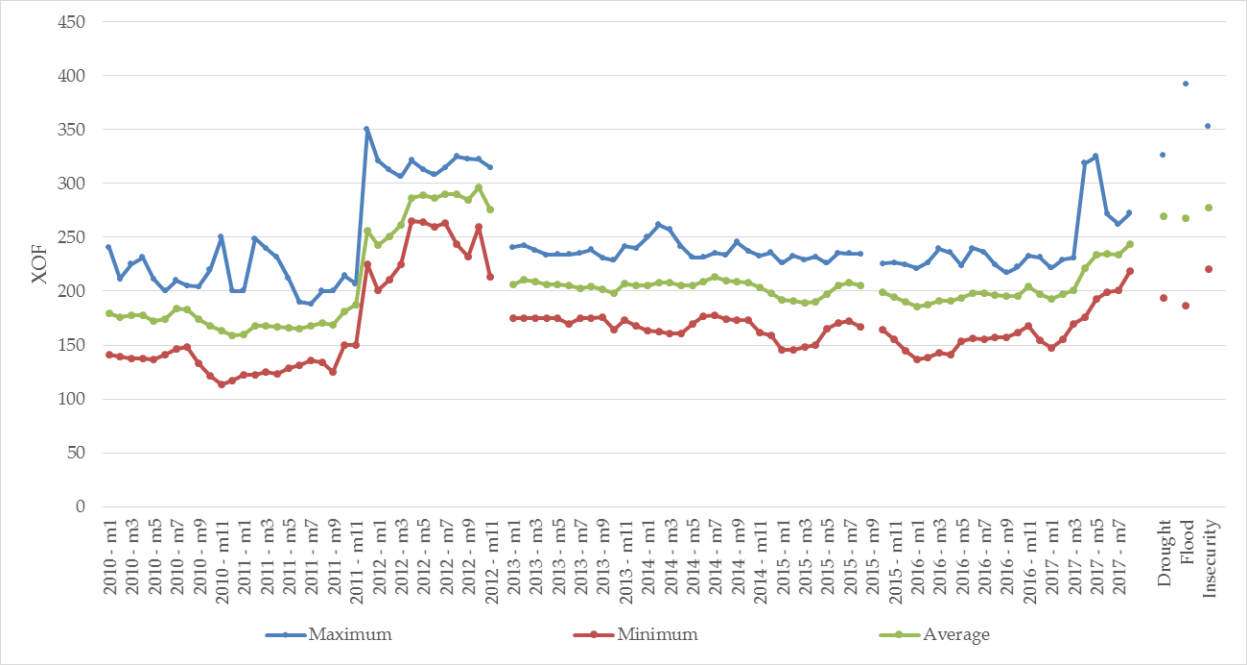
[26] To improve the presentation of data in a single graph, figures from the different regions were summarized by the average, the minimum and the maximum values. WFP only surveys a sample of markets. In some areas some pockets of higher inflation may persist.

calculated considering the seasonally adjusted trend – already presented with the consumer price index for food – and variations that occurred during the 2011/12 season, in which crops were affected by a drought.

The flood scenario was built looking back at the price levels and variations in past flood events for each region. In the event of a flood,[27] the variations would have less impact on the total output of the different regions, except in Kidal, where historically the price effect of flooding has been higher and more variable. In this case, the increase is estimated to be around 20 percent – this in the region with the highest staple food prices in Mali.

In the event of widespread insecurity incidents, the historical information analysed[28] suggests that the biggest price rises would occur in the Timbuktu region, with an estimated increase of 35 percent. In Gao, prices would rise by around 30 percent and in Kayes, by 23 percent. In Kidal, staple food prices would rise 12 percent above their current levels, which already make it difficult to put together a food basket. In other regions, prices are expected to remain stable.

*Figure 4: Millet prices (per kg)*




*Source: WFP/VAM, Author's calculation*

Similar variations were assumed for each staple food,[29] namely imported and local rice, wheat, sorghum and beans. Other foods, divided in groups, were assumed to vary as per the national food consumer price index, with no regional disparity.

[27] As the shock factors were built as an average ratio of these variations, we could assume this scenario is representative of moderate flooding in each region.
[28] The shock factors are built observing the variations in prices that occurred in 2012/13.
[29] Prices are publicly available from the source database via VAM's *Dataviz*.

The combination[30] of all the price shock factors, or ratio between baseline and each scenario, is presented in Table 4.

*Table 4: Food price shock factors by scenario and commodity group*

| Scenario | Commodity | Kayes | Koulikoro | Sikasso | Segou | Mopti | Timbuktu | Gao | Kidal | Bamako |
|---|---|---|---|---|---|---|---|---|---|---|
| Drought | Cereal | 115% | 102% | 101% | 89% | 95% | 119% | 119% | 130% | 113% |
| | Pulses | 110% | 108% | 106% | 105% | 93% | 122% | 112% | 108% | 106% |
| | Other | 107% | 103% | 86% | 99% | 103% | 131% | 120% | 108% | 112% |
| Flood | Cereal | 111% | 99% | 98% | 85% | 92% | 114% | 114% | 126% | 109% |
| | Pulses | 106% | 104% | 102% | 101% | 90% | 118% | 108% | 104% | 102% |
| | Other | 103% | 100% | 83% | 95% | 99% | 127% | 116% | 104% | 108% |
| Insecurity | Cereal | 123% | 101% | 101% | 101% | 106% | 135% | 130% | 112% | 106% |
| | Pulses | 114% | 101% | 101% | 101% | 106% | 135% | 130% | 103% | 107% |
| | Other | 114% | 101% | 101% | 101% | 106% | 135% | 130% | 103% | 107% |

*Source: Author's calculation*

## 3.4 LABOUR MARKET

The positive crop production this agricultural season is expected to sustain average earnings and generate more job offers than last at baseline level, when lack of employment reportedly affected more than 46 percent of households (ENSAN, February 2017). This will help improve the purchasing power of poor households dependent on farm and small trade labour. However, job opportunities for unskilled labourers could be limited in northern regions and the river delta areas of Mopti as a result of insecurity.

An increase of 10 percentage points in southern regions, excluding Mopti, was applied as a shock factor to all incomes of households prone to lack of employment[31] at the baseline period, assuming that the country's improved economic prospects will trigger a rise in employment and, partially, in salaries. This is applied proportionally to all sectors of the economy before adding the shock factors for the three simulated scenarios.[32] In Timbuktu, Ségou, Gao and Kidal the shock factor was assumed to be a 10 percentage point reduction because of insecurity.

[30] Average price variation between August 2011 and August 2012 (for scenario 3) and between the baseline month and the year before (for scenario 1 and 2) is applied to the Seasonal-Holt Winters forecast of food price variation. Additional information was used to distinguish between the two climate shocks scenarios, 3 percentage points were added to prices in flood-prone areas as a result of the seasonally adjusted, de-trended food price anomaly in 2012 with TRAMO on food prices, combining qualitative information obtained on OPIDIN for the flood scenario. In the event of a drought, 7 percentage points were added to food prices, as a result of the seasonally adjusted, de-trended food price anomaly in 2011 with TRAMO on food prices.

[31] As extracted from the household assessment data.

[32] The Income section will present the results of the application of the various income shock factors to the combination of household members' employment status, household composition, region and sector of the economy.

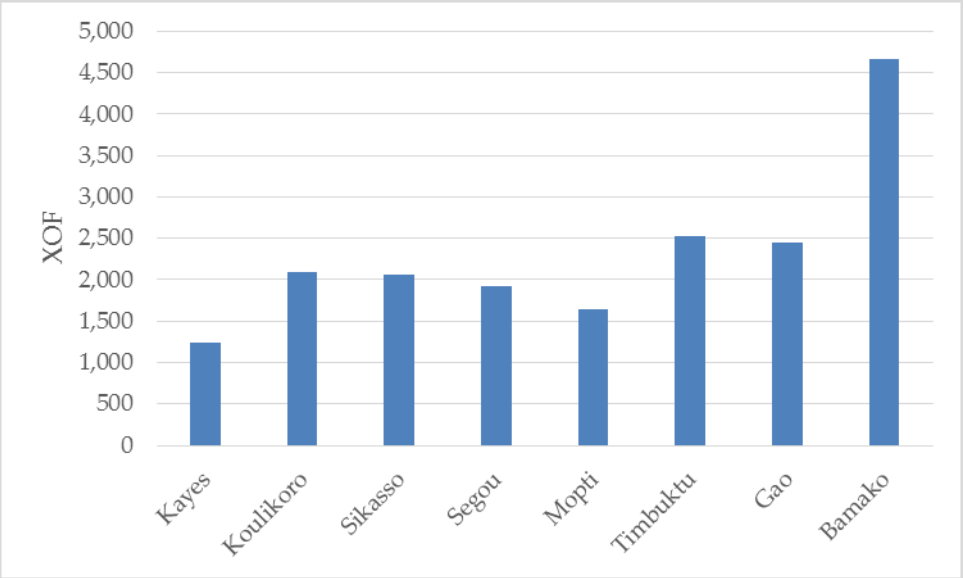
# 4 Running the simulation

## 4.1 INCOME

Through the model we estimate the changes in the relative importance of the different income sources, simulating the impact that the combination of shock factors has on household livelihoods.

Shares of income from different sources in the baseline scenario are presented in Figure 6, while weekly levels, per capita, are expressed in Figure 5.

*Figure 5: Average weekly per capita income by region*




*Source: ENSAN, February 2017; Author's calculations*
*Note: Figures from Kidal, biased by suspected misreporting in household size, have been removed from this graph*

The baseline scenario[33] shows major differences in the share of income from different sources per region. Households in Sikasso and Ségou largely depend on agricultural production for their income (at 44 and 38 percent), with a low share from livestock, fishing and forestry sector (3 and 7 percent). Households in Timbuktu and Mopti have their income sources divided in similar ways, with agriculture contributing 26 percent of income and livestock, fishing and forestry providing the second largest share (15 and 17 percent). Small business and the sale of food products complete the picture for Mopti, which reportedly has the second lowest average per capita weekly income (XOF1650). Households in Kayes are the poorest in terms of per capita weekly income (XOF1240); the biggest sector is crop cultivation (20 percent) while other sectors such as small business, public administration and salaries, transfers and other sources generate around 15 percent of income each. In Koulikoro, households receive 21 percent of their income from crop cultivation, 21 percent from small businesses and 20 percent from public administration and salaries. The regions of Gao and Kidal are characterized by the presence of households who earn a large share of income from pastoralist activities (22 and 25 percent) and food trade (17 and 19 percent). Households in Kidal earn the most, in particular

[33] For a focused analysis of the baseline data, please see the dedicated ENSAN report.

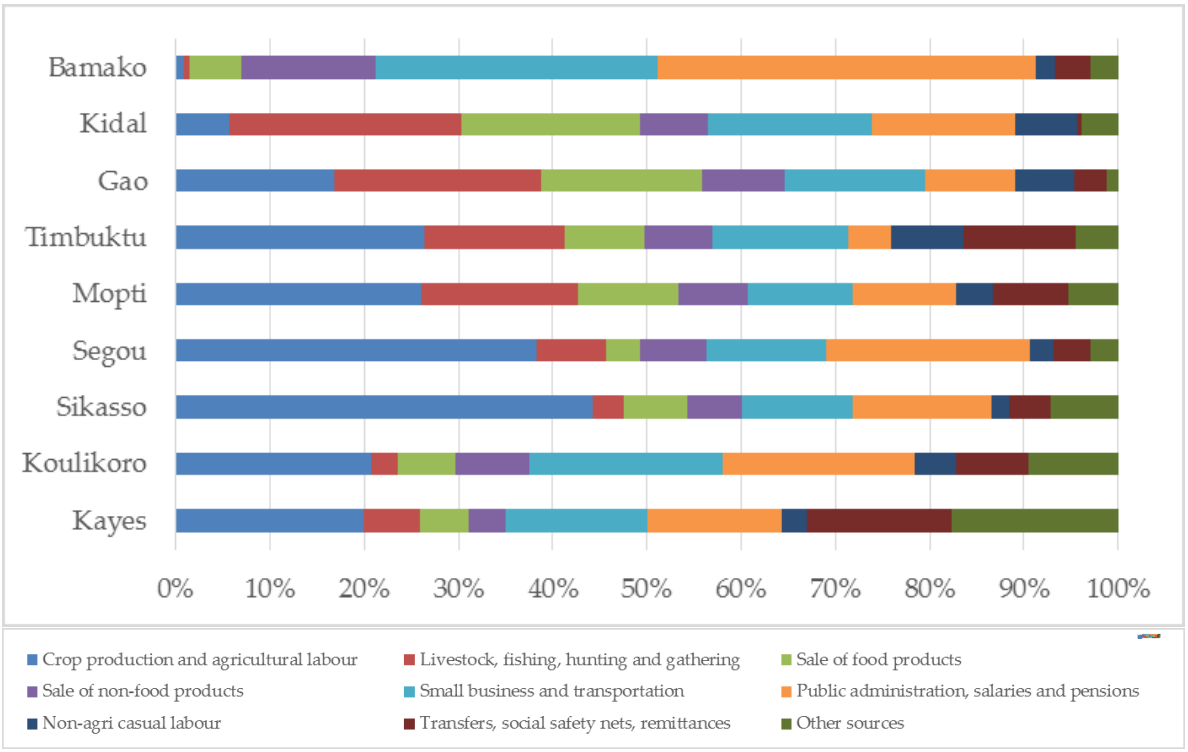
from small business, transportation and salaries. A handful of households report an income twenty times higher than the average household income from small business. Finally, the administrative area of Bamako has productive activities that are less related to agriculture. Households earn most of their income from public administration, salaries and pensions (40 percent), followed by small business and transportation (30 percent) and the trade of non-food items (14 percent), with an average income of XOF4,660.

In the drought scenario, livestock, fishing, hunting and gathering activities see the most notable changes in income source concentration compared to the baseline (as presented in Figure 6 and further disaggregated in Table 12Table 12 in Annex II). Households in Kidal will obtain even more of their income from those primary activities (with an increase of 8.1 percent), while the relative importance of all other income sources in the household budget will reduce by between 2.5 and 2.7 percent. The reverse is true in Timbuktu and Gao: the former will see the share of income earned from livestock activities drop by 7.9 percent, in favour of other activities (up 1.2 to 1.6 percent). Households living in Gao will be subject to a 7.2 percent fall in earnings from livestock activities, while other activities will grow their relative weight within total household income by between 1.9 and 2.2 percent.

In the flood scenario, the shock factors impact the income sources of households living in the various regions in different ways compared with the baseline. Crop production and sale will generally increase their relative importance, except in Gao and Kidal, where this type of income is expected to decrease in favour of livestock activities. In relative terms, Koulikoro, Sikasso and Ségou will derive a larger part of household per capita monthly income from crop production and sale, but also from other non-agricultural casual labour activities (4.5, 4.1 and 3.8 percent). In Sikasso, Ségou and Mopti, the share of income from livestock will increase consistently (6.4, 6.7 and 7.2 percent) at the expense of other activities.

In the heightened insecurity scenario, crop production and agricultural activities will not change consistently in relative terms. For households living in Kayes, the share of income coming from these activities is expected to rise by 8.4 percent, with a 2 to 2.4 percent drop in income from other activities. The same result is expected in Koulikoro, while in Sikasso the share of income from agriculture and pastoralist activities will rise by 5.5 percent, with a corresponding drop ranging from 4.7 to 5 percent in the relative contribution to total average income of all other activities. In this scenario, the aforementioned regions and Kidal will suffer the most in relative terms, as the benefits of the forecasted national economic growth will be directed to fewer activities if insecurity intensifies.

*Figure 6: Baseline share of income per source, by region*

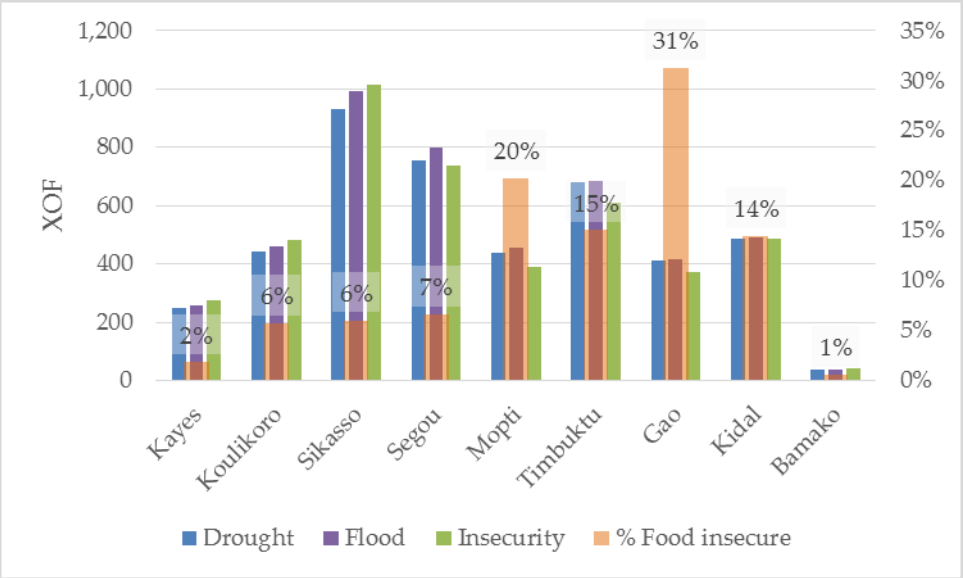



*Source: ENSAN, February 2017; author's calculation*

A comparison of average weekly per capita agricultural income and the baseline share of food-insecure households by region reveals a notable difference from findings in other countries:[34] the level of income from agriculture is not positively correlated with food security in Mali, in particular for regions that are predominantly rural (Figure 7). In the absence of this significant linkage, it is interesting to see how food insecurity in the baseline is already quite diverse. Gao has the highest rate, with 31 percent of households at Level 3 or 4 of the Food Insecurity Index derived from CARI. This is followed by Mopti, where 20 percent of households are food insecure according to the same index, while in Timbuktu and Kidal about 15 percent of households were found to be food insecure in February 2017. The diversification of income sources within households and in most regions allows households to withstand the economic impact of a shock.

[34] Previous similar analysis was run on household data from Chad, Nigeria, Niger, Malawi and Democratic Republic of the Congo. The analysis showed that a high level of income from agriculture usually is directly linked to, or positively correlated with, a high level of food security.

*Figure 7: Per capita weekly agricultural income and share of food-insecure households by region*




*Source: ENSAN, February 2017; author's calculation*

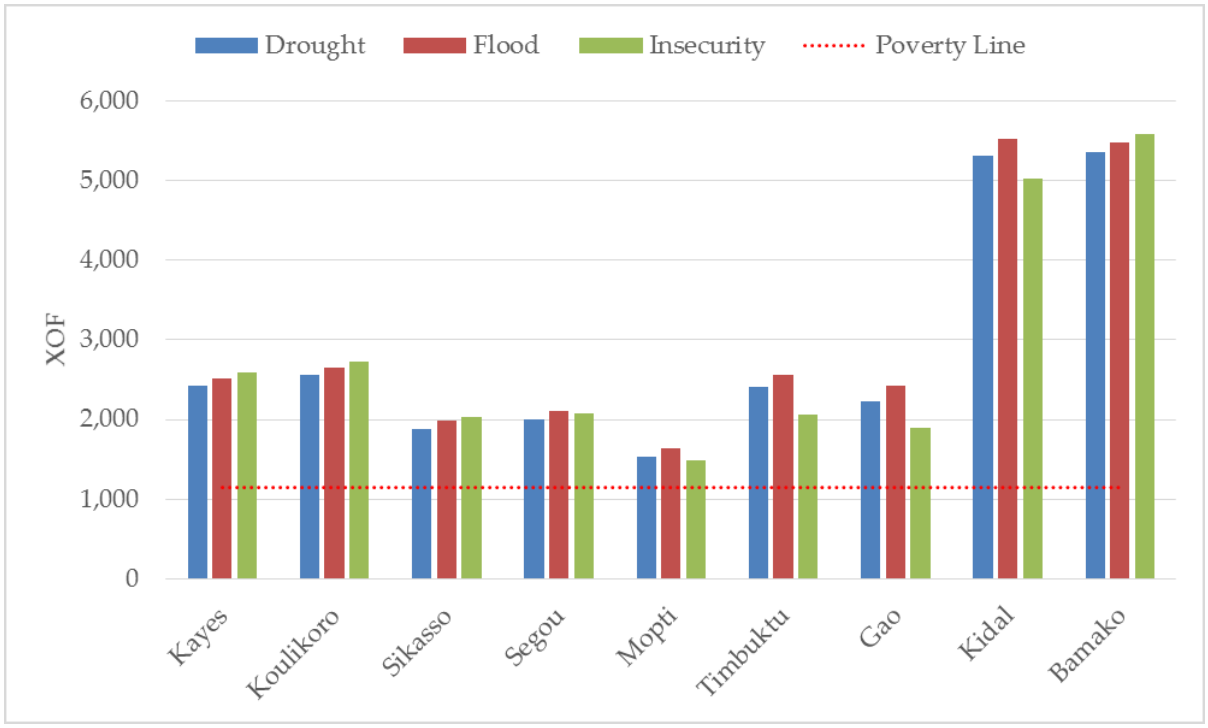
## 4.2 EXPENDITURES

The estimates of Malian households' economic behaviour and the simulation of the impact of shocks on their expenditure are based on the ENSAN 2017.

The estimates for average propensity to consume and the elasticity coefficients (Annex I) obtained from baseline household expenditures, prices and consumption were combined with the shock factors defined in Section 3: Assumptions to derive the new household expenditure pattern for each scenario.

The analysis of expenditures in different scenarios confirms the capacity of households to maintain their level of expenditure (Figure 8) given in population variability of propensity to spend and adversity to reducing food expenditures, in particular. Households living in Kidal and Bamako spend more than those living in other regions. The median expenditures of households living in Mopti are the lowest in the country, and the scenario of rising insecurity is the worst for inhabitants of this region, Gao, Timbuktu and Kidal.

*Figure 8: Per capita weekly expenditures in different scenarios, median per region*



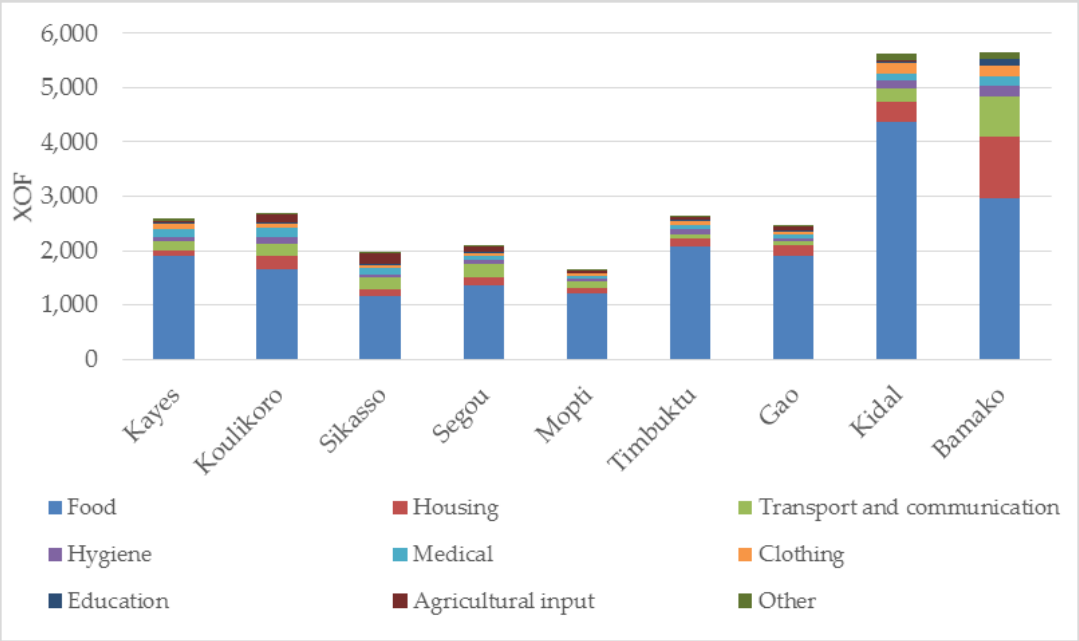

*Source: Author's calculation*[35]

The differences[36] in the allocation of the high levels of expenditures by households living in Kidal and Bamako are further explored in Figure 9Figure 9. Expenditures in Bamako are linked to various items with food representing almost XOF3,000 in the total per capita budget of XOF5,650. In Kidal, this proportion is very different, with XOF4,362 spent on food out of a total budget of XOF5,620. Given the higher substitutability of other items compared to food, and the high prices for consumers in Kidal, any drop in income or increase in prices will have a much greater and more direct effect on the food security of households in Kidal. In Koulikoro, Sikasso and Ségou, food expenditures make up an average 60 to 65 percent of the household budget. In Kayes, Mopti, Kidal, Timbuktu and Gao, they constitute between 73 and 78 percent, leaving households with few alternatives. Expenditures on agricultural inputs, crucial for the development of the primary sectors, are the highest in Koulikoro, Sikasso and Ségou, where households spend 6 to 9 percent of their per capita budget on such items.

[35] Poverty line refers to US$2 converted into XOF.

[36] In this paragraph, we refer to baseline data, since the allocation of expenditures between different groups does not change significantly in the various scenarios.

*Figure 9: Per capita weekly expenditure, average by sector and region*




*Source: ENSAN, February 2017*

Although sampling is limited, it is important to try to analyse expenditure levels for the different scenarios by the sex of the household head and their literacy level, as shown in Table 5.

*Table 5: Sample size by sex and literacy level*

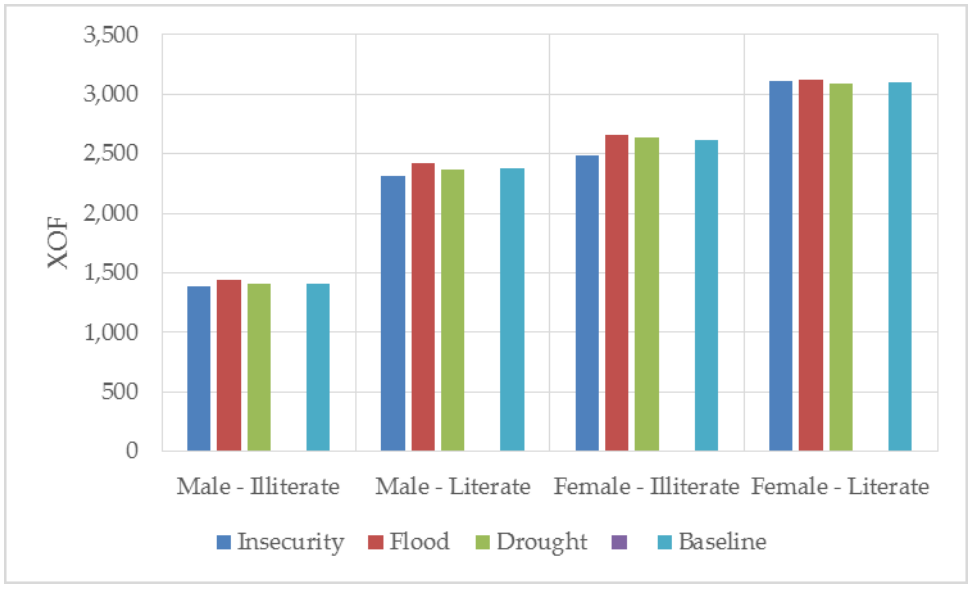
| | Sample size | |
|---|---|---|
| | Count | Share |
| Male - Illiterate | 4268 | 43% |
| Male - Literate | 4979 | 50% |
| Female - Illiterate | 443 | 4% |
| Female - Literate | 280 | 3% |

*Source: ENSAN, February 2017*

Per capita weekly expenditures, divided by sex and literacy (Figure 10), show that households with an illiterate head spend less than those with a literate one, for both males and females, but the gap is much larger for households led by men. Variations in the different scenarios of the median value are in the order of +/- 5 percent.

Households led by women spend more than those led by men, and their capacity to spend does not seem to be diminished by flooding or droughts. The households led by women included in the sample are mostly from Kayes, Bamako and Timbuktu, with large differences in their literacy rates. Kayes and Timbuktu have among the lowest literacy rates for women heads of household (15 and 25 percent) while Bamako has the highest (54 percent). The uneven distribution of households led by women across the regions of Mali could explain why their expenditures are higher than those of households led by men, together with the higher dependency rate of households led by women.

*Figure 10: Median weekly per capita expenditure by sex and literacy of household head*




*Source: Author's calculation*


*Picture: Women receiving WFP in-kind assistance.*

## 4.3 FOOD SECURITY

The different scenarios assume an economic situation which is improving in macroeconomic terms. In the simulation, average income and food expenditures vary little, and consumer inflation is contained in its food and non-food components. However, the additional price rises that the different scenarios would trigger, as described in the section on shocks, would still lead more households into food insecurity.[37] Shocks would affect households in different ways: if grouped by quartile of per capita weekly expenditures (Table 6), households who spend less are always more prone to food insecurity than those who spend the most.

However, the biggest increase in food-insecure households is estimated to occur in the event of rising insecurity which, for those with the lowest expenditures, would translate into a 16 percentage point increase, up to 37 percent. The flood scenario would cause an increase in food-insecure households in the two highest quartiles, while it would have less impact in the two lower quartiles, with a slight fall in the share of food-insecure households. In the event of a drought, households in the higher expenditure quartile see the biggest change, with an increase in the share of food-insecure households from baseline of 11 percentage points for the mid-high quartile. Even so, rates of food insecurity would still be highest among households in the lower expenditure quartile (29 percent).

There is large variability in food insecurity rates by region (Figure 11). In all three scenarios, the share of households with a caloric intake below the threshold of 1,800 kcal/person/day in Bamako remains stable or increases slightly, by up to 6 percent in the drought scenario. In the baseline assessment, 23 percent of households living in Kidal had low caloric intake; this share rises to 34 percent in the insecurity scenario, to 41 percent in the flooding scenario, and to 50 percent in the event of drought. In Gao, the region with the highest level of food insecurity recorded during the baseline assessment (29 percent), the share of households with low caloric intake peaks at 75 percent in the insecurity scenario. Flooding would render 41 percent food insecure, and drought would leave 59 percent food insecure.

*Table 6: Share of households consuming less than 1,800 kcal per person per day by quartile of per capita weekly expenditures*

| | Drought | Flood | Insecurity | Baseline |
|---|---|---|---|---|
| Lowest | 29% | 18% | 37% | 21% |
| Mid-Low | 19% | 12% | 25% | 13% |
| Mid-High | 20% | 11% | 23% | 9% |
| Highest | 7% | 5% | 9% | 4% |

*Source: Author's calculation*

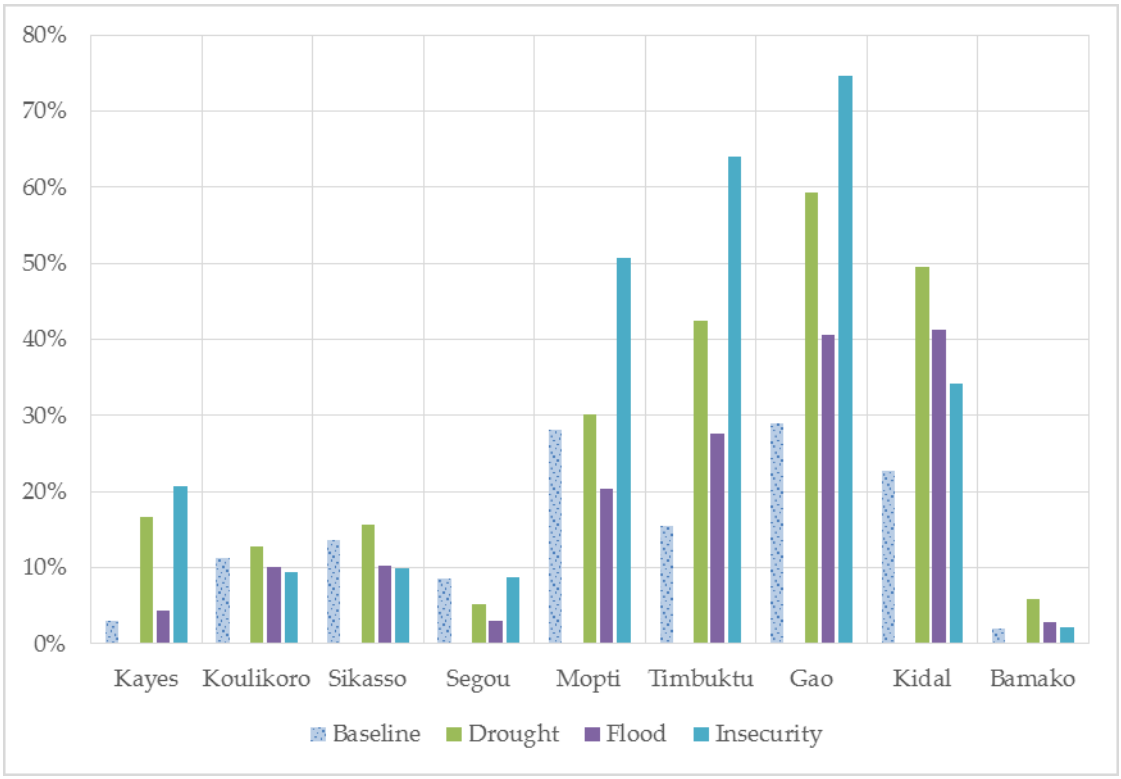
According to the simulation, Timbuktu is the region that would see the greatest relative increase in food insecurity. In the baseline assessment, only 16 percent of households were below the 1,800 kcal/person/day threshold, but under the scenario of rising insecurity this share would quadruple to 64 percent. Given the strong market dependency, significant

[37] The new level of expenditures by food item that are obtained by combining the elasticities of the second-stage estimation with the shock factors are translated into quantity of food consumed, and then into daily caloric consumption. A household is classified as food insecure if its daily caloric intake is less than 1,800 kcal per person.

increases are also forecast in the event of drought (up 27 percentage points) and flooding (up 12 percentage points).

In Mopti, insecurity would see the share of households with low caloric intake rise from the baseline assessment level of 28 percent to 51 percent. In Kayes, a region where just 3 percent of households had low caloric intake in the baseline, food insecurity rates would rise in the event of a drought (to 17 percent of the population) or with heightened insecurity (up to 21 percent). There are no significant changes in food security as gauged by caloric intake for the other regions.

*Figure 11: Share of households with caloric intake below 1,800 kcal/person/day, by region and scenario*




*Source: Author's calculations*

Households with different main sources of income fare differently under the three scenarios (Table 7). In the baseline, the highest share of food-insecure households is found among those whose main source of income is non-agricultural casual labour. Despite the nature of the shocks, flooding and droughts do not cause the food insecurity of a large portion of households working in agriculture. Instead, the largest percentage change is among households whose main source of income is pastoralist activities, non-agricultural casual labour, or transfers from relatives and social safety nets. In the event of insecurity, the households suffering the greatest relative decline in food security are those who rely on the sale of non-food products (whose food insecurity rate almost triples) and those dependent on small businesses and transportation (with double the share of food-insecure households).

*Table 7: Share of households with caloric intake below 1,800 kcal/person/day, by main income source*

| Main income source | Insecurity | Flood | Drought | Baseline |
|---|---|---|---|---|
| Crop production and agricultural labour | 22% | 12% | 19% | 16% |
| Livestock, fishing, hunting and gathering | 45% | 16% | 25% | 16% |
| Sale of food products | 17% | 12% | 17% | 9% |
| Sale of non-food products | 30% | 15% | 21% | 11% |
| Small business and transportation | 22% | 12% | 17% | 9% |
| Public administration, salaries and pensions | 7% | 4% | 6% | 3% |
| Non-agri casual labour | 43% | 21% | 33% | 21% |
| Transfers, social safety nets, remittances | 35% | 12% | 27% | 11% |
| Other sources | 18% | 5% | 17% | 6% |

*Source: Author's calculation*

# 5 Operationalizable simulation results

The shock impact simulation produces proportions of food insecurity as defined by different methodologies, such as the Comprehensive Approach for Reporting Indicators of Food Security (CARI). This approach was chosen to translate the caloric gap into metric tons of cereal equivalent food aid necessary to fill the gap and the numbers of food-insecure people per region.

The shares of food-insecure households were translated[38] into rough numbers of food-insecure people using projected population estimates. The results are presented in Table 8. Further results can be found in Annex II; additional numbers of people expected to be in Phase 3 or 4 are presented in Table 10**Error! Reference source not found.**, while Table 11 examines severe food insecurity, showing only the number of individuals falling in CARI Phase 4.

*Table 8: Number of food-insecure people (in CARI Phase 3 or 4) by region*

| Region | Insecurity | Flood | Drought | Baseline | Population |
|---|---|---|---|---|---|
| Kayes | 1,497,000 | 838,000 | 1,330,000 | 257,000 | 3,600,000 |
| Koulikoro | 310,000 | 299,000 | 412,000 | 349,000 | 2,432,000 |
| Sikasso | 309,000 | 299,000 | 378,000 | 380,000 | 2,159,000 |
| Segou | 647,000 | 337,000 | 423,000 | 640,000 | 3,111,000 |
| Mopti | 1,428,000 | 778,000 | 980,000 | 1,026,000 | 2,377,000 |
| Timbuktu | 1,393,000 | 730,000 | 832,000 | 446,000 | 1,533,000 |
| Gao | 840,000 | 598,000 | 694,000 | 479,000 | 970,000 |
| Kidal | 44,000 | 51,000 | 54,000 | 30,000 | 121,000 |
| Bamako | 85,000 | 102,000 | 131,000 | 65,000 | 2,537,000 |
| **Mali** | 6,553,000 | 4,032,000 | 5,234,000 | 3,672,000 | 18,840,000 |

*Source: Author's calculation, population estimates extracted from ENSAN, February 2017; rounding applied*

Finally, the gap in the caloric intake to reach a daily consumption of 1800 kcl per adult equivalent was multiplied by the projected population and rescaled to kilograms per month to give estimates of the metric tons of cereal equivalent food aid necessary to cope in the different scenarios, broken down by region (Table 9).

[38] Applying the CARI methodology using as indicators per capita caloric intake, the share of food expenditures, and the baseline value of the coping strategy index. These figures assume households will not adopt any additional coping strategies. Note that this is different from the shares reported in Table 7.

*Table 9: Metric tons of cereal equivalent monthly food aid needed to fill the gap to 1800 kcal/person/day*

| Region | Insecurity | Flood | Drought | Baseline |
|---|---|---|---|---|
| Kayes | 6,900 | 1,950 | 4,350 | 870 |
| Koulikoro | 2,180 | 2,270 | 3,670 | 2,760 |
| Sikasso | 3,600 | 3,600 | 5,310 | 4,710 |
| Segou | 2,880 | 1,070 | 1,810 | 2,720 |
| Mopti | 19,200 | 5,550 | 9,200 | 8,630 |
| Timbuktu | 32,750 | 6,660 | 10,340 | 3,920 |
| Gao | 21,320 | 7,350 | 10,650 | 4,950 |
| Kidal | 970 | 1,420 | 1,450 | 510 |
| Bamako | 580 | 740 | 1,190 | 420 |
| **Mali** | 90,380 | 30,610 | 47,970 | 29,490 |

*Source: Author's calculation*

# 6 Concluding remarks

The main signals from the Malian economy are positive, and projections from several sources point to economic growth in the country. Households have multiple income sources, which diminishes the risks typically faced in regions where livelihoods are associated with one single activity. Despite the moderate assumptions underpinning the shock factors, the simulation shows how local price variations could have a major impact on the share of households who can afford to buy enough food to provide a sufficient caloric intake for their members.

Households living in Kayes, Mopti, Timbuktu and Gao are particularly prone to shocks caused by an increase in insecurity. Under this scenario, the model forecasts that food aid requirements would double, with most of the extra need originating in these four regions.

Drought would trigger a 260 percent increase in the metric tons of food aid needed, particularly in Timbuktu, Gao and Kayes. In Kidal, food assistance requirements would triple.

Local flooding would have much less impact in an economic growth scenario. Kidal would see the largest increase in the number of food-insecure households, caused by rising prices.

Given the variability of prices in the country and the seasonality of staple food prices, it is important to invest in market integration and implement mechanisms that can react to factors that could destabilize staple food prices.

Among the most vulnerable livelihoods are pastoralists, casual workers not employed in agriculture, households who rely on transfers and social safety nets, and those engaged in small non-food trade. Activities to build the resilience of these households should be considered, given their low capacity to respond to shocks (particularly to insecurity and drought) as shown by the simulation.

## ANNEX I

The economic behaviour of each household is modelled through a Linear Expenditure System (LES) and a Linearized Almost Ideal Demand System[39] (LAIDS). This is a two-stage budget allocation demand system. It means that first, a household decides what percentage of their income to spend on food and other major non-food groups (such as education, health and communication). Then, the household decides how to allocate their food expenditure across different food items. In technical terms, a LES is used to estimate own-price elasticities and expenditure elasticities for two consumption groups[40] – 'elasticity' expresses how the allocation of income to food and non-food groups changes when total household income or prices change. The estimation uses data on the following:

- Household demographics;
- Household income;
- Expenditures on food and non-food items;
- Number of days in which any food item from different groups has been consumed by household members over a seven-day recall period;
- Agricultural inputs; and
- Crop production.

In the second stage, we estimate a LAIDS for nine food groups,[41] thereby obtaining a new set of income and price elasticities which express how the consumption of each food item changes when price and income change.

Once the complete set of elasticities has been estimated, it is possible to simulate the impact of shocks on household food consumption in a few steps: i) translate the shock into shock factors, ii) estimate the new income allocation based on shock factors and previously estimated elasticities, and iii) derive the resulting household food consumption and caloric intake.

Shocks can be translated into shock factors by considering the hypothetical change in certain economic variables (e.g. production, wages, price, income and remittances) from the baseline year to the year in which the shock would take place. For example, a production shock similar to the drought of the agricultural season 2011/12 can be translated into a shock impact factor defined as the crop production outcomes ratio between the baseline and the simulated period. Similar ratios for food prices and consumer price index levels can be applied as well.

The combination of shock factors and estimated elasticities allows us to estimate new expenditures in the shock year and consequently, food consumption. Since household food expenditures (but not quantities) are commonly available in surveys, we derive the quantities

[39] Deaton and Muellbauer, 1980. "An Almost Ideal Demand System" in *American Economic Review*, 1980, vol. 70, issue 3, 312–26.

[40] Food items and non-food items.

[41] Cereals, tubers, pulses, vegetables, fruits, proteins of animal provenance, dairy products, sugary products, oil and fats.

by linking these expenditure shares to human food consumption as available in FAO's Food Balance Sheet and expressed in terms of daily caloric consumption per person for each item (group).[42] We assume that the sampled households with acceptable food consumption[43] have a consumption pattern in line with what is described in the Food Balance Sheet. Thanks to these assumptions we are able to obtain a proxy for quantities consumed in each food group and compare it with the food security situation for a representative population's sub-group. The final step is to transform these estimated food quantities into food security indicators by transforming consumption shares into grams using NutVal data.[44]

[42] FAOSTAT – Food Balances

[43] In this section, we refer to acceptable food consumption when the Food Consumption Score is equal to 42, the threshold level for Mali.

[44] We used the NutVal 4.0 edition

## ANNEX II

*Table 10: Additional number of food-insecure people (in CARI Phase 3 or 4) by region*

| Region | Insecurity | Flood | Drought | Population |
|---|---|---|---|---|
| Kayes | 1,240,000 | 581,000 | 1,073,000 | 3,600,000 |
| Koulikoro | - | - | 63,000 | 2,432,000 |
| Sikasso | - | - | - | 2,159,000 |
| Segou | 7,000 | - | - | 3,111,000 |
| Mopti | 402,000 | - | - | 2,377,000 |
| Timbuktu | 947,000 | 284,000 | 386,000 | 1,533,000 |
| Gao | 361,000 | 119,000 | 215,000 | 970,000 |
| Kidal | 14,000 | 21,000 | 24,000 | 121,000 |
| Bamako | 20,000 | 37,000 | 66,000 | 2,537,000 |
| **Mali** | 2,991,000 | 1,042,000 | 1,827,000 | 18,840,000 |

*Source: Author's calculation, population estimates extracted from ENSAN, February 2017; rounding applied*

*Table 11: Number of severely food-insecure people (in CARI Phase 4) by scenario and region*

| Region | Insecurity | Flood | Drought | Baseline | Population |
|---|---|---|---|---|---|
| Kayes | 38,000 | 14,000 | 22,000 | 36,000 | 3,600,000 |
| Koulikoro | 50,000 | 24,000 | 27,000 | 50,000 | 2,432,000 |
| Sikasso | 50,000 | 30,000 | 30,000 | 50,000 | 2,159,000 |
| Segou | 97,000 | 40,000 | 40,000 | 97,000 | 3,111,000 |
| Mopti | 173,000 | 69,000 | 107,000 | 179,000 | 2,377,000 |
| Timbuktu | 40,000 | 118,000 | 130,000 | 128,000 | 1,533,000 |
| Gao | 92,000 | 184,000 | 233,000 | 192,000 | 970,000 |
| Kidal | 4,000 | 4,000 | 4,000 | 4,000 | 121,000 |
| Bamako | 3,000 | 5,000 | 5,000 | 3,000 | 2,537,000 |
| **Mali** | 547,000 | 488,000 | 598,000 | 739,000 | 18,840,000 |

*Source: Author's calculation, population estimates extracted from ENSAN, February 2017; rounding applied*

*Table 12: Average weekly income per capita (XOF)*

| Region | Crop production and agricultural labour | Livestock, fishing, hunting and gathering | Sell of food products | Sell of non-food products | Small business and transportation | Public administration, salaries and pensions | Non-agri casual labour | Transfers, social safety nets, remittances | Other sources | Total Income | Scenario |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Kayes | 247 | 73 | 64 | 48 | 187 | 175 | 33 | 190 | 218 | 1236 | Baseline |
| Koulikoro | 433 | 57 | 127 | 165 | 428 | 424 | 91 | 161 | 198 | 2084 | Baseline |
| Sikasso | 912 | 69 | 140 | 118 | 242 | 306 | 40 | 90 | 146 | 2063 | Baseline |
| Segou | 737 | 141 | 68 | 138 | 243 | 416 | 49 | 74 | 57 | 1921 | Baseline |
| Mopti | 430 | 274 | 176 | 120 | 185 | 179 | 65 | 133 | 86 | 1648 | Baseline |
| Timbuktu | 664 | 377 | 214 | 180 | 363 | 114 | 195 | 300 | 114 | 2521 | Baseline |
| Gao | 411 | 538 | 422 | 213 | 364 | 237 | 154 | 82 | 31 | 2451 | Baseline |
| Kidal | 487 | 2081 | 1597 | 614 | 1461 | 1287 | 566 | 30 | 332 | 8457 | Baseline |
| Bamako | 36 | 31 | 256 | 666 | 1393 | 1870 | 97 | 175 | 137 | 4661 | Baseline |
| Kayes | 250 | 75 | 64 | 48 | 188 | 175 | 33 | 191 | 219 | 1242 | Scenario 1 |
| Koulikoro | 440 | 57 | 128 | 165 | 429 | 425 | 93 | 163 | 200 | 2099 | Scenario 1 |
| Sikasso | 932 | 76 | 140 | 119 | 243 | 306 | 41 | 90 | 147 | 2093 | Scenario 1 |
| Segou | 752 | 157 | 68 | 138 | 244 | 416 | 50 | 74 | 57 | 1955 | Scenario 1 |
| Mopti | 436 | 274 | 176 | 120 | 185 | 179 | 66 | 133 | 86 | 1655 | Scenario 1 |
| Timbuktu | 666 | 343 | 214 | 180 | 363 | 114 | 195 | 300 | 114 | 2490 | Scenario 1 |
| Gao | 412 | 490 | 422 | 213 | 364 | 237 | 154 | 82 | 31 | 2405 | Scenario 1 |
| Kidal | 488 | 2310 | 1597 | 614 | 1461 | 1287 | 567 | 30 | 332 | 8687 | Scenario 1 |
| Bamako | 36 | 35 | 256 | 667 | 1395 | 1871 | 98 | 175 | 137 | 4670 | Scenario 1 |
| Kayes | 256 | 75 | 64 | 48 | 188 | 175 | 34 | 191 | 219 | 1249 | Scenario 2 |
| Koulikoro | 461 | 57 | 128 | 165 | 429 | 425 | 97 | 163 | 200 | 2124 | Scenario 2 |
| Sikasso | 991 | 76 | 140 | 119 | 243 | 306 | 43 | 90 | 147 | 2155 | Scenario 2 |
| Segou | 797 | 157 | 68 | 138 | 244 | 416 | 53 | 74 | 57 | 2003 | Scenario 2 |
| Mopti | 454 | 304 | 176 | 120 | 185 | 179 | 69 | 133 | 86 | 1706 | Scenario 2 |
| Timbuktu | 673 | 377 | 214 | 180 | 363 | 114 | 198 | 300 | 114 | 2533 | Scenario 2 |
| Gao | 416 | 597 | 422 | 213 | 364 | 237 | 156 | 82 | 31 | 2517 | Scenario 2 |
| Kidal | 490 | 2310 | 1597 | 614 | 1461 | 1287 | 570 | 30 | 332 | 8692 | Scenario 2 |
| Bamako | 36 | 35 | 256 | 667 | 1395 | 1871 | 98 | 175 | 137 | 4671 | Scenario 2 |
| Kayes | 275 | 75 | 64 | 48 | 188 | 175 | 33 | 191 | 219 | 1266 | Scenario 3 |
| Koulikoro | 481 | 57 | 128 | 165 | 429 | 425 | 91 | 163 | 200 | 2138 | Scenario 3 |
| Sikasso | 1013 | 76 | 140 | 119 | 243 | 306 | 40 | 90 | 147 | 2173 | Scenario 3 |
| Segou | 737 | 141 | 68 | 138 | 244 | 416 | 49 | 74 | 57 | 1923 | Scenario 3 |
| Mopti | 387 | 247 | 159 | 108 | 166 | 161 | 59 | 120 | 77 | 1483 | Scenario 3 |
| Timbuktu | 597 | 340 | 193 | 162 | 327 | 103 | 175 | 270 | 102 | 2269 | Scenario 3 |
| Gao | 370 | 484 | 379 | 192 | 328 | 213 | 139 | 73 | 28 | 2206 | Scenario 3 |
| Kidal | 486 | 1873 | 1438 | 553 | 1315 | 1158 | 510 | 27 | 299 | 7659 | Scenario 3 |
| Bamako | 40 | 35 | 256 | 667 | 1395 | 1871 | 98 | 175 | 137 | 4674 | Scenario 3 |

*Source: ENSAN 2017 – February (baseline), Author's calculation*

Released February 2018

WFP
wfp.org

vam
food security analysis