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Outlook

GFA 30

August 2019

International Food Security Assessment, 2019-2029

Projections for higher incomes and lower food prices translate into improved food security outlook for 2029 for 76 low- and middle-income countries

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Karen Thome, Michael D. Smith, Kamron Daugherty, Nicholas Rada, Cheryl Christensen, and Birgit Meade

Abstract

USDA-ERS presents results from its International Food Security Assessment model, a demand-driven framework that includes information on domestic prices and consumer responsiveness to changes in prices and incomes. Given projections for lower food prices and rising incomes, food security for the 76 low- and middle-income countries included is expected to improve through 2029. The share of population that is food insecure is projected to fall from 19.3 percent in 2019 to 9.2 percent in 2029. The number of food-insecure people is projected to fall markedly from 782 million to 399 or a decline of 45 percent, faster than the decline in the food gap, the amount of food necessary to allow all food-insecure people to reach the nutritional target of 2,100 calories per capita per day, indicating somewhat slower change in the intensity of food insecurity, at the aggregate level.

Keywords: Food security, food insecurity, food prices, income, food demand, trade, production, commercial imports, export earnings, calories, nutritional target, Sub-Saharan Africa, North Africa, Asia, Latin America and the Caribbean, Food Insecurity Experience Scale, FIES.

Acknowledgments

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Preface

This report continues the series of food assessments in developing countries begun in the late 1970s by USDA's Economic Research Service. *Global Food Assessments* were done from 1990 to 1992, hence the GFA series. In 1993, the title was changed to *Food Aid Needs Assessment* to more accurately reflect the contents of the report, which focuses on selected developing countries with recent or ongoing food deficits. In 1997, we widened our analysis beyond the assessment of aggregate food availability to include more aspects of food security. We therefore changed the title to *Food Security Assessment*. Starting with the report published in July 2011, we changed the name to *International Food Security Assessment* to clarify that this is not an assessment of U.S. food security.

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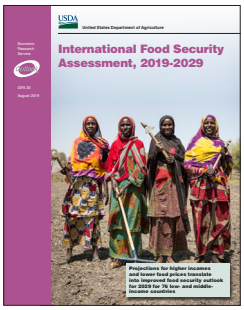


International Food Security Assessment, 2019-2029

Karen Thome, Michael D. Smith, Kamron Daugherty, Nicholas Rada, Cheryl Christensen, and Birgit Meade

What Is the Issue?

International food price spikes over the past decade have challenged the food security of vulnerable populations, as evidenced by riots due in part to sharp increases in prices of basic foods in some parts of the world, from Haiti to Bangladesh to Egypt. Low food prices and rising incomes can improve a country's food security situation because people can more readily afford and access food. The speed of improvement in food security is also affected by inequality in income and consumption, as well as by agricultural production and market conditions. For example, if average income gains accrue predominantly to lower income households, thus making income distribution more equal, food security will improve faster than if inequality in incomes widens. Understanding how these factors collectively affect food supply and demand provides a measure of progress in food security. This report assesses food security indicators for 76 low- and middle-income countries grouped into four regions: Sub-Saharan Africa (39 countries), North Africa (4 countries), Latin America and the Caribbean (11 countries), and Asia (22 countries).

What Did the Study Find?

In 14 out of 76 countries, more than 50 percent of their populations were estimated to be food insecure in 2019. Eight of those countries are in Central and East Africa, one in West and Southern Africa each, and three in Asia. Haiti is the most food-insecure country in the Western Hemisphere, with 47 percent estimated to be food insecure in 2019.

Given projections for lower food prices and rising incomes for most countries in this report, food security generally is expected to improve between 2019 and 2029. Food security is assessed using three indicators, all of which are projected to improve:

- The share of the food-insecure population is expected to fall from 19.3 percent to 9.2 percent.
- The number of food-insecure people is projected to fall from 728 million to 399 million.
- The food gap—the amount of food required to allow all food-insecure people to reach the caloric target of 2,100 calories per person per day—is projected to decline from 33.5 million tons to 21.9 million tons.

Gains in food security vary across regions.

- In **Asia**, where income growth is strong, the share of the food-insecure population is projected to decline from 13.9 percent in 2019 to 3.5 percent in 2029.
- The challenge is greater in **Sub-Saharan Africa (SSA)** where population growth is higher and income growth lower. In 2019, SSA has an estimated 35.3 percent of its population food insecure; despite improvements, 22.5 percent are still projected to be food insecure in 2029.
- In **Latin America and the Caribbean (LAC)**, the share of the population that is food insecure is projected to drop from 17.4 percent in 2019 to 8.3 percent in 2029.
- Food security is also projected to improve for **North Africa**, the most food-secure region in the study. There, the share of the population that is food insecure falls from 5.2 percent in 2019 to 1.9 percent in 2029.

Of note, these projections show potential improvements assuming favorable income and price trends. The projections do not include predictions of future weather and conflict-induced crises and food shortfalls—constant challenges in some of the most food-insecure countries—and therefore are most representative of a baseline scenario.

How Was the Study Conducted?

The ERS demand-oriented International Food Security Assessment (IFSA) model projects food demand and food gaps in 76 low- and middle-income countries through 2029. Food security is evaluated for each country by estimating the share of the population unable to reach a caloric target of 2,100 calories per person per day. The intensity of food insecurity is measured by determining the gap between projected food demand for those falling below the threshold and the caloric target. Food demand is expressed in grain equivalents based on caloric content to allow aggregation across four separate food groups: the major grain consumed in the country, other grains, roots and tubers, and all other food. Average per capita food consumption data are from the United Nations' Food and Agriculture Organization (FAO) Food Balance Sheets and FAO's cereal balances. Observed domestic prices are from FAO's Global Information Early Warning System (GIEWS) database. Tariff data are from the World Bank World Integrated Trade Solution (WITS). Incomes, exchange rates, and Consumer Price Indexes (CPI) are from the ERS International Macroeconomic Dataset. World prices are from USDA's Agricultural Projections to 2028.

International Food Security Assessment, 2019-2029

Overview

The ERS International Food Security Assessment (IFSA) model projects per capita food demand and compares that against a nutritional target of 2,100 calories per person per day, an average caloric level necessary to sustain a healthy and active lifestyle, to determine whether populations in 76 low- and middle-income countries (historical food aid recipients) should be considered food secure. Demand projections are based on food prices and incomes. Given projections of rising incomes (according to the ERS International Macroeconomic Data Set) and relatively low and stable food prices over the medium term, international food security is expected to improve through 2029. Income projections for 2019 were revised downward for parts of the world since this report was prepared, leading to a more positive picture than would be obtained as of July 2019. Model projections cannot take into account future unknown adverse events such as destruction and disruption caused by catastrophic weather, armed conflict, or great political and economic instability. For this reason, the following results are most representive of a baseline scenario. Furthermore, it is important to note that the following study focuses on just two of the four aspects or 'pillars' of food security: ***Availability*** of food is accounted for by projecting food production and trade; financial ***access*** to food is accounted for by projecting per capita incomes and food prices. The remaining pillars, ensuring that the food nutrients can be utilized (preventing diseases from poor drinking water, etc.) and ensuring stability (absence of armed conflict, hyperinflation, etc.) are equally important but beyond the scope of this study.

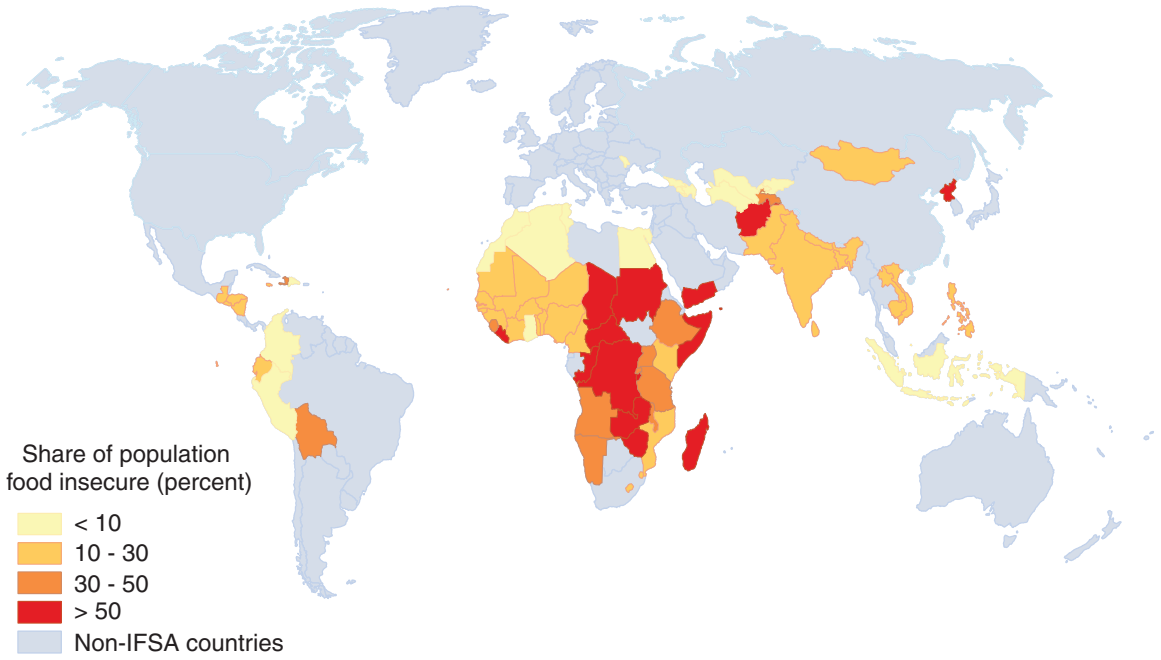
For the 76 countries covered by this report, an estimated 19.3 percent of their population is projected to be food insecure in 2019. This means that 728 million people out of the total population of 3.8 billion in these 76 countries may not have consistent access to the daily caloric target of 2,100 calories.

Projected per capita income growth for the coming decade remains positive in almost all of the 76 countries, and international prices for major grains are projected to continue decreasing in real terms. However, local prices may not always follow global trends due to fluctuating currencies or poor linkages between local and international markets.

Over the next 10 years, the share of the population that is food insecure in the 76 countries studied is projected to fall to 9.2 percent (399 million people) by 2029, a 45-percent drop in the number of food-insecure people from 2019.

The food gap, defined as the amount of food needed for all food-insecure people to reach the caloric target, is an indicator of the intensity of food insecurity. It can be expressed in calories per capita per day or in grain-equivalent quantities and is used to measure the annual national food shortfall. For the 76 countries examined, the total food gap is projected to decline in all four regions, from a total of 33.5 million tons in 2019 to 21.9 million tons in 2029.

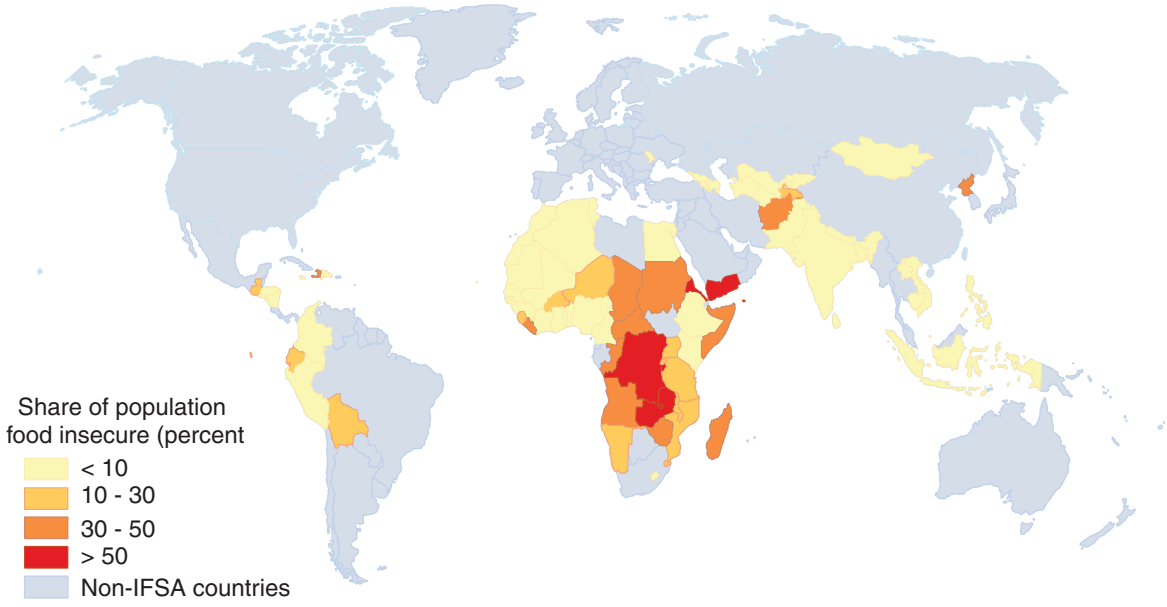
Figure 1
Share of population that is projected to be food insecure, 2019



IFSA = International Food Security Assessment.

Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.

Figure 2
Share of population that is projected to be food insecure, 2029



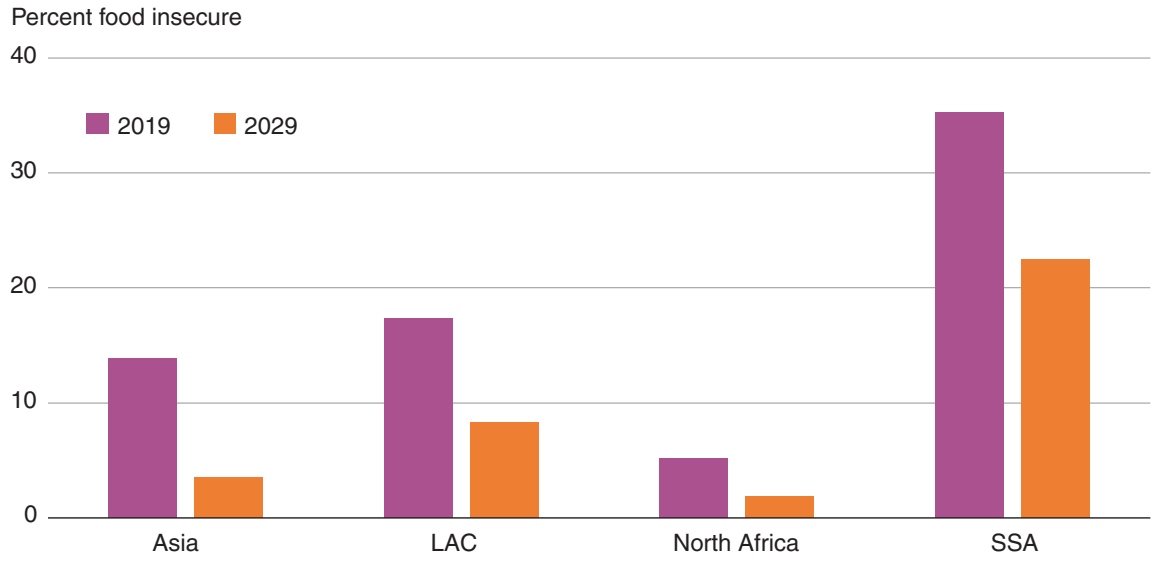
IFSA = International Food Security Assessment.

Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.

The 76 countries examined in this study are divided into four major regions: Sub-Saharan Africa (SSA), Asia, Latin American and the Caribbean (LAC), and North Africa. Current levels of food insecurity (based on estimates for 2019) vary greatly across these regions. SSA (39 countries) has the highest share and largest number of food-insecure people: 35.3 percent of the population, or 355 million food-insecure people (appendix table 1). Asia (22 countries), despite being the most populous region, has an estimated 333 million food-insecure people (13.9 percent) in 2019. In LAC (11 countries), 17.4 percent of the population is food insecure, while North Africa (4 countries) has the lowest share of food-insecure people, at 5.2 percent.

Food security is projected to improve by 2029 in all IFSA regions over the next 10 years; the share of the population that is food insecure in the 76 countries studied is projected to fall to 9.2 percent (399 million people) by 2029, a 45-percent drop in the number of food-insecure people from 2019. In North Africa, the number of food-insecure people is projected to decrease by more than half, with less than 2 percent of the population projected as food insecure in 2029. In the 11 LAC countries included in this study, the share of the population that is food insecure is projected to decrease by more than half, falling to 8.3 percent by 2029.[1] SSA is projected to see the slowest improvement in food security, with the share of food-insecure people falling 36 percent to 22.5 percent of the population (app. table 1). The greatest decline in food insecurity is projected for the 22 Asian countries included in this study: the share of food insecure is projected to drop by about 75 percent to 3.5 percent of the population, and the number of food insecure people is projected to decline from 333 to 93 million people.

Figure 3a
The share of the population that is food insecure is projected to fall by 2029

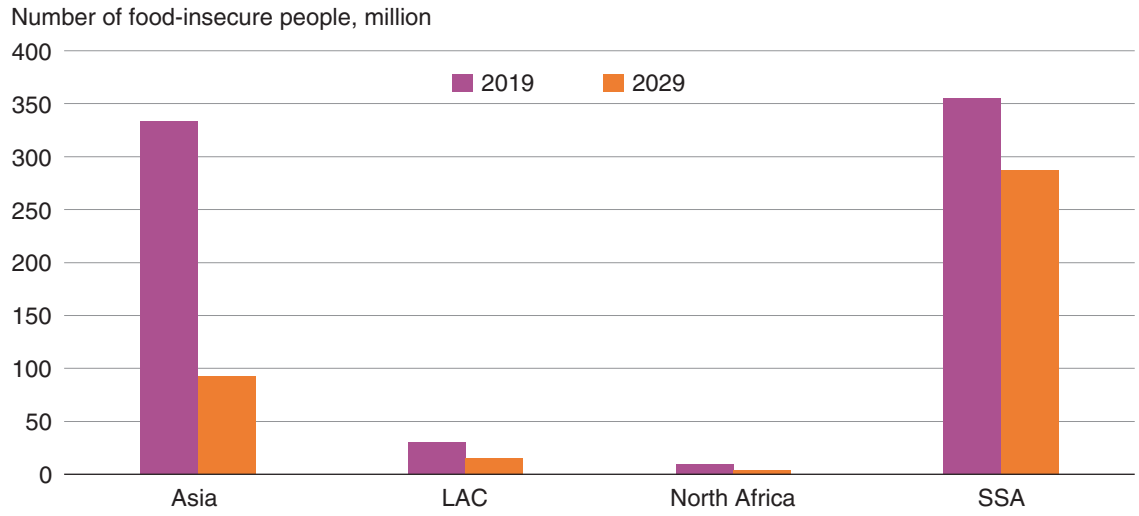


LAC = Latin America and the Caribbean, SSA = Sub-Saharan Africa.

Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.

[1]Venezuela, a country that has experienced food shortages in recent times, is not part of this study. Recent economic indicators and surveys suggest a fast worsening food security situation in that country.

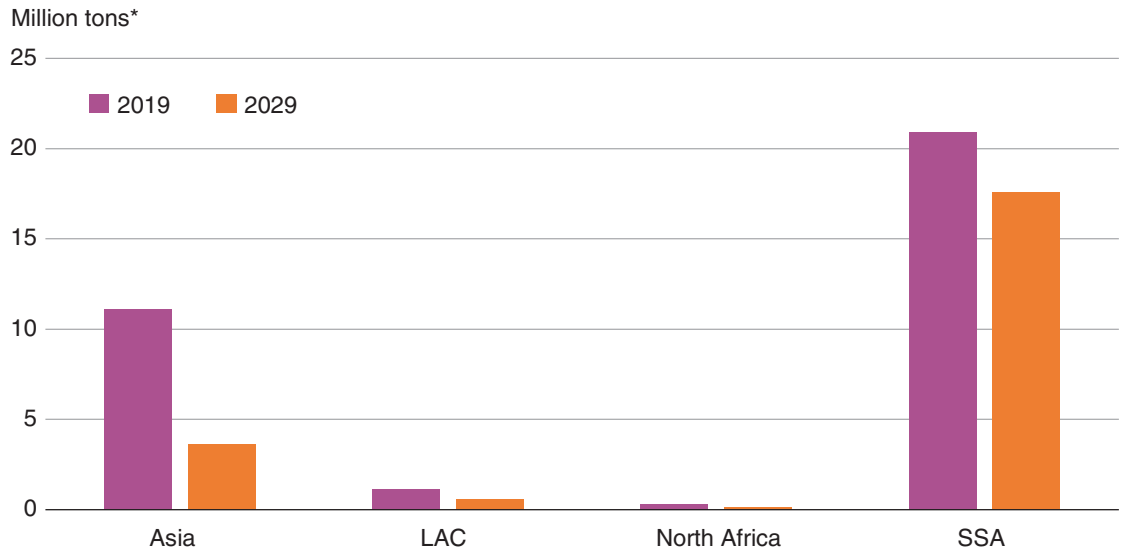
Figure 3b
The number of food-insecure people is projected to decline



LAC = Latin America and the Caribbean, SSA = Sub-Saharan Africa.

Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.

Figure 3c
The total food gap is projected to decline by 2029



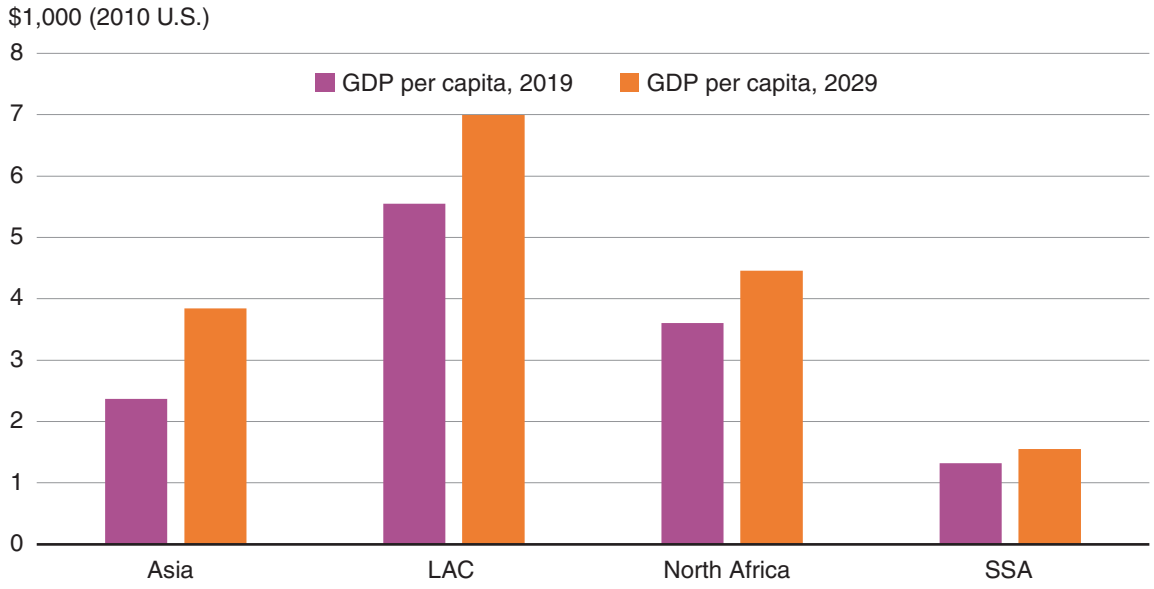
*Measured in grain equivalent.
LAC = Latin America and the Caribbean, SSA = Sub-Saharan Africa.

Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.

Figure 4
SSA accounts for one-fourth of the population of the 76 countries but is projected to have almost half the food-insecure people in 2019

LAC = Latin America and the Caribbean, SSA = Sub-Saharan Africa.
Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.

Figure 5
Inflation-adjusted income per capita by region, 2019 and 2029



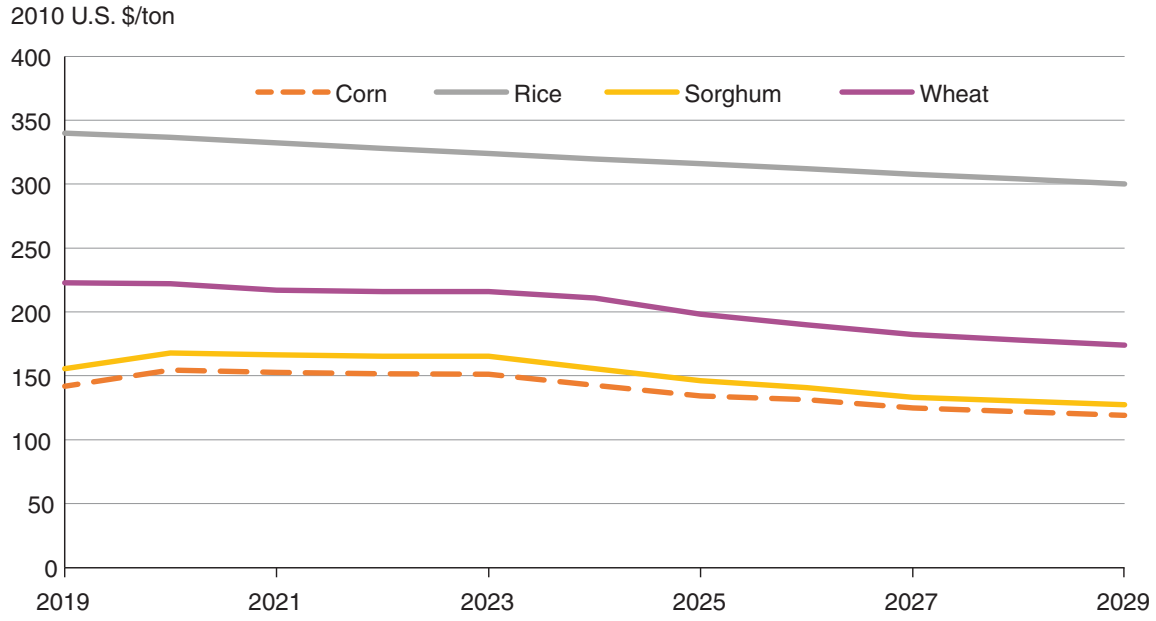
LAC = Latin America and the Caribbean, SSA = Sub-Saharan Africa.
Note: Value in 2010 U.S. dollars to adjust for inflation.
Source: USDA, Economic Research Service calculations using ERS Macroeconomic Data Set.

Per capita income is projected to increase[2] between 2019 and 2029 in almost all the countries examined. Notable exceptions are countries experiencing armed conflict and political instability such as Somalia and Yemen. In most parts of the world, economic growth is projected to be slightly faster over the coming decade, as export-dependent economies currently affected by low prices of extractable commodities begin to grow again. Asia is projected to sustain historically fast growth in gross domestic product (GDP), especially in India and Southeast Asia. Despite improved GDP growth prospects in parts of SSA, rapid population growth dampens the impact of these gains on per capita income growth.

International food commodity prices are expected to fall slightly in inflation-adjusted terms over the coming decade (figure 6). In some markets, world and domestic food prices are integrated through trade. In other cases, barriers to trade can cause domestic prices to move independently of world prices; some agricultural commodities (e.g., cassava) are rarely traded.

Increases in food grain demand, as well as grain demand for feed and other uses, are expected to be met by domestic production and imports (table 1). Feed grain demand (part of "other grain demand" in table 1) is projected to grow faster than food grain demand, as incomes rise and consumers can afford more animal source foods. Likewise, as incomes rise, diets diversify, and people obtain a smaller share of their caloric intake from food grains such as wheat and rice. As a result, grain demand on a per capita basis stabilizes and may even decrease. This trend is most noticeable in South Asia and Southeast Asia. Grains are typically staple foods for the world's poorest consumers. Thus, as the population grows in the 76 countries studied, their total food grain demand increases by 30 percent (versus a 40-percent increase in other grain demand).

Figure 6
Inflation-adjusted prices of major grains, 2019-29



Note: Prices in 2010 U.S. dollars to adjust for inflation.

Source: USDA Agricultural Projections to 2028, Long-term Projections report OCE-2019-1.

[2]Macroeconomic projections come from the ERS International Macroeconomic Data Set, which uses data from the World Bank Development Indicators, the International Financial Statistics of the International Monetary Fund, IHS Global Insight, and Oxford Economic Forecasting, as well as estimated and projected values developed by USDA's Economic Research Service.

Table 1
Food security indicators for 76 low- and middle-income countries, 2019 and 2029

Year	Food grain demand	Other grain demand*	Grain production	Implied additional supply required**
	Million tons			
2019	577	256	660	173
2029	754	360	754	361

*Other grain demand includes seed, feed, waste, and processing.
**The gap between grain demand and domestic grain production.

Source: USDA, Economic Research Service.

Grain production for the 76 countries examined is projected to increase 1.4 percent per year through 2029. In most regions, production gains are expected to come from improved yields, because there is little additional arable land to bring into production and because low prices for agricultural commodities discourage area expansion. In SSA, grain production is expected to rise faster than the 76-country average. In that region, input use and yields are low to begin with, leaving much room for improvement; some area expansion is also expected as more resilient seed varieties and irrigation investment allow expansion into formerly less well suited areas.

The gap between domestic grain production and demand grows over the projection period for the 76 countries. Historically, commercial import growth has outpaced production (Tandon et al., 2017). In North Africa and LAC, grain imports exceed domestic grain production. In SSA, demand for wheat and rice grows with income, outpacing domestic production, but many countries continue to supply most of their demand for other grains through domestic production.

How Food Security Is Assessed: Method and Definitions (for more detailed information on the model, see Appendix A.)

Food demand is projected for 76 low- and middle- income countries—39 in SSA, 4 in North Africa, 11 in LAC, and 22 in Asia. Food is divided into four groups: (1) the major grain consumed in the country, (2) other grains, (3) root crops, and (4) all other food. The IFSA model's projections of food demand are expressed in grain equivalent based on the caloric content of food items to allow for aggregation across food groups; this grain equivalent may be expressed in either kilograms or calories. For example, grains have roughly 3.5 calories per gram, and tubers have about 1 calorie per gram. One ton of tubers is therefore equivalent to 0.29 ton of grain.

The IFSA model analyzes the gap between projected food demand, which is a function of per capita income and food prices and a nutritional target of 2,100 calories per capita per day. This report uses three indicators of food insecurity. The ***food gap*** measures the food needed to raise consumption at every income level to the nutritional target. In many countries, per capita consumption in the lower income deciles is significantly less than per capita consumption for the country as a whole. In these countries, the distribution gap provides a measure of the intensity of hunger—the extent to which the food security of already hungry people deteriorates as a result of income declines or other negative economic conditions. This measure can be expressed on a per capita basis (in calories per day), or as an aggregate measure (the total tons of food needed to fill the gap in a particular country).

The second indicator is the **share of the population that is food insecure**. Food demand is assumed to be met and equal to consumption. We no longer assess consumption by income decile, but instead in a continuous manner across all income levels.

Finally, the **number of food-insecure people**—those who cannot meet the nutritional target—is based on total population and the population share that consumes below the nutritional target. Terms commonly used in this report include:

- **Food consumption**—equal to food demand if we assume that the demand is met.
- **Food access**—depends on a consumer's purchasing power. Food access is estimated based on income level and food prices within each country according to an income-consumption relationship.
- **Food insecurity**—occurs when estimated per capita food consumption for a consumer at a certain income level falls shorts of the nutritional target of 2,100 calories per person per day.

Regional Overview

The food security indicators and model projections presented here for 2019 and 2029 are based on historical data and projections from the ERS International Macroeconomic Data Set. The production data are as of January 2019, so events since then, including droughts and flooding, are not reflected in these data even though they may have caused crop damage in some countries for example as induced by Cyclone Idai in March of 2019 in Southern Africa.

Changes in food security vary across regions. In Sub-Saharan Africa, food security is projected to improve, but slowly, due to rapid population growth and relatively low per capita income growth. SSA has more food-insecure people than Asia, which is the most populous region. The 22 countries in Central Asia, East Asia, and Southeast Asia included in this assessment, collectively referred to in this report as Asia, are projected to see the fastest improvements in food security, as the region's largest economies continue to benefit from rapid income growth. The four North African countries assessed are also projected to experience improvements in food security, though levels of food insecurity there are relatively low to begin with. In the 11 countries in the Latin America and Caribbean (LAC) region that are covered by the assessment—5 in Central America, 3 in the Caribbean, and 3 in South America—the share of population that is food insecure is projected to fall by more than half by 2029.

Sub-Saharan Africa

The Sub-Saharan Africa (SSA) region has a population of over 1 billion people. Among the four regions covered by the assessment, SSA has the largest number and highest share of its population food insecure (355 million people, or 35 percent of the population in 2019). Food security is projected to improve by all three measures used in this report, but by 2029, SSA will still account for over 70 percent (287 million people) of the food-insecure people in the 76 countries covered by this assessment. The SSA region has the world's fastest growing population. Thus, the region's projected annual GDP growth of 4 percent only translates to average per capita income growth of 1.6 percent per annum.

West Africa is the largest subregion in SSA in terms of both population and GDP, but the prevalence of food insecurity is below the regional average, with under 9 percent of the population projected to be food insecure in 2029. Per capita GDP growth in West Africa is projected to be faster than the SSA average, as the Nigerian economy picks up steam despite increasing conflict in the Sahel region (fig. 7). The number of food-insecure people in West Africa is projected to fall 39 percent over the next 10 years, from 70 million to 43 million.

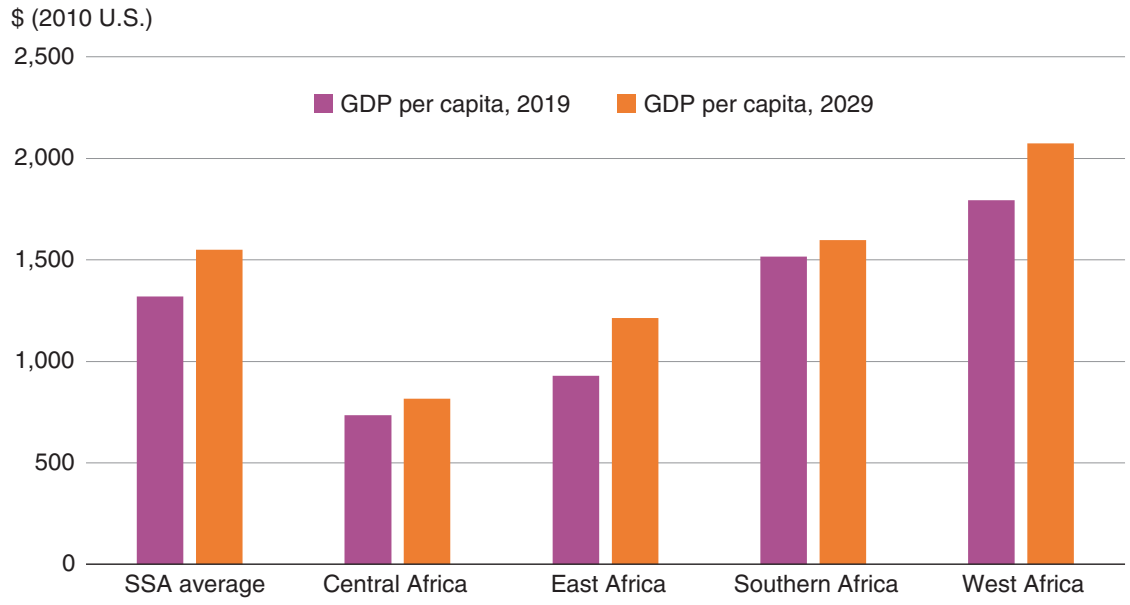
East Africa is projected to experience similar improvements in food security as West Africa, with the share of population that is food insecure decreasing by about half over the next 10 years. Per capita GDP in East Africa is lower than in the SSA region as a whole, but East Africa has faster annual per capita GDP growth. In 2019, East Africa has the most food-insecure people (142 million) among SSA subregions; this number is projected to fall to 90 million by 2029.

Central Africa, despite having the smallest population of the 4 subregions in SSA, is projected to have the largest number of food-insecure people in 2029, increasing 15 percent to 93 million. While the number of food-insecure people is projected to increase over the next 10 years, due in part to slow economic growth and inflation in some countries (several countries in Central Africa are not projected to experience the lower global food prices that are part of the projections), the share of food-insecure people is projected to fall from 65 percent to 60 percent. This lower share is still the largest projected share of food-insecure people in 2029 for the regions and subregions covered in this report, and Central Africa is projected to remain the poorest in terms of per capita GDP as well.

The food security situation in Southern Africa is also projected to improve slowly over the next 10 years, with the pace of improvement influenced by the pace of per capita GDP growth. For the next 10 years, the annual per capita growth rate across Southern Africa countries is projected to be 0.5 percent. This is the slowest per capita GDP growth rate for all IFSA regions and subregions. Despite having high per capita GDP compared to the SSA average, the large, non-diversified economies in Southern Africa have struggled to recover from periods of low commodity prices and poor fiscal policy. The ***share*** of food-insecure people is projected to fall from 43 percent to 33 percent over the next 10 years, while the ***number*** of food-insecure people is projected to fall only 1 percent, to 61 million people.

SSA's grain production is projected to grow just over 2 percent per year over the next 10 years, through increased productivity and area expansion. This increase is slower than the increase in both food and feed demand for grains, which customarily increases with rising population and higher incomes that allow people to afford more food. This means that SSA's implied additional supply required (IASR) for grain is expected to grow over the next decade, from 23 percent of total grain demand to 32 percent.[3]

Figure 7
Inflation-adjusted incomes per capita by SSA subregion, 2019 and 2029



SSA = Sub-Saharan Africa. Note: Value in 2010 U.S. dollars to adjust for inflation.

Source: USDA, Economic Research Service calculations using ERS Macroeconomic Data Set.

[3]IASR could come from imports or increased production beyond projected levels to provide sufficient food availability to meet demand. The food gap, on the other hand, is based on a shortfall of projected demand below the nutritional target due to insufficient purchasing power for lower income populations.

Table 2
Food security indicators for Sub-Saharan Africa, 2019 and 2029

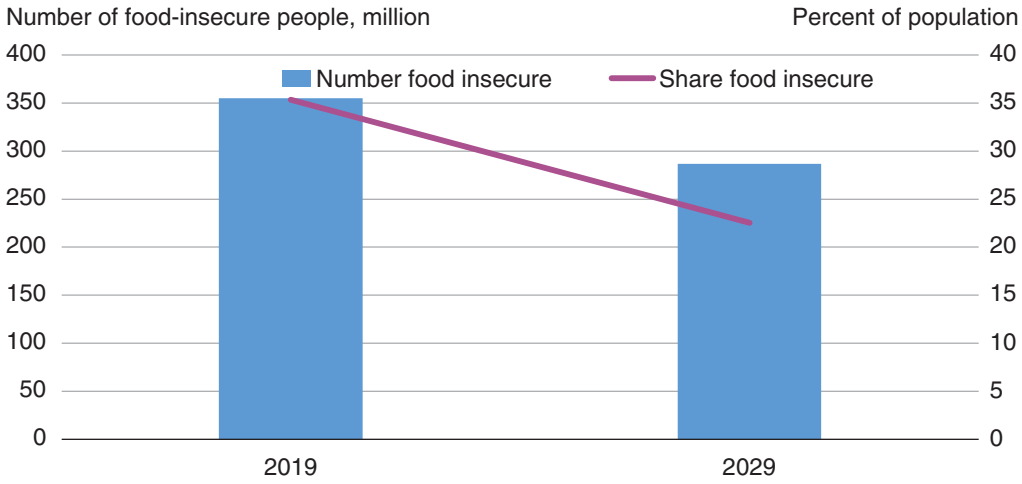
Year	Food grain demand	Other grain demand*	Grain production	Implied additional supply required**
	Million tons			
2019	123,902	39,785	125,859	37,828
2029	179,159	49,242	154,614	73,786

*Other grain demand includes seed, feed, waste, and processing.

**The gap between grain demand and domestic grain production.

Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.

Sub-Saharan Africa indicators of food insecurity



Sub-Saharan Africa
(1 billion people in 2019)

Sub-Saharan Africa has the highest share and number of food-insecure people, with 355 million food-insecure (35% of the population). We project a 19-percent reduction in the number of food-insecure people by 2029.

Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.

	Population		Population food insecure		Population share food insecure		Food gap (per capita)		Food gap (total)*	
	2019	2029	2019	2029	2019	2029	2019	2029	2019	2029
	Million		*Million*		*Percent*		*Kcal/day*		*1,000 MT*	
Sub-Saharan Africa	**1,004**	**1,273**	**354.9**	**286.5**	**35.3**	**22.5**	**509**	**530**	**20,919**	**17,588**
Central Africa	125	154	80.5	92.7	64.6	60.1	797	811	7,539	8,836
East Africa	353	446	142.4	90.0	40.3	20.2	445	407	7,458	4,306
Southern Africa	143	187	61.6	60.9	42.9	32.5	450	420	3,246	2,992
West Africa	383	485	70.4	42.9	18.4	8.8	334	298	2,676	1,454

*Measured in grain equivalents.

Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.

Central Africa

The population of the Central African subregion (125 million people) is the most food insecure in Africa and one of the most food insecure in the world. An estimated 65 percent of the subregion's population is food insecure in 2019. Sixty percent of the subregion's population is projected to be food insecure by 2029—a modest 5-percent decrease. While not accounted for in the projection approach, weather shocks, conflict, and political instability, which displace large numbers of people throughout the region, are expected to be the greatest obstacles to improving food security in Central Africa as a whole. Ongoing challenges can be reflected in the agricultural and income projections, but the modeling framework does not account for future crises and therefore must be regarded as a best-case scenario.

The Republic of Congo (ROC) has a population of 5.2 million people, approximately half of whom are estimated to be food insecure in 2019. The ROC continues to recover from years of internal conflict and is currently home to tens of thousands of refugees fleeing conflicts in the neighboring countries of the Democratic Republic of the Congo (DR Congo) and Central African Republic (CAR), both of which rely heavily on humanitarian assistance. Thirty-three percent of the ROC's population is projected to be food insecure by 2029, a 34-percent decline in the share. This improvement in food security is attained via projected growth in annual per capita GDP to $3,000 by 2029.

Cameroon has the region's lowest share of food insecurity in 2019, at 15 percent of its 26 million residents. The country retains the lowest share in 2029 as well, despite ongoing internal problems and conflict disrupting some of its agricultural production. The projections suggest that Cameroon's food security will continue to improve in the coming 10 years, with a 59-percent decrease in the share of the population that is food insecure, to 6 percent in 2029, and a 55-percent decrease in the total food gap to 55,000 metric tons.

The Central African Republic (CAR) faces one of the most dire food security situations in the region, with 76 percent of the population estimated as food insecure in 2019. With the Government and 14 armed groups reaching an accord in February 2019, there is optimism for relief from the violent conflict that has exacerbated food insecurity in the CAR. This optimism extends into the coming decade, with a projected 36-percent decrease in the share of food insecure (to 48 percent) by 2029. The per capita food gap is also projected to decrease, from 570 calories in 2019 to 418 calories per day in 2029.

The Democratic Republic of the Congo (DR Congo) is estimated to be the most food-insecure country in the Central African subregion and one of the most food insecure-countries in the world, with an estimated 80 percent of its population (70 million people) food insecure in 2019. Food insecurity in the DR Congo is projected to see no significant improvement in the coming decade; by 2029, the DR Congo is projected to be the most food-insecure country in the world. The outlook is greatly diminished due to rampant political instability, recurrent Ebola outbreaks, persistent armed conflict, poor infrastructure hindering humanitarian intervention, and large displaced populations; all of these factors contribute to market disruptions and poor access to agricultural land.

References

Cameroon. 2019. *Country Economic Forecast: Cameroon*. Oxford, Feb.

Food and Agriculture Organization of the United Nations, World Food Programme. 2019. FAO/WFP Crop and Food Security Assessment Mission to the Central African Republic, Special Report. March.

Tandon, S., M. Landes, C. Christensen, S. LeGrand, N. Broussard, K. Farrin, and K. Thome, 2017. *Progress and Challenges in Global Food Security.* U.S. Department of Agriculture, Economic Research Service, EIB-175, July.

USAID. 2019a. "Food Assistance Fact Sheet—Democratic Republic of the Congo." Feb. 15.

USAID. 2019b. "Food Assistance Fact Sheet—Republic of the Congo." March 25.

U.S. Department of Agriculture, Economic Research Service 2019. International Macroeconomic Data Set.

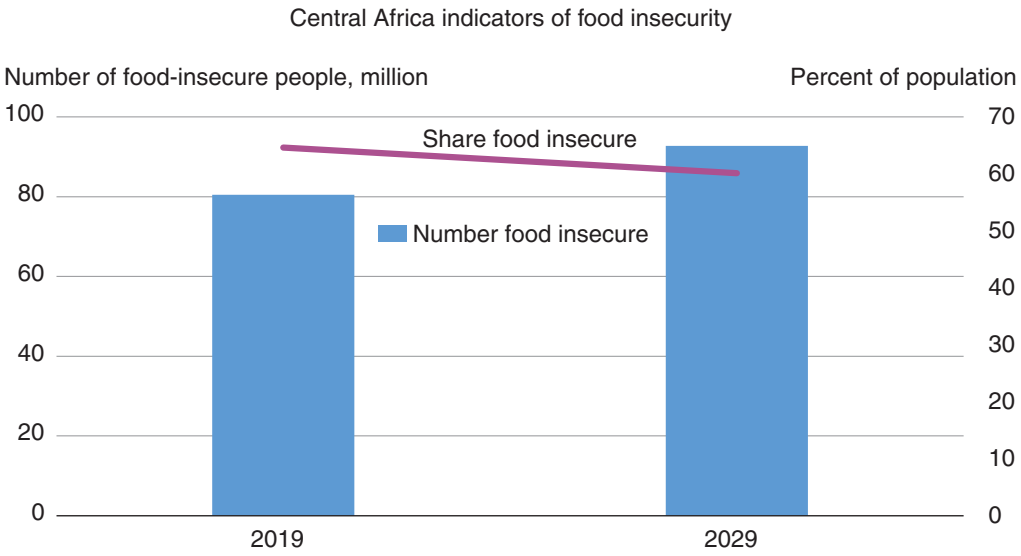
Table 3
Food security indicators for Central (SSA) Africa, 2019 and 2029

Year	Food grain demand	Other grain demand*	Grain production	Implied additional supply required**
	1,000 tons			
2019	6,130	1,878	5,572	2,435
2029	8,269	2,186	6,735	3,720

*Other grain demand includes seed, feed, waste, and processing.

**The gap between grain demand and domestic grain production.

Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.



Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.

Central Africa
(125 million people in 2019)

Central Africa continues to be the most food insecure region within SSA and the only one where the number of food-insecure people is projected to increase, albeit at a slower rate than population growth which is reflected in projections for a small decline in the share of food insecure people.

Ongoing conflict in much of the region leads to disruptions in food production and internally displaced persons, adding to problems resulting from disease outbreaks and insufficient infrastructure.

	Population		Population food insecure		Population share food insecure		Food gap (per capita)		Food gap (total)*	
	2019	2029	2019	2029	2019	2029	2019	2029	2019	2029
	Million		*Million*		*Percent*		*Kcal/day*		*1,000 MT*	
Central Africa	**125**	**154**	**80.5**	**92.7**	**64.6**	**60.1**	**797**	**811**	**7,539**	**8,836**
Cameroon	26	34	3.8	2.0	14.6	6.0	268	227	123	55
Central African Republic	6	7	4.5	3.5	76.0	48.2	570	418	291	166
Congo	5	7	2.6	2.1	50.3	32.9	415	347	129	89
Congo, DR	87	107	69.6	85.1	79.8	79.6	864	862	6,996	8,526

*Measured in grain equivalents.

Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.

East Africa

In the East African countries included in this assessment, an estimated 40 percent of the population is food insecure in 2019. This figure masks dramatic differences across countries. In several countries (Burundi, Chad, Eritrea, Somalia, and Sudan), half or more of the population is food insecure, while in others (Ethiopia, Kenya, Rwanda, Tanzania, and Uganda), the food-insecure share is significantly smaller. The subregion is projected to cut its food insecurity share by half by 2029, when only one country—Burundi—is projected to have more than half of its population food insecure, and the share food insecure in both Kenya and Ethiopia is projected to drop to 7 percent. While the prevalence of food insecurity in East Africa declines significantly, the depth of food insecurity, as measured by the distribution gap, falls by only 7 percent. Again, there are significant cross-country differences, with two countries essentially not reducing the gap (Burundi and Somalia) and three countries (Eritrea, Ethiopia, and Kenya) reducing the caloric gap by 30 percent or more.

In most of East Africa, food production in 2018 recovered from weather- and pest-related challenges of the previous year. As a result, emergency food assistance needs in most countries declined in 2019, although refugees and internally displaced people continue to be in need of assistance (FSIN, 2019).

Drivers of projected improvements in food security include strong growth in per capita GDP and sustained low food prices; both of these factors increase grain demand significantly. Real per capita growth in GDP for the East Africa subregion during the coming decade is projected to be 2.7 percent, slightly below the 3-percent growth seen during 2013-18. However, two countries—Somalia and Burundi—are significant outliers to this pattern, with projected growth rates of just 0.2 percent and -0.7 percent, respectively. Two other countries—Ethiopia and Kenya—have projected growth rates (4.7 percent and 3.8 percent, respectively) that are much higher than the average for the subregion.

Most countries in the East Africa subregion are projected to see cereal prices decline by less than 1 percent per year between 2019 and 2029, well below the annual declines (from 2.5 percent to 7.0 percent) experienced during the previous 5 years. Three countries—Chad, Eritrea, and Sudan—are projected to see cereal prices decline by more than 1 percent per annum in the coming decade.

Food grain demand per capita is projected to grow by 19 percent in the coming decade, reflecting positive real per capita GDP growth and low prices for agricultural commodities. However, because population growth remains high, aggregate food grain demand increases by 50 percent, with the highest growth occurring in Uganda and Ethiopia. As a result, projected demand growth in the East Africa subregion outstrips production growth as indicated by a projected implied additional supply required (IASR) that more than doubles over the projection period. Meeting projected demand will require a substantial increase in imports.

Five East African countries have a majority of their population food insecure. In five countries in East Africa—Burundi, Chad, Eritrea, Somalia, and Sudan—more than half the population is food insecure in 2019. Moreover, these five countries are projected to remain the five most food-insecure countries in East Africa in 2029. Burundi and Somalia are projected to undergo essentially no change in the share of the population that is food insecure by 2029, while the remaining three countries are projected to reduce this share in the coming decade.

With 70 percent of its population food insecure in 2019, **Burundi** is one of East Africa's most food-insecure countries. This small, landlocked country is mostly rural. Deforestation and its environmental consequences are a major problem. High population density and low cereal yields (reflecting poor soil fertility and lack of inputs) constrain domestic agricultural production. Moreover, Burundi

is forecast to have negative per capita GDP growth over the next decade, following negative growth during 2013-18. Without growth in the agricultural sector or in the national economy as a whole, Burundi is projected to make little improvement in food security, leaving 68.5 percent of its population food insecure in 2029.

Somalia has 50 percent of its population food insecure in 2019 and is projected to have almost the same level of food insecurity—48.3 percent—in 2029. The country's real annual per capita GDP growth rate is projected to decline from 0.7 percent during 2013-18 to 0.2 percent over the coming decade. Persistent conflict continues to weaken the Somalian economy. The Food and Agriculture Organization of the United Nations (FAO) and the World Food Program (WFP) identify Somalia as one of 8 conflict-caused food security emergencies (FAO and WFP, 2019). International food assistance is significant as parts of the country face emergency conditions despite improved harvests in 2018.

Eritrea is East Africa's most food insecure country in 2019, with over 90 percent of its population food insecure, even though Eritrea, like most other countries in the subregion, saw favorable levels of cereal production in 2018 (FAO, Country Brief: Eritrea, 2018). Even with a projected annual increase in real per capita GDP of 1.9 percent during the coming decade, 75 percent of the Eritrean population will still be food insecure in 2029. However, the intensity of food security in Eritrea is projected to decline significantly, with the per capita food gap closing from 803 calories in 2019 to 511 calories in 2029.

Chad has an estimated 61 percent of its population food insecure in 2019, but this share is projected to decrease to 46.5 percent by 2029. Chad is forecast to have real annual per capita GDP growth of 1.9 percent during 2019-29, following negative growth during the previous 5 years. Economic growth increased following the Glencore debt renegotiation of February 2018 and substantial inflows of external financing (African Development Bank, 2019). Conflict with Boko Haram in the Lake Chad Basin continues to affect food security in western Chad (USAID, Lake Chad Basin Fact Sheets). The ERS modeling framework does not capture these kinds of causes of acute food insecurity. The modeling framework is better suited to capture chronic food insecurity arising from low income levels and/or high food prices.

In **Sudan**, 56.8 percent of the population is food insecure in 2019. By 2029, this share is projected to decline to about 30 percent, with a 24-percent reduction in the per capita food gap. Sudan's real annual per capita GDP growth rate is projected to decline from 2.4 percent during 2013-18 to 1.8 percent over the coming decade. Food prices, rising sharply since the fall of 2017, became a political issue in Sudan. Higher fuel and input prices—reflecting foreign currency shortages, a weak local currency, and high inflation—led to rising cereal prices from late 2017 through March 2019, despite increased production (FAO, GIEWS, 2019). FAO reported that in February 2019, prices of sorghum, millet, and wheat grain were at near-record highs up to twice what they were a year ago (FAO, GIEWS, 2019). Higher food prices were a reason cited by demonstrators in protests that subsequently led to a change in government in April 2019.

Significant improvements in food security are projected for faster growing countries. Growth in real per capita GDP combined with low food prices drives projected improvements in food security for the remaining countries in the East Africa subregion. All countries reduce the prevalence of food insecurity, with Ethiopia, Kenya, and Uganda also reducing its intensity.

Ethiopia has 33 percent of its population food insecure in 2019 and is projected to have only 7 percent of its population projected to be food insecure in 2029. Ethiopia is also projected to decrease its per capita food gap by over 30 percent by 2029, significantly reducing both the intensity of food security and its prevalence. In 2018, Ethiopia's cereal production recovered from the drought-reduced levels of 2017, but the lingering effects of the drought still affected livestock production to some extent (FSIN, 2019). Real per capita income in Ethiopia is projected to increase at an annual rate of 4.7 percent between 2019 and 2029, the highest projected rate of income growth in the East African subregion.

Kenya has an estimated 29 percent of its population food insecure in 2019, the lowest in the East African subregion. Kenya is projected to have 6.6 percent of its people food insecure by 2029. Maize production recovered from the significantly reduced level of 2017, and adequate supplies of maize were available in the country's markets in 2018. Drought conditions improved, although some pastoral populations in the northern and eastern parts of the country remain in need of emergency food assistance (FSIN, 2019). Kenya is also projected to reduce its per capita food gap by 29 percent over the next 10 years, thus reducing the intensity of food security as well as its prevalence. Kenya is projected to have real per capita growth of 3.8 percent per annum over the next decade, slightly above its average for the previous 5 years.

Almost 40 percent of **Uganda's** population is food insecure in 2019, but this share is projected to decrease to 18 percent by 2029. Uganda is also projected to reduce the intensity of food insecurity, as the per capita food gap declines by 20 percent. Uganda's real per capita GDP is projected to grow at 2.7 percent per year, up from 1.6 percent during the previous 5 years. However, Uganda still has emergency food security needs due to the large number of refugees in the country, many of whom are from South Sudan and the DRC.

In **Rwanda**, 32.8 percent of the population is food insecure in 2019; this share is projected to decline to 13.7 percent by 2029. Rwanda is projected to experience real annual per capita GDP growth of 3 percent between 2019 and 2029, down from 4.4 percent between 2013 and 2018.

About 37 percent of **Tanzania's** population is food insecure in 2019. Tanzania's real annual per capita GDP growth rate is projected to decline from 3.9 percent during 2013-18 to 2.0 percent during 2019-29. The share of the population that is food insecure is projected to decline as well, but only about 10 percent—less than the average for the subregion—leaving 26.4 percent of the population food insecure by 2029. Tanzania's per capita food gap is projected to decline by the same percentage over the coming decade.

References

African Development Bank (AfDB). 2019. *African Economic Outlook 2019.*

Food and Agriculture Organization of the United Nations, Global Information and Early Warning System (FAO, GIEWS). 2019. *Country Briefs: Sudan*, March 29.

Food and Agriculture Organization of the United Nations, Global Information and Early Warning System (FAO, GIEWS). 2018. *Country Briefs: Eritrea*, October 25.

Food and Agriculture Organization of the United Nations (FAO) and World Food Program (WFP). 2019. *Monitoring Food Security in Countries with Conflict Situations: A joint FAO/WFP Update for the United Nations Security Council*. Issue 5. January.

Food Security Information Network (FSIN). 2019. 2019 Global Report on Food Crises: Joint Analysis for Better Decisions, April.

U.S. Agency for International Development. 2019. Lake Chad Basin Complex Emergency Fact Sheets.

Table 4

Food security indicators for East (SSA) Africa, 2019 and 2029

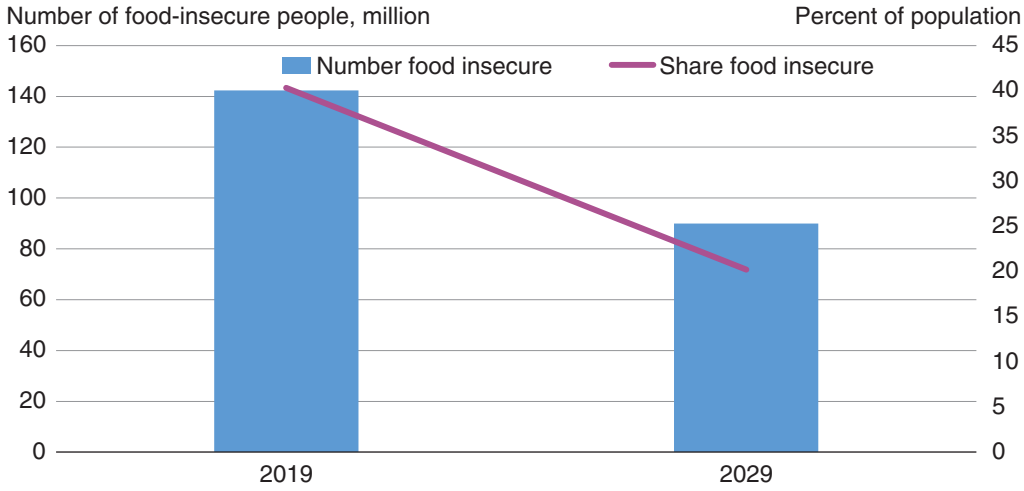
Year	Food grain demand	Other grain demand*	Grain production	Implied additional supply required**
	1,000 tons			
2019	42,898	15,891	49,560	9,228
2029	64,415	16,974	59,872	21,517

*Other grain demand includes seed, feed, waste, and processing.

**The gap between grain demand and domestic grain production.

Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.

East Africa indicators of food insecurity



East Africa
(353 million people in 2019)

The region includes countries with more than half of their populations food insecure as well as well as other countries with food insecurity shares closer to 30 percent. Except for Burundi and Somalia income growth is projected to be relatively strong over the next ten years.

Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.

	Population		Population food insecure		Population share food insecure		Food gap (per capita)		Food gap (total)*	
	2019	2029	2019	2029	2019	2029	2019	2029	2019	2029
	Million		*Million*		*Percent*		*Kcal/day*		*1,000 MT*	
East Africa	**353**	**446**	**142.4**	**90.0**	**40.3**	**20.2**	**445**	**407**	**7,458**	**4,306**
Burundi	12	17	8.6	11.5	70.4	68.5	516	505	518	673
Chad	13	15	7.7	6.9	61.1	46.5	679	589	643	505
Eritrea	6	7	5.8	5.0	96.4	74.5	803	511	580	319
Ethiopia	111	145	36.5	10.1	32.7	7.0	346	240	1,396	268
Kenya	49	56	14.3	3.7	29.1	6.6	311	223	530	98
Rwanda	12	15	4.1	2.0	32.8	13.7	399	316	190	74
Somalia	12	15	5.8	7.1	50.1	48.3	488	479	322	389
Sudan	39	46	21.9	13.9	56.8	30.4	470	359	1,248	602
Tanzania	57	74	21.1	19.6	37.0	26.4	479	429	1,137	944
Uganda	42	57	16.7	10.2	39.6	18.0	450	354	895	432

*Measured in grain equivalents.

Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.

Southern Africa

This year, the Southern Africa subregion has been significantly affected by erratic and extreme weather events such as Cyclone Idai, associated with El Niño. The impacts of the latest droughts and flooding in the subregion have yet to be fully assessed. The subregion is estimated to have 43 percent of its population food insecure in 2019. Major disruptions in agricultural production and hundreds of thousands of displaced people could lead to lower levels of food security than those projected. Given current data, food security in the subregion is projected to improve, with the share of the population that is food insecure falling to 32.5 percent by 2029.

Zimbabwe, Lesotho, Namibia, Angola, and Zambia have been badly stricken with drought, and water for livestock is becoming scarce, leading to animal deaths. These drought conditions persist while other parts of Southern Africa—Malawi, western regions of Zimbabwe, Mozambique (the central regions were the most affected), and Madagascar—were within reach of Cyclone Idai, leading to the displacement of hundreds of thousands of people and disrupting agricultural production in March 2019. The 2019 estimate of the share of Southern Africa's population that is food insecure—Angola (38 percent), Lesotho (12 percent), Madagascar (54 percent), Malawi (33 percent), Mozambique (29 percent), Namibia (41 percent), Swaziland (26 percent), Zambia (61 percent), and Zimbabwe (62 percent)—does not take into account this recent disruption, and food insecurity is likely to be higher if recent weather events impede food availability in the coming decade.

Food insecurity is projected to decrease by 24 percent in Southern Africa by 2029. However, the extreme weather events of 2019 are not factored into the projections. Shares of food-insecure populations in 2029 are projected to dip to very low levels in Lesotho (2 percent) and in Malawi (11 percent) and Swaziland (16 percent). Food insecurity in most other countries in the region is projected to decrease around 30-40 percent between 2019 and 2029.

Angola is projected to have its food-insecure share increase by 22 percent (to 46 percent) and its per capita food gap to increase by 9 percent (to 421 calories per day) by 2029. Factors contributing to Angola's food security projection include its inability to diversify its economy away from dependence on natural resources, an inability to utilize its agricultural land, and government corruption problems that are not unique to Angola but also constrain long-term growth elsewhere in Africa.

References

Famine Early Warning Network (FEWS NET). 2019. "Widespread drought and flooding from Cyclone Idai drive high assistance needs through early 2020." April 5.

U.S. Agency for International Development. 2019. "Food Assistance Fact Sheet—Angola." April 4.

Table 5

Food security indicators for Southern (SSA) Africa, 2019 and 2029

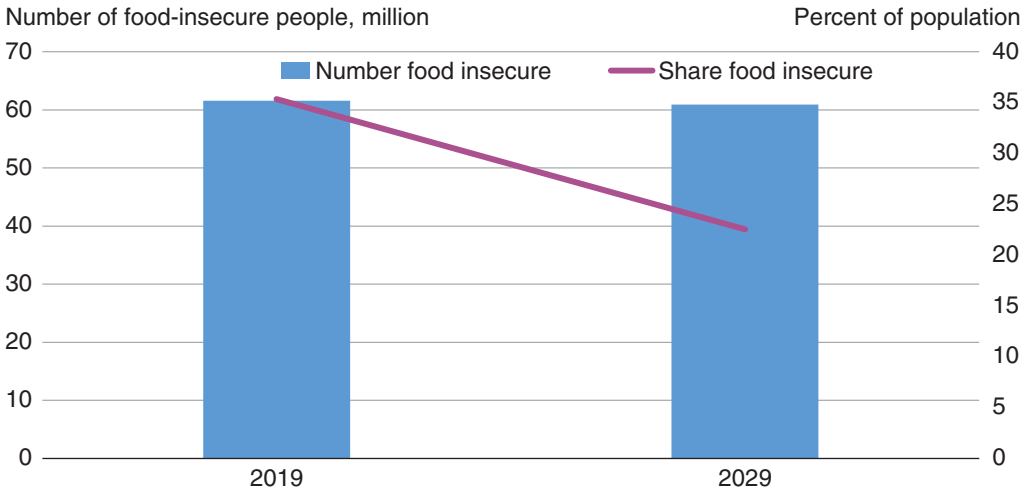
Year	Food grain demand	Other grain demand*	Grain production	Implied additional supply required**
	1,000 tons			
2019	17,831	4,682	13,962	8,551
2029	25,544	7,873	15,255	18,161

*Other grain demand includes seed, feed, waste, and processing.

**The gap between grain demand and domestic grain production.

Source: USDA, Economic Research Service based on results from the International Food Security Assessment model.

Southern Africa indicators of food insecurity



Southern Africa
(143 million people in 2019)

Extreme weather, including cyclones and drought, adversely impacted food security in 2019. While the share of population food insecure in projected to improve, the number stays relatively constant through 2029

Source: USDA, Economic Research Service based on results from the International Food Security Assessment model.

	Population		Population food insecure		Population share food insecure		Food gap (per capita)		Food gap (total)*	
	2019	2029	2019	2029	2019	2029	2019	2029	2019	2029
	Million		*Million*		*Percent*		*Kcal/day*		*1,000 MT*	
Southern Africa	**143**	**187**	**61.6**	**60.9**	**42.9**	**32.5**	**450**	**420**	**3,246**	**2,992**
Angola	31	44	11.9	20.1	37.8	45.9	387	421	571	1,052
Lesotho	2	2	0.2	0.0	11.7	2.2	256	197	7	1
Madagascar	26	33	14.2	13.0	53.8	39.6	403	348	590	467
Malawi	21	28	6.9	3.2	33.4	11.4	370	280	294	105
Mozambique	28	36	7.9	5.5	28.5	15.3	420	357	402	235
Namibia	3	3	1.1	0.8	41.1	24.4	317	264	41	24
Swaziland	1	2	0.4	0.3	25.6	16.1	289	255	12	7
Zambia	17	23	10.3	11.4	60.9	50.8	620	560	761	763
Zimbabwe	14	17	8.8	6.6	61.5	38.1	521	411	569	338

*Measured in grain equivalents.

Source: USDA, Economic Research Service based on results from the International Food Security Assessment model.

West Africa

The IFSA West Africa subregion comprises 16 countries: Benin, Burkina Faso, Cabo Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo. West Africa has the largest population (383 million) and the largest total GDP ($687 billion at 2010 prices) of the SSA subregions. It is also the most food-secure subregion, with 18.4 percent of the population food insecure in 2019. The food security situation in West Africa is expected to improve further in the coming decade, with the food-insecure share decreasing to less than 9 percent by 2029, an improvement of 52 percent. West Africa also has the smallest per capita food gap (334 kcal/day) of the SSA subregions, and this measure of food insecurity is also expected to continue to improve in the coming decade. Subregional projections for annual real per capita GDP growth of 1.5 percent and relatively low inflation help drive these improvements; as a consequence, the number of food-insecure people in West Africa falls from 70 million to 43 million between 2019 and 2029.

Nigeria is the largest economy in the subregion and in all of Africa. Its population of 200 million represents 52 percent of the population in the West Africa subregion, and it has 53 percent (37.6 million) of the subregion's total food-insecure population. Nigeria's projected per capita GDP growth for the coming decade is on the low end for the West Africa subregion, at 1.3 percent per year. Still, the share of the Nigerian population that is food insecure is projected to fall from 18.8 percent in 2019 to 8.7 percent in 2029. Nigeria is also projected to halve its total food gap by 2029; this is the amount of food needed to bring all food insecure people up to 2100 calories per day. Despite these projected improvements, 22 million people in Nigeria will still be food insecure in 2029. While economic growth is beginning to pick up, Nigeria still faces security challenges in the Lake Chad basin. The displacement of people and disruptions of livelihoods and markets associated with these security challenges contribute to food insecurity.

Because of its size, Nigeria drives the food security metrics for the West Africa subregion, and aggregate measures obscure variation across the subregion. Several countries in West Africa have relatively low levels of food insecurity and are projected to have even lower levels by 2029. In all, 12 of the 16 countries in the West Africa subregion are projected to have less than 10 percent of their populations food-insecure by 2029. Broad-based economic growth, continued per capita income growth above 2 percent per year, relatively low inflation, and political stability are among the main drivers of these improvements. **Ghana** and **Senegal** are among the best performers over the 10-year horizon, projected to decrease food insecurity shares by about 75 percent to under 3 percent food insecure in 2029. **Gambia**, **Guinea-Bissau**, **Cabo Verde**, and **Benin** are also projected to reduce the number of food-insecure people over 60 percent.

While most countries in West Africa are projected to make significant strides in improving food security in the coming decade, the coastal countries of **Liberia** and **Sierra Leone** make slower progress. The two countries begin the decade with the highest shares of food-insecure people in West Africa (54 percent and 41 percent, respectively). Liberia also has the lowest per capita GDP in the subregion, and both countries are emerging from years of negative income growth, disease, and natural disasters, all of which contribute to both high initial levels of food insecurity and slow improvement in the situation.

The Sahel area is facing increasing violence, and the security situation in Burkina Faso, Mali, and Niger has deteriorated noticeably over the past year. While the share of food-insecure people in **Mali** is projected to decrease to less than 10 percent by 2029, the shares in both **Burkina Faso** and **Niger** are projected to remain over 10 percent. Recent upticks in violence have led to more internal displacements of people, which disrupts livelihoods, markets, and agricultural activity. Food prices are projected to remain low in most of the subregion.

Grain production in West Africa is projected to grow at an annual rate of 2.5 percent during the coming decade—a rate that is faster than the SSA average. The West Africa subregion has had consecutive seasons of normal or better production. In addition, governments in West Africa have promoted increased production through the cultivation of more land, the planting of better seed varieties, and the adoption of improved storage and processing technologies. Much of this investment has taken place in the value chain for rice, which is fast becoming the preferred staple throughout the region, while some countries (e.g., Ghana) have also invested heavily in root and tuber production. Despite these developments and higher levels of grain production, grain demand in West Africa continues to outstrip production. As a result, the implied additional supply required (IASR) for the region is projected to increase by 72 percent between 2019 and 2029.

References

Famine Early Warning Systems Network (FEWS NET). 2019. "Burkina Faso: Key Message Update: IDPs are dependent on humanitarian assistance and markets." April 26.

Nzeka, U. 2019. *Nigeria Grain and Feed Annual*. U.S. Department of Agriculture, Foreign Agricultural Service, Global Agricultural Information Network (GAIN) Report No. NG-19002. May 6.

Table 6

Food security indicators for West (SSA) Africa, 2019 and 2029

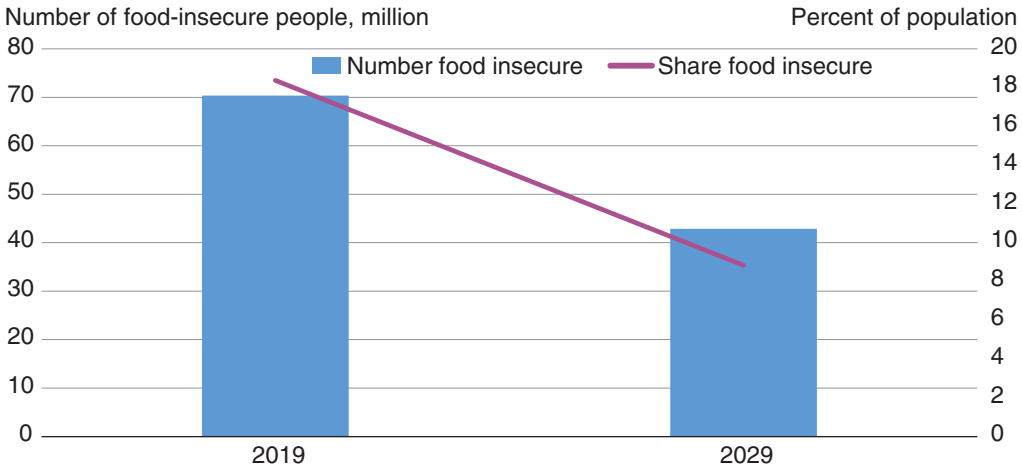
Year	Food grain demand	Other grain demand*	Grain production	Implied additional supply required**
	1,000 tons			
2019	57,043	17,549	56,764	17,828
2029	80,931	22,530	72,752	30,709

*Other grain demand includes seed, feed, waste, and processing.

**The gap between grain demand and domestic grain production.

Source: USDA, Economic Research Service based on results from the International Food Security Assessment model.

West Africa indicators of food insecurity



Source: USDA, Economic Research Service based on results from the International Food Security Assessment model.

West Africa
(383 million people in 2019)

Western Africa, the most populous SSA subregion, is also the region with the lowest food insecurity share, projected at 18.4 percent for 2019, and projected to decline by more than half over the next 10 years. Liberia is estimated to be the most food insecure country in the region, with close to 54 percent of the population food insecure in 2019. Improvements are projected given positive income growth and steady food prices, but by 2029 the food insecure population is projected to still be at 40 percent.

	Population		Population food insecure		Population share food insecure		Food gap (per capita)		Food gap (total)*	
	2019	2029	2019	2029	2019	2029	2019	2029	2019	2029
	Million		*Million*		*Percent*		*Kcal/day*		*1,000 MT*	
West Africa	**383**	**485**	**70.4**	**42.9**	**18.4**	**8.8**	**334**	**298**	**2,676**	**1,454**
Benin	12	15	1.8	0.6	15.2	4.1	297	236	58	16
Burkina Faso	21	28	5.4	4.0	25.5	14.2	447	387	303	194
Cabo Verde	1	1	0.1	0.0	14.0	4.4	257	209	2	1
Côte d'Ivoire	25	29	3.2	2.1	12.8	7.1	360	323	132	77
Gambia	2	3	0.4	0.1	18.1	5.4	282	223	12	3
Ghana	29	35	1.8	0.6	6.2	1.6	236	197	48	13
Guinea	13	17	2.4	1.5	18.4	8.8	347	297	88	47
Guinea-Bissau	2	2	0.5	0.2	27.2	8.5	326	249	17	5
Liberia	5	6	2.6	2.6	53.6	40.2	609	535	163	140
Mali	19	25	2.4	1.9	12.5	7.3	293	265	81	57
Mauritania	4	5	0.6	0.3	14.9	5.8	322	270	22	9
Niger	21	28	5.1	3.7	24.7	13.5	375	323	257	163
Nigeria	200	253	37.6	22.0	18.8	8.7	280	237	1,232	611
Senegal	15	19	1.8	0.4	11.4	2.3	220	170	46	9
Sierra Leone	6	8	2.7	2.0	41.3	24.1	457	381	134	84
Togo	8	11	2.1	0.9	24.8	8.4	327	256	81	28

*Measured in grain equivalents.

Source: USDA, Economic Research Service based on results from the International Food Security Assessment model.

North Africa

The four countries in the North Africa subregion—Algeria, Egypt, Morocco, and Tunisia—are among the most food-secure countries covered in this report. The share of the North African population that is food insecure in the subregion is projected to decline from 5.2 percent in 2019 to about 2 percent in 2029. The severity of food insecurity is projected to decline modestly over this period, with the per capita calorie gap falling from 251 to 223. People in these four countries are now consuming at a caloric level comparable to many high-income countries, thanks in part to consumption support policies that could become more difficult to finance in the future. Three of the four countries (Algeria, Egypt, and Tunisia) saw significant increases in food prices in 2018/19, in all cases reflecting rising financial pressures and more challenging national economic conditions..

Cereal production in North Africa differed across countries in 2018. Algeria and Morocco experienced record levels of production, while Egypt and Tunisia had a below-average year. Real annual per capita GDP growth is projected to increase from 1.4 percent during 2013-18 to 2.1 percent over the 2019-29 projection period. Real domestic grain prices are projected to decline, but by less than the annual average for 2013-18. As a result, the region's grain demand is projected to grow by 30 percent between 2019 and 2029.

Algeria is the only oil exporter among the four countries covered in the North Africa region. Lower oil prices placed a strain on Algeria's fiscal situation through the end of 2017 and into 2018. In response, the Algerian Government added new taxes, which increased both food prices and inflation generally. Food prices in June 2018 were 7 percent above those in June 2017. Price levels declined after June, but were still above previous years' prices into early 2019 (FAO, Country Brief: Algeria, 2018a).

Algeria's real annual per capita GDP growth rate is projected to equal 1.3 percent through 2029—unchanged from its level during the past 5 years (2014-18) and the lowest projected level in the North Africa subregion. Algeria is projected to remain North Africa's most food-insecure country, but with the share of the population that is food insecure falling from 7.3 percent in 2019 to 3.7 percent in 2029.

Algeria had a record cereal crop of 6 million tons in 2018—more than three-quarters larger than the weather-affected crop of 2017 and 60 percent above the 2013-17 average. (FAO, GIEWS, 2018a). As a result, the import requirements for Algeria to be food secure will drop.

Following large-scale political demonstrations, Algeria's head of state resigned in March 2018. While the interim government promised elections by July 4, 2019, demonstrations still continued after that announcement.

Egypt, with a population of 102 million, contains more than half the subregion's population. Egypt's real annual per capita GDP growth rate is projected to increase from 1.6 percent during 2013-18 to 2.3 percent during the coming decade. Projected stronger growth in per capita income, slightly lower food prices, and continuing population growth (annual rate of 2 percent) result in a 37-percent increase in cereal demand between 2019 and 2029. The share of Egypt's population that is food insecure is projected to decline from 4.5 percent in 2019 to 1.9 percent in 2029.

With support policies such as a bread subsidy that entitles each beneficiary to five loaves of bread per day, average daily caloric intake in Egypt has been high relative to income levels. Around 70 million Egyptians benefit from a subsidy card program that entitles each recipient to EGP 21 ($1.16 in U.S.

currency) worth of goods monthly in addition to five loaves of bread per day at a EGP 0.05 per loaf ($0.01). The subsidized price of the bread is estimated to be less than one-tenth the actual cost. Bakeries are subsidized for the difference, currently at the rate of about EGP 0.57 per loaf. Under the current support systems, beneficiaries can convert their unused "bread quota" into points to spend on 44 selected food products redeemable in State-owned shops or partnered private shops. For the 2018/19 fiscal year, the Egyptian Government allocated EGP 86 billion ($4.8 billion) for bread and food subsidy programs, up EGP 1 billion from the 2017/18 allocation (FAO, GIEWS, 2018b).

Tunisia is North Africa's most food-secure country. The share of the population that is food insecure is projected to decline from 5.2 percent in 2019 to less than 1 percent by 2029. The real per capita income growth rate is projected to increase from 0.9 percent during 2013-18 to 3.4 percent during 2019-29. Domestic cereal prices are projected to decrease, but less than during the previous few years

Morocco benefits from economic and political stability. Its openness to trade and investment, along with its strategic location, have attracted significant foreign investment and helped to develop the country's economy—including its agricultural sector—over the past decade. Food insecurity affects an estimated 4.5 percent of the Moroccan population of 34.6 million, whose income is distributed more unequally than that of Algeria or Egypt. Morocco's projected real annual per capita GDP growth rate of 2.9 percent for 2019-29 is higher than the rate of 2.1 percent achieved during 2013-18. Projected steady income growth in the absence of high inflation results in a marked decline in food insecurity to 1.4 percent by 2029.

References

Food and Agriculture Organization of the United Nations, Global Information and Early Warning System (FAO, GIEWS). 2018a. *Country Brief: Algeria*. September 24.

Food and Agriculture Organization of the United Nations, Global Information and Early Warning System (FAO, GIEWS). 2018b. *Country Brief: Egypt*. December 3.

Table 7

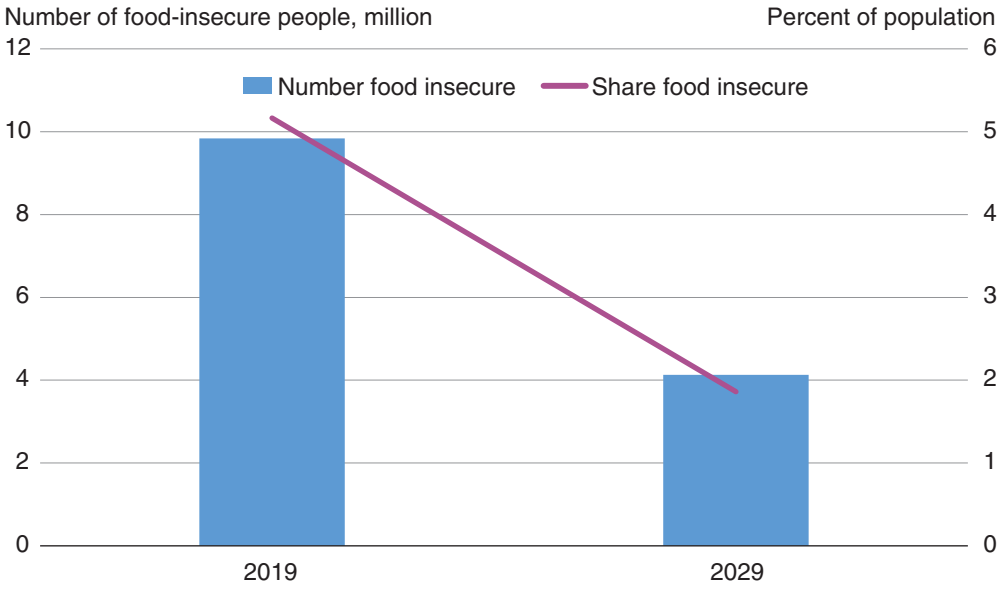
Food security indicators for North Africa, 2018 and 2028

Year	Food grain demand	Other grain demand*	Grain production	Implied additional supply required**
	1,000 tons			
2019	47,020	37,698	33,888	50,830
2029	61,320	43,253	35,048	69,526

*Other grain demand includes seed, feed, waste, and processing. **The gap between grain demand and domestic grain production.

Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.

North Africa indicators of food insecurity



North Africa
(190 million people in 2019)

North Africa is the most food-secure region by our measures and the number of food insecure people is projected to continue to fall over the next 10 years. This improvement is dependent on continuing consumption support policies, as well as stable food prices

Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.

	Population		Population food insecure		Population share food insecure		Food gap (per capita)		Food gap (total)*	
	2019	2029	2019	2029	2019	2029	2019	2029	2019	2029
	Million		*Million*		*Percent*		*Kcal/day*		*1,000 MT*	
North Africa	**190**	**222**	**9.8**	**4.1**	**5.2**	**1.9**	**251**	**223**	**308**	**115**
Algeria	42	48	3.1	1.8	7.3	3.7	257	232	103	53
Egypt	102	124	4.6	1.7	4.5	1.4	260	225	136	44
Morocco	35	38	1.6	0.5	4.5	1.4	246	212	50	14
Tunisia	12	12	0.6	0.1	5.2	0.9	244	197	18	3

*Measured in grain equivalents.

Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.

References

Algeria, *Exporter Guide*, GAIN Report AG1711, Dec. 26, 2017.

Egypt, *Grain and Feed Annual 2018*, GAIN Report EG18008, February 26, 2018.

Egypt, *Update to Egypt's Rice Production, Consumption, and Trade Figures*, GAIN Report EG1812, April 5, 2018.

Food and Agriculture Organization, *Crop Prospects and Food Situation*, Quarterly Global Report, December 2017.

Food and Agriculture Organization, *Crop Prospects and Food Situation*, Quarterly Global Report, March 2018.

Tunisia. *Country Economic Forecast: Tunisia*, Oxford.

Tunisia. *Exporter Guide*, 2017 GAIN Report TS1711, Dec. 31, 2017.

Morocco. *Grain and Feed Update*, GAIN Report MO1802, Jan. 10, 2018.

Morocco. *Exporter Guide, 2017.* GAIN Report MO1717, Dec. 31, 2017.

Latin America and the Caribbean

In this assessment, the Latin America and Caribbean (LAC) region encompasses 11 countries that are current or former food aid recipients. While about 17 percent of the region's population is food insecure in 2019, the region includes a number of countries with much higher levels of food insecurity. In Haiti, by far the most food-insecure country in the region, 47.2 percent of the population is food insecure. In several other LAC countries—including Bolivia, Ecuador, and Guatemala—more than a quarter of the population is food insecure.

By 2029, the share of the region's population that is food insecure is projected to fall by more than half to 8.3 percent. In that year, all LAC countries except Haiti are projected to have less than 15 percent of their populations food insecure. The general drivers of improved food security in the region are strong economic growth and stable to declining real domestic cereal prices. The LAC region is projected to have real per capita GDP growth averaging 2.3 percent per annum between 2019 and 2029, up from an average of 1.8 percent during 2013-18. Slower population growth contributes to higher per capita income prospects. Regional demand for cereals is projected to grow by 34 percent over the same period. Almost half of the increase will be for nonfood cereals. Projected growth in demand outstrips projected growth in domestic production, suggesting that much of the increased demand will be supplied by imports.

Haiti is the most food-insecure country among the LAC countries included in the assessment. In recent years, the country has suffered devastating natural disasters such as earthquakes and hurricanes, in addition to political instability. Longstanding deforestation has resulted in extensive soil erosion, which in turn exacerbates the impacts of more frequent droughts. Agriculture remains an essential sector to the economy despite its vulnerability to natural disasters. Localized dryness in Haiti has affected production of cereal crops, except for rice. Sociopolitical unrest has affected the economy and the country's exchange rate, making imports more expensive and driving up domestic prices (FSIN, 2019). The number of people in crisis or emergency conditions increased from 1.3 million in October 2017-February 2018 to 2.3 million in October 2018-February 2019 (FSIN, 2019).

Haiti's real annual per capita GDP growth is projected to increase from an average of 0.1 percent during 2013-18 to 1.8 percent in 2029. Under these conditions, Haiti would see improvements in both the prevalence and intensity of food insecurity. The share of the population food insecure would decline from 47.2 percent in 2019 to 37.6 percent in 2029, and the food gap would decline from 632 to 577 calories per capita per day. Even with this reduction, Haiti would still have the highest food gap in the LAC region.

The four **Central American** countries (El Salvador, Guatemala, Honduras, and Nicaragua) differ significantly in the shares of the population that are food insecure in 2019, ranging from 14.8 percent in Nicaragua to 29 percent in Guatemala. All four countries have territory within the Central American Dry Corridor (CADA), a region with dry tropical forests located on the Pacific side of Central America—stretching from the Pacific coast of the Mexican State of Chiapas to the western parts of Costa Rica and Panama and including part of the Pacific side of Guatemala, El Salvador, Honduras, and Nicaragua. In recent seasons, severe dryness during the flowering and grain-filling stage of cereal development reduced the maize harvest and the resilience of small farmers in the CADA (FSIN, 2019). However, the number of people in crisis or emergency in the CADA remained stable despite the drought, as the areas affected changed from one growing season to the next (FSIN, 2019).

Guatemala, the largest economy in Central America, has one of the most unequal income distributions in the Western Hemisphere, with the richest 20 percent of the population owning about 51 percent of the country's wealth. About one-third of Guatemala's 16 million people live in or around the capital. Of those living in rural areas, 40 percent are of indigenous origin, and this population is, on average, poorer and more food insecure. Guatemala's real annual per capita GDP growth is projected to be 2.2 percent between 2019 and 2029, compared with 1.7 percent during 2013-18. Agriculture is one of the country's largest economic sectors, accounting for about 13.5 percent of GDP and more than 40 percent of total exports. By 2029, the portion of Guatemala's population that is food insecure is projected to decline to 14.8 percent.

Honduras has 22.2 percent of its population food insecure in 2019, with that share projected to decline to 9.2 percent by 2029. Remittances are an important part of personal incomes and they accounted for 19 percent of Honduras' GDP in 2017, compared with 13 percent of GDP generated by the agricultural sector. However, agriculture employs a larger share of workers, at 28 percent, than any other sector of the economy. Despite economic and agricultural diversification, many Hondurans depend on subsistence farming, with little access to other sources of income. Food insecurity among the rural population continues to be a problem. Honduras' food gap in 2019 is estimated at 327 calories per capita per day and is projected to decline to 268 calories by 2029.

El Salvador is the smallest country in Central America and the country with the highest population density, containing 6.4 million people. Tourism has become a key sector and is contributing to improved economic prospects. Dry conditions in 2018 led to a slightly smaller cereal harvest, mainly due to decreased corn production (FAO, GIEWS, 2018). The share of the population that is food insecure—estimated at 16.5 percent in 2019—is projected to decline to 8.2 percent by 2029.

Food insecurity in **Nicaragua**, the poorest of the Central American countries examined in this assessment, is lower than in several of its neighbors. The share of Nicaragua's population that is food insecure is projected to decline from 14.8 percent in 2019 to 5.6 percent in 2029. Nicaragua has the most equal income distribution in the region, with lower incomes spread more evenly across all income groups. Social safety net policies such as consumer subsidies play an important role in supporting lower income households. The positive food security outlook for Nicaragua is largely based on the country's relatively stable economy and low inflation. As in the other Central American countries, agriculture is still an important sector, accounting for 15 percent of GDP and almost 75 percent of the country's exports. Subsistence farming is prevalent in rural Nicaragua, while the urban population depends heavily on imported food.

In South America, Bolivia and Ecuador are projected to have less than half their 2019 prevalence of food insecurity by 2029. **Bolivia's** real annual per capita GDP growth for 2019-29 is projected at 2.2 percent, down from 2.9 percent during 2013-18. The share of the population that is food insecure is projected to decline from 30.7 percent in 2019 to 12.8 percent in 2029.

Ecuador is the only country covered in the LAC region that derives a significant share of its income from crude petroleum exports. A sustained period of declining and relatively low oil prices through early 2018 led to tight fiscal budgets and declining or slow economic growth, with real annual per capita GDP growth averaging only 0.1 percent during 2013-18. With real per capita GDP growth projected at 1.8 percent for 2019-29, food security is projected to improve significantly as the share of the Ecuadorian population that is food insecure declines from 28.2 percent in 2019 to 12.3 percent in 2029.

In the remaining four LAC countries covered by this assessment—**Colombia**, the **Dominican Republic**, **Jamaica**, and **Peru**—food insecurity is estimated between 7 and 12 percent in 2019. Each of these countries is an upper middle-income country. With a strong economic growth forecast, these shares are projected to drop below 4 percent in all four countries by 2029.

References

Food and Agriculture Organization of the United Nations, Global Information and Early Warning System (FAO, GIEWS). 2018. *Country Briefs El Salvador.* November 16.

Food Security Information Network (FSIN). 2019. 2019 *Global Report on Food Crises: Joint Analysis for Better Decisions.* April.

Table 8

Food security indicators for Latin America and the Caribbean, 2019 and 2029

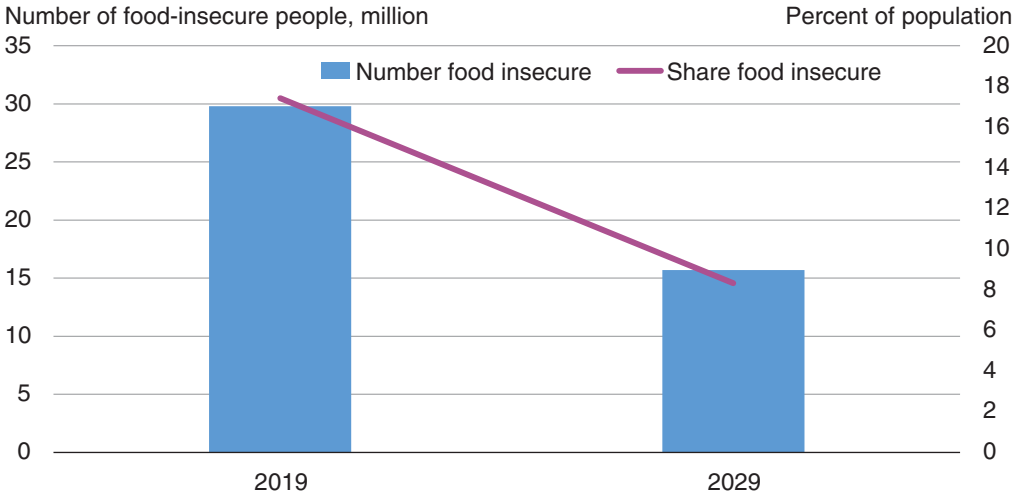
Year	Food grain demand	Other grain demand*	Grain production	Implied additional supply required**
	1,000 tons			
2019	19,937	19,200	17,006	22,131
2029	24,055	26,531	18,149	32,437

*Other grain demand includes seed, feed, waste, and processing.

**The gap between grain demand and domestic grain production.

Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.

Latin America and the Caribbean indicators of food insecurity



Latin America and the Caribbean
(171 million people in 2019)

Haiti continues to be the most food-insecure country in the region. Food security is projected to improve despite the slowest projected GDP growth of all the regions.

Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.

	Population		Population food insecure		Population share food insecure		Food gap (per capita)		Food gap (total)*	
	2019	2029	2019	2029	2019	2029	2019	2029	2019	2029
	Million		*Million*		*Percent*		*Kcal/day*		*1,000 MT*	
Latin America/Caribbean	**171**	**188**	**29.8**	**15.7**	**17.4**	**8.3**	**341**	**330**	**1,151**	**587**
Bolivia	11	13	3.5	1.7	30.7	12.8	317	252	136	51
Colombia	49	53	3.6	1.3	7.3	2.4	238	203	98	30
Dominican Republic	11	12	0.9	0.3	7.8	2.2	213	177	21	5
Ecuador	17	19	4.7	2.3	28.2	12.3	265	214	147	58
El Salvador	6	6	1.0	0.5	16.5	8.2	262	227	29	13
Guatemala	16	19	4.7	2.7	29.1	14.8	353	295	185	91
Haiti	11	12	5.2	4.6	47.2	37.6	632	577	342	279
Honduras	9	11	2.1	1.0	22.4	9.2	327	268	77	30
Jamaica	3	3	0.4	0.1	12.2	3.6	223	181	9	2
Nicaragua	6	7	0.9	0.4	14.8	5.6	313	262	32	11
Peru	32	34	3.0	0.9	9.4	2.5	220	180	76	18

*Measured in grain equivalents.

Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.

Asia

In 2019, the 22 Asian countries included in this report were home to more people than any other region studied, roughly 2.4 billion people or 64 percent of the total population covered by this assessment. Two countries, India and Indonesia, account for 66 percent of the total population in the Asia region, and both countries—like the region as a whole—has seen population growth decline from more than 2 percent in the 1980s to about 1.3 percent by 2019 and they are expected to continue slowing population growth over the next decade to roughly 1 percent per year.

Four other populous countries—Pakistan, the Philippines, Vietnam, and Bangladesh—together account for 24 percent of the region's population. While each of these four countries mirror the regional trend of slower population growth, Pakistan shows the highest projected annual population growth (1.3 percent) among the four countries during 2019-29.

Of all the countries in Asia, **Afghanistan** is projected to have the fastest rate of population growth over the next decade (2.3 percent per year), but that country only accounts for 1.5 percent of the region's population.

In 2019, the Asian countries studied account for 46 percent of the total number of food-insecure people in the 76 countries covered by this assessment. The ERS model projects that by 2029, Asia's share will fall to 23.2 percent of the 76-country total. Despite this declining share, the intensity of Asian food insecurity is projected to increase. Asia requires 281 calories per capita per day—low relative to the world average—to bring consumption levels in 2019 to a 2,100-calorie target. By 2029, ERS projects that the gap will increase 16.4 percent to 329 calories per capita per day. In contrast, the world average food insecurity intensity in 2019 was 394 calories per capita per day. In the projections, this gap increases 20 percent to 471 calories by 2029.

Asia's 2019 food gap (the amount of food necessary to allow all income groups to reach the 2,100-calorie target) is estimated at 11.1 million metric tons of grains—roughly half of the food gap estimated for Sub-Saharan Africa— and projected to drop to 3.6 million metric tons by 2029. In sum, Asia's population growth is expected to slow, while per capita grain demand is projected to increase. Average per capita income is projected to increase by 62 percent, rising from $2,372 (2010 prices) in 2019 to $3,843 in 2029. As a result, Asia's food-insecure population is projected to equal 92.6 million people by 2029, or 3.5 percent of the region's total population.

Much of the improvement in Asia's food security is due to substantial gains by India and Indonesia. These two countries account for half of Asia's food-insecure population (of the Asian countries included in this assessment) in 2019 but are projected to account for just 13 percent of the regional share by 2029. The number of food-insecure people in **India** is projected to decline from 141.6 million to 7.8 million between 2019 and 2019. As a share of its national population, food insecurity in India declines from 10.8 percent to less than 1 percent. Underlying these projections is growth in per capita GDP, which is expected to rise from $2,303 (2010 prices) to $4,002 over the coming decade. Thus, while India is projected to require more grain for the entire population to reach consumption levels of 2,100 calories, income growth at all deciles makes it possible to obtain the food necessary for the total number of food-insecure people in India to decline. This assumes the demand not met by domestic production can be filled through imports, thus increasing the import share of consumption.

Indonesia is also projected to see a substantial improvement in food security over the next decade, with the number of food-insecure people decreasing from 21.1 million in 2019 to 4.3 million in 2029. As a share of the national population, that reflects a decline from 8.0 percent to 1.5 percent. Indonesia's food gap is expected to narrow from 580,000 metric tons in 2019 to 93,000 metric tons in 2029; this is the amount of food required to ensure that the entire population has access to 2,100 calories per day. Indonesia's food gap, expressed in calories per capita per day, decreases from 246 to 195. This reduction in the per capita food gap reflects improvements in per capita GDP. Indonesia's real per capita GDP is projected to increase from $4,550 (2010 prices) in 2019 to $6,976 in 2029, an increase of 53.3 percent.

Other countries of food-security importance in the region include Pakistan, the Philippines, Vietnam, and Bangladesh. These countries account for 31 percent of Asia's food-insecure people in 2019; this share is projected to decline to 25.8 percent by 2029. Individually, the share of the population that is food secure in each country is projected to decline between 2019 and 2029, from 17.5 percent to 4.4 percent in **Pakistan**, from 17.2 percent to 4.8 percent in the **Philippines**, from 10.9 percent to 1.1 percent in **Vietnam**, and from 17.8 percent to 4.4 percent in **Bangladesh**. Among these countries, the Philippines is projected to have the lowest real annual GDP per capita growth over the next decade (3.7 percent). Pakistan has the next highest growth rate (3.9 percent), behind Bangladesh (4.8 percent) and Vietnam (5.2 percent). These countries will require higher GDP growth if they are to eliminate food insecurity.

Afghanistan accounted for 5.7 percent of Asia's food-insecure population in 2019 but is projected to account for 17 percent of that population by 2029. Real annual per capita GDP growth in Afghanistan is projected to be 1.7 percent over 2019-29—a slower rate than projected for other Asian countries but higher than Afghanistan's projected growth in per capita annual grain demand (1.0 percent). Despite accounting for an increasing share of Asia's food-insecure population, ERS projects that the share of Afghanistan's population that is food insecure will fall from 53.2 percent in 2019 to 35.4 percent in 2029.

Asia's most food-insecure countries are Yemen and North Korea. Yemen continues to suffer armed conflict and internal population displacement. With 83 percent of its population food insecure in 2019, **Yemen** is among the world's most food-insecure countries, second only to Eritrea. Ongoing conflict and the accompanying prospects for limited economic growth are projected to leave Yemen with 74 percent of its population food insecure in 2029. The intensity of food insecurity is projected to decline, however, with the per capita food gap falling from 615 calories per capita per day in 2019 to 540 calories in 2029. Yemen is projected to have an annual real GDP growth rate of 1 percent over the 2019-29 period. This is a dramatic improvement from the 20.5-percent *decline* in real per capita GDP during 2014-18. Nevertheless, the projected improvement in food security over the next decade is very uncertain given the ongoing war, which has already claimed tens of thousands of lives and is contributing to famine and diseases such as cholera.

An estimated 57.3 percent of **North Korea**'s population was food insecure in 2019, affecting 14.6 million people. A recent assessment by the United Nations indicated that 10.9 million people in North Korea were in need of humanitarian assistance (United Nations Resident Coordinator for DPR Korea, 2019: 5). North Korea's real per capita GDP is projected to grow by 1.1 percent a year between 2019 and 2029, an improvement over the negative growth rates seen during 2013-18. Domestic grain prices are forecast to decline slightly over the next decade. Under these conditions, the number of food-insecure people in North Korea is projected to decline by 3.5 million, but 42

percent of the population would remain food insecure in 2029 even with this improvement. The intensity of food insecurity is also projected to decrease, as the per capita calorie gap declines from 418 in 2019 to 356 in 2029.

Observational data on North Korean food security are difficult to obtain. However, in 2017, UNICEF conducted a Multiple Indicator Cluster Survey (MICS) that collected data on child malnutrition for the 8,499 households interviewed. The study covered 10 Provinces, with a breakout for urban and rural populations. The findings suggest pervasive food insecurity. The study reported that 19 percent of children were stunted, with the figure rising to 27 percent for those in the lowest 20 percent of the income distribution. Stunting was more prevalent in rural areas (24.4 percent) than in urban areas (15.6 percent). There was also significant provincial variability, ranging from 10 percent to 31.8 percent (UNICEF, Central Bureau of Statistics, 2018).

References

Food and Agriculture Organization of the United Nations, Global Information and Early Warning System (FAO, GIEWS). 2018a. Country Brief: Yemen. December 21.

Food and Agriculture Organization of the United Nations, Global Information and Early Warning System (FAO, GIEWS). 2018b. Country Update: The Democratic People's Republic of Korea: High temperatures and below average rainfall could affect the 2018 main season food output, September 5.

Food Security Information Network (FSIN). 2019. 2019 Global Report on Food Crises: Joint Analysis for Better Decisions. April.

UNICEF, Central Bureau of Statistics. 2018. Multiple Indicators Cluster Survey, 2017, Survey Findings Report, Democratic People's Republic of Korea.

United Nations Resident Coordinator for DPR Korea. 2019. DRP Korea Needs and Priorities. March 6.

World Food Program (WFP). 2019. DPR Korea Country Brief. January.

Table 9

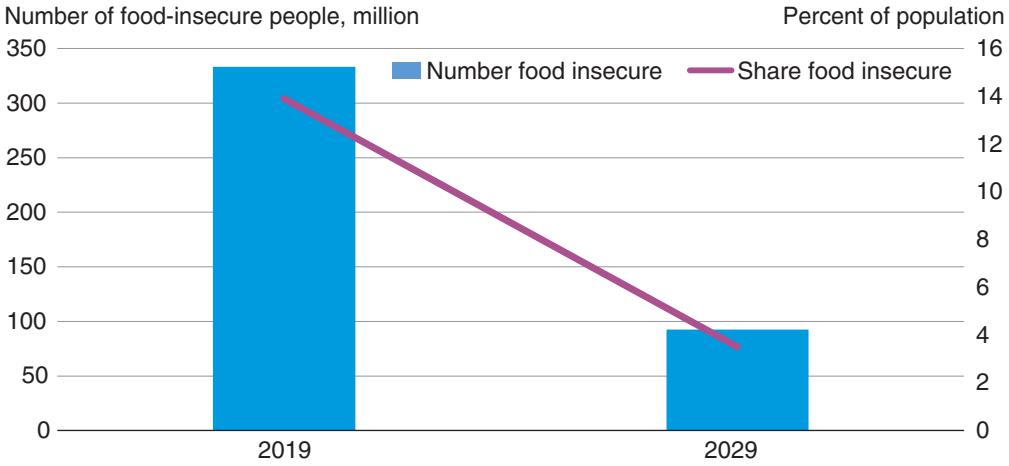
Food security indicators for Asia, 2019 and 2029

Year	Food grain demand	Other grain demand*	Grain production	Implied additional supply required**
	1,000 tons			
2019	385,693	154,839	482,768	57,764
2029	489,942	236,700	545,991	180,650

*Other grain demand includes seed, feed, waste, and processing. **The gap between grain demand and domestic grain production.

Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.

Asia indicators of food insecurity



Asia
(2.4 billion people in 2019)

Much of the projected improvement in Asia's food security over the next ten years is due to substantial gains by India and Indonesia. The largest countries in this region have per capita income growth above 4 percent per year.

Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.

	Population		Population food insecure		Population share food insecure		Food gap (per capita)		Food gap (total)*	
	2019	2029	2019	2029	2019	2029	2019	2029	2019	2029
	Million		*Million*		*Percent*		*Kcal/day*		*1,000 MT*	
Asia Total	**2,396**	**2,647**	**333.2**	**92.6**	**13.9**	**3.5**	**281**	**329**	**11,078**	**3,601**
Afghanistan	36	45	19.0	15.8	53.2	35.4	367	305	805	556
Armenia	3.0	2.9	0.1	0.0	3.3	0.2	175	131.4	2.2	0.1
Azerbaijan	10	11	0.3	0.1	2.8	0.6	161	135	6	1
Bangladesh	161	176	28.7	7.8	17.8	4.4	271	209	793	165
Cambodia	17	19	3.2	0.6	19.2	3.3	295	215	100	14
Georgia	5	5	0.3	0.0	5.1	0.7	198	156	7	1
India	1,312	1,448	141.6	7.8	10.8	0.5	235	158	3,622	135
Indonesia	265	284	21.1	4.3	8.0	1.5	246	195	580	93
Kyrgyzstan	6	6	0.4	0.1	6.7	1.4	207	168	10	2
Laos	7	8	0.9	0.1	12.7	0.9	234	159	25	1
Moldova	3	3	0.1	0.0	2.1	0.0	148	102	1	0
Mongolia	3	3	0.5	0.1	15.6	1.7	254	178	16	1
Nepal	30	32	3.1	0.4	10.3	1.2	241	178	86	8
North Korea	26	27	14.6	11.1	57.3	41.6	418	356	696	448
Pakistan	211	240	36.9	8.9	17.5	3.7	298	225	1,332	243
Philippines	108	124	18.5	6.0	17.2	4.8	297	234	609	156
Sri Lanka	23	24	3.4	0.7	14.9	2.8	242	182	91	14
Tajikistan	9	10	3.0	1.6	33.8	16.4	377	307	138	62
Turkmenistan	5	6	0.2	0.0	3.9	0.6	190	154	5	1
Uzbekistan	30	33	2.4	0.1	8.0	0.5	205	144	63	3
Vietnam	98	105	10.6	1.2	10.9	1.1	269	195	303	25
Yemen	29	35	24.3	26.0	83.1	74.0	615	540	1,788	1,673

*Measured in grain equivalents.

Source: USDA, Economic Research Service, based on results from the International Food Security Assessment model.

Identifying the Risk Factors of Food Insecurity Around the World Using FAO's Food Insecurity Experience Scale

Michael D. Smith

Food insecurity—the lack of access to sufficient, safe, and nutritious food—exists at some level in every country. Identifying the world's food insecure and the risk factors for food insecurity can help governments and aid organizations target their assistance to those most in need and develop more effective assistance programs.

As mentioned in the Overview, food security is commonly conceptualized as resting on four pillars: food availability, food access, food utilization, and food stability. Food security can be measured at the national level by estimating the availability and distribution of food within a country or at the individual (or household) level by asking people directly about their experiences of obtaining enough food. Measurement of food security shifted from national food supplies to include people's direct access to food, which was partly the result of Amartya Sen's examination of widespread malnutrition in the developing world. Sen (1982) showed that most famines were not caused by a lack of food per se, but rather by an inability to access and buy food.

Until recently, there was not an individual-level measure that could be used to make valid comparisons of food insecurity across countries to help identify common causes and risk factors. Other approaches, such as the International Food Security Assessment (IFSA) presented in this report, rely on national-level measures of food insecurity that are primarily used for monitoring global food insecurity (another example is FAO's prevalence of undernourishment). These national-level measures are unable to identify the characteristics of the food insecure or to determine where those people lived within a particular country. This changed in 2014, however, when the United Nations Food and Agriculture Organization's (FAO) Voices of the Hungry project developed an experiential measure of food insecurity, the Food Insecurity Experience Scale (FIES), which is the first standardized measure of people's direct experiences of food insecurity appropriate for application on a global scale.

The FIES is modeled after the ERS's U.S. Household Food Security Survey Module, which has been tested, validated, and used annually in the United States since 1995. The FIES consists of eight questions that capture experiences ranging in severity from worrying about running out of food to actually not eating for a whole day—in each case, because of a lack of funds or other resources. The questions are posed to a sample of individuals across 150 countries through Gallup's annual World Poll.

Recent research using the FIES (Smith, Kassa, & Winters, 2017; Smith, Rabbitt, & Coleman-Jensen, 2017) found that—although some food insecurity risk factors (low levels of education and limited social networks, for instance) were the same in many countries—there were also differences across regions and levels of economic development. These findings highlight how country-specific data can inform policies to enhance economic development and reduce food insecurity.

The Evolution of Measuring Food Insecurity

U.S. ethnographic research in the early 1990s identified the stages that households experience when living with food insecurity (Radimer, Olson, & Campbell, 1990; Radimer, Olson, Greene, Campbell, & Habicht, 1992). Household food insecurity is initially characterized by worry about having enough food, followed by dietary changes to make available food last longer, and, finally, a decrease in food consumption—first in adults, then by any children in the household. Research shows that these stages are consistent in both developed and developing countries, and across languages and cultures (Coates et al., 2006).

Measures of food insecurity generated by experiential data collected through household or individual surveys may be more precise than measures based on national per capita food supplies, as experiential data can capture people's direct access to food. FAO's measure of prevalence of undernourishment defines undernourishment as the proportion of the population whose dietary energy consumption is less than a predetermined threshold. The FAO's measure acts as a national-level proxy for food insecurity but requires strong assumptions about the distribution of food within a country because of the lack of reliable survey data about food consumption. FAO selected the prevalence of undernourishment measure to monitor the Millennium Development Goal (MDG) of halving world hunger by 2015. The measure performed relatively well in this regard, but as an aggregate measure, it was unable to identify the characteristics of the food insecure or determine where within a country they live (Ballard, Kepple, & Cafiero, 2013). ERS's International Food Security Assessment (IFSA) uses a demand-oriented framework that adjusts for income disparities to assess the availability of food at a national level for 76 low-income countries. The analysis of food consumption by income deciles provides a measure of access to food at the national-level, but does not provide information on the geographical distribution of food insecurity within countries.

As a complement to these two country-level measures, experiential food insecurity measures offer insights into the determinants of food insecurity at the individual level, making it possible to identify the characteristics and geographic concentration of the food insecure..

FAO Standardized the FIES to Allow Cross-Country Comparisons

Prior research identifying predictors of experiential food insecurity in developing countries relied heavily on the collection of primary data, with small samples focused on a specific locality, often, without a robust way to measure food insecurity. FAO created the FIES to gather consistent and comprehensive information on the prevalence and severity of global food insecurity and to provide countries with a tool to monitor their national food security. FAO contracted Gallup, Inc., in 2014 to collect data in most countries around the world.

The Gallup World Poll gathers information on an individual's labor force participation, income, education, opinions, experiences, future aspirations, demographic characteristics, and country and region identifiers. In most countries, the Gallup World Poll interviews 1,000 individuals and is nationally representative. The number of individuals interviewed is higher for countries with larger populations. For example, in 2014, 3,000 and 5,000 individuals were interviewed in India and China, respectively. Telephone interviews are conducted for medium- and high-income countries with telephone coverage of at least 80 percent. Face-to-face interviews are administered in most developing countries.

The FIES survey consists of eight questions designed to assess the adequacy of an individual's access to food. The questions focus on respondents' behaviors and experiences when they have

encountered difficulties in meeting their basic food needs over the previous 12 months. Typical of other food insecurity surveys, the FIES questions are asked in order of severity. Each question in the FIES specifies that the respondent's food-insecure condition stems from a lack of money or other resources to obtain adequate food.

Table 1
FAO Food Insecurity Experience Scale (FIES)

Q1.	During the last 12 MONTHS, was there a time when You were worried you would not have enough food to eat because of a lack of money or other resources?
Q2.	Still thinking about the last 12 MONTHS, was there a time when you were unable to eat healthy and nutritious food because of a lack of money or other resources?
Q3.	Was there a time when you ate only a few kinds of foods because of a lack of money or other resources?
Q4.	Was there a time when you had to skip a meal because there was not enough money or other resources to get food??
Q5.	Still thinking about the last 12 MONTHS, was there a time when you ate less than you thought you should because of a lack of money or other resources?
Q6.	Was there a time when your household ran out of food because of a lack of money or other resources?
Q7.	Was there a time when you were hungry but did not eat because there was not enough money or other resources for food?
Q8.	During the last 12 MONTHS, was there a time when you went without eating for a whole day because of a lack of money or other resources?

Source: USDA, Economic Research Service. using Survey questions from United Nations, Food and Agriculture Organization, Voices of the Hungry project.

The severity of the respondent's food insecurity is based on the conditions and behaviors reported in response to the survey. An individual's food security status can be determined by summing the affirmed responses. This classification method, however, does not allow for cross-country comparisons, because the same number of affirmed responses would not necessarily correspond to the same level of severity in different countries. Differences across countries in languages, livelihood arrangements, and food-related cultural norms and expectations may affect the way in which the FIES questions are understood by the respondent, and, in turn, may affect their responses.

To ensure the measured severity of food insecurity is comparable across countries, FAO equates the food-insecurity scales for each country to the FIES Global Standard Scale (FAO, 2016; Nord, 2014; Nord, Cafiero, & Viviani, 2016). The FAO equating procedure maintains cross-country comparability by creating two standard food-insecurity thresholds—moderate food insecurity and severe food insecurity. The thresholds are adjusted to place the country's scale on the same metric as the global standard.

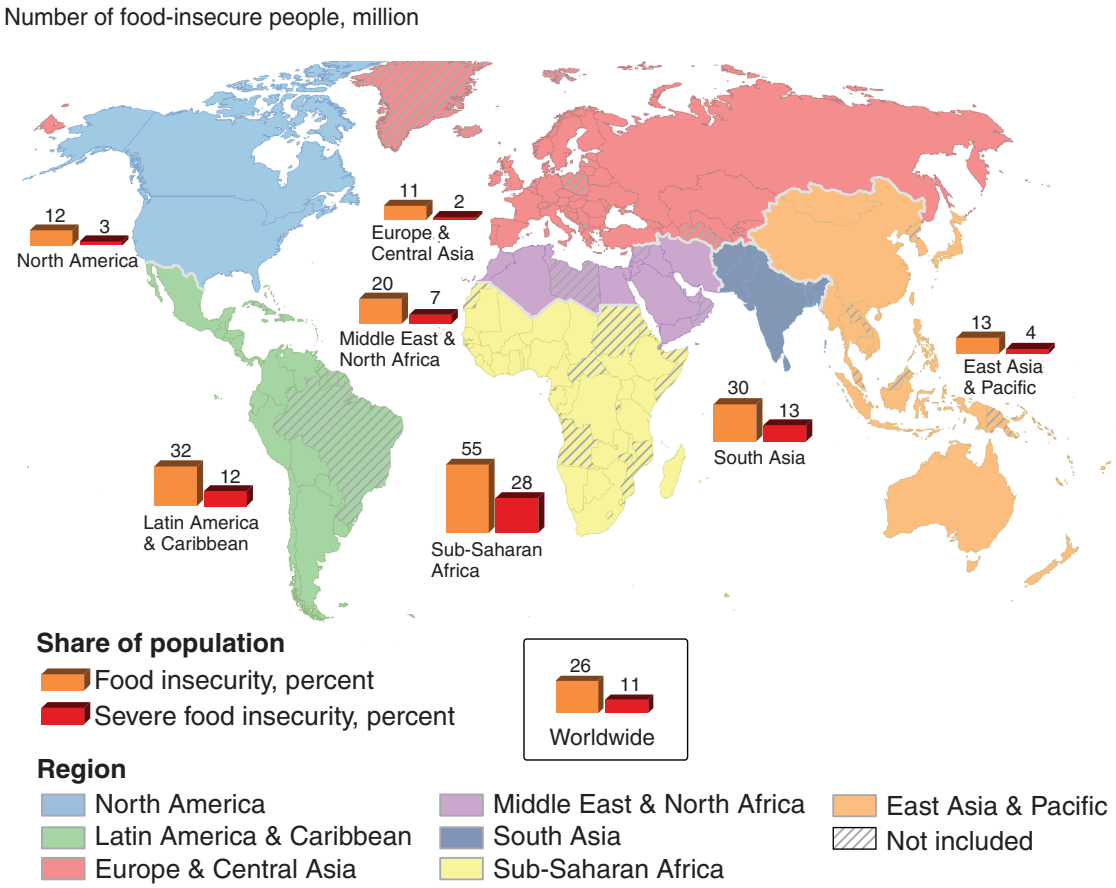
Individuals are classified as experiencing mild food insecurity if they report a raw score (i.e., number of affirmed responses after the equating procedure) of at least 1 but less than the country-specific threshold for moderate food insecurity (typically, a raw score of 3 or 4). Individuals are classified as experiencing moderate food insecurity if their reported raw score is greater than the FIES threshold for moderate food insecurity but less than the country-specific threshold for severe food insecurity (typically, a raw score of 7). Individuals are assigned a status of severe food insecurity if they report a raw score greater than or equal to the threshold for severe food insecurity.

Similar to 2019 IFSA Results, Global Food Insecurity in 2017 Was Highest in Sub-Saharan Africa using the FIES

Data from the 2017 FIES show significant variation across global regions and economic development in the prevalence of food insecurity and severe food insecurity. Food insecurity represents the sum of the share of people facing either moderate or severe food insecurity. Severe food insecurity captures individuals experiencing the most extreme range of food insecurity per the FIES and is commonly associated with individuals reporting experiences related to hunger. In 2017, Sub-Saharan Africa had the highest prevalence of food insecurity (55 percent) and severe food insecurity (28 percent), followed by Latin America and the Caribbean (32 percent food insecure and 12 percent severely food insecure), and South Asia (30 percent and 13 percent). Food insecurity and severe food insecurity were lowest in North America and Eastern Europe and Central Asia.

As expected, food insecurity was highest among low-income countries (58 percent) and lowest in high-income countries (11 percent), as defined by the classification of economic development used by the World Bank in 2015. According to this classification, low-income countries have an annual gross national income (GNI) per capita of $1,045 or less, and high-income countries have an annual GNI per capita above $12,736. Upper- and lower-middle-income countries are separated at $4,125.

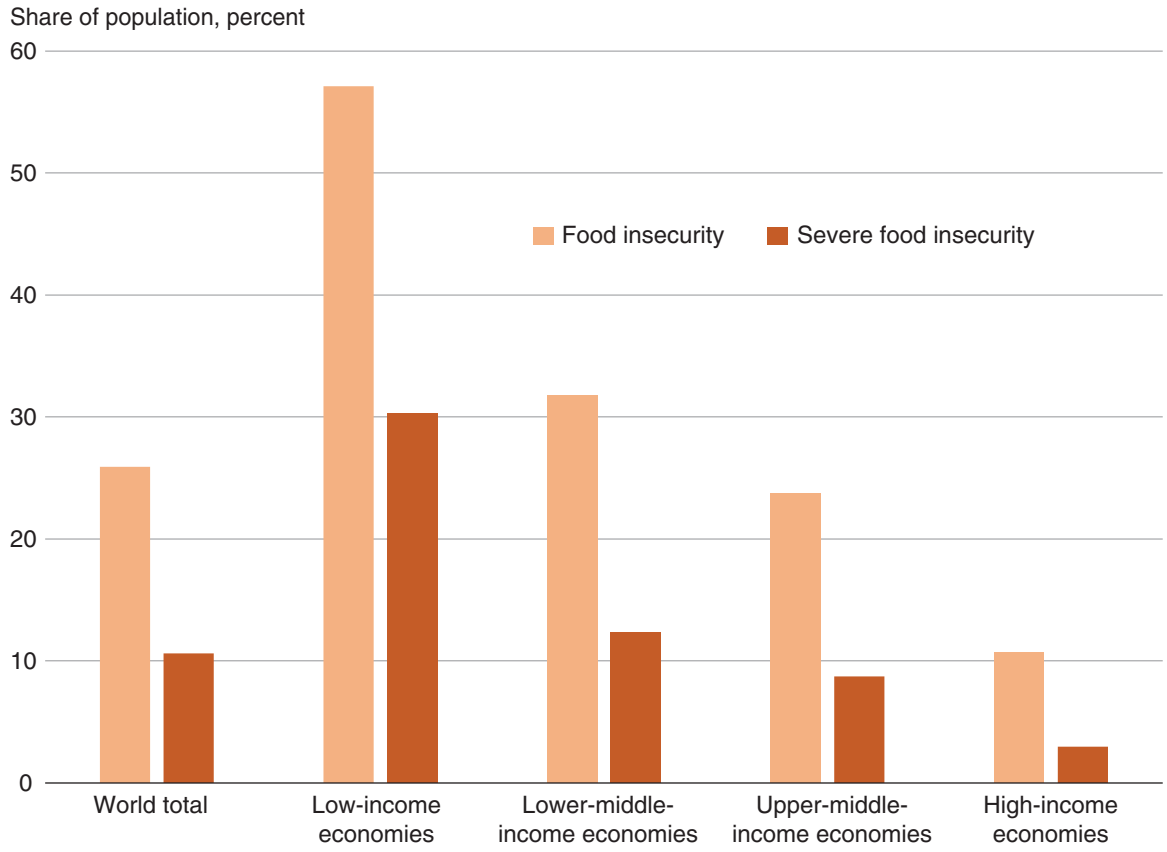
Figure S1-1
Diet composition of 76 IFSA countries



Source: USDA, Economic Research Service using data from the 2017 Gallup World Poll.

Figure S1-2

In 2017, close to 60 percent of people in low-income countries were food insecure according to the FIES



Note: In the classification scheme used by the World Bank in 2015, low-income countries have Gross National Income (GNI) per capita of $1,045 or less; lower-middle-income countries have GNI per capita between $1,045 and $4,125; upper-middle-income countries have GNI per capita between $4,125 and $12,736; and high-income have GNI per capita above $12,736.

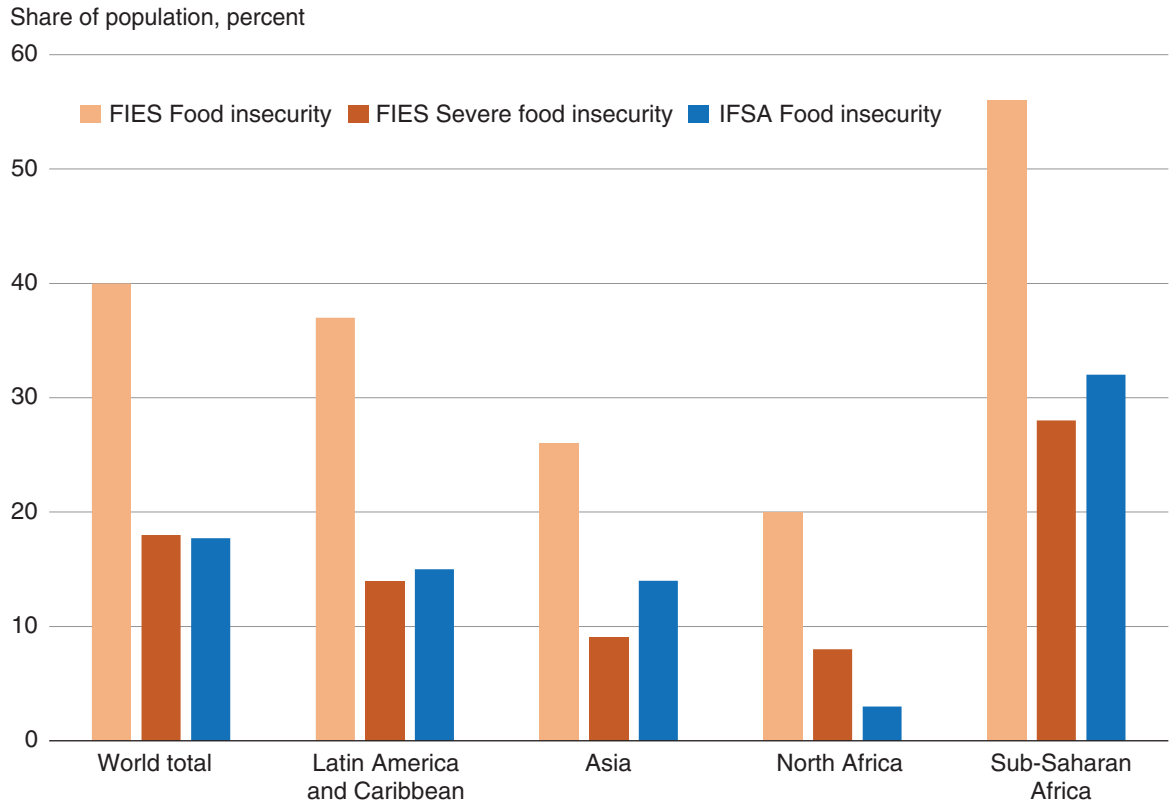
Source: USDA, Economic Research Service using data from 2017 Gallup World Poll.

Comparing the 2017 regional estimates (including the same countries in each region) from the FIES with those of the IFSA, we see similar prevalence estimates between the FIES *severe* food insecurity category and the IFSA estimates of food insecurity. Both methods show significant variation in the prevalence of food insecurity across global regions.

Using the 2017 FIES, Sub-Saharan Africa had the highest prevalence of severe food insecurity (28 percent), followed by Latin America and the Caribbean (14 percent), Asia (9 percent), and North Africa (8 percent). Similarly, the 2017 IFSA shows that Sub-Saharan Africa had the highest prevalence of food insecurity (32 percent), followed by Latin America and the Caribbean (15 percent), Asia (14 percent) and North Africa (3 percent).

It should not be surprising that the micro and macro approaches estimate different prevalence rates of food insecurity (the approaches rely on different methodologies, data, coverage, etc.). However, we should expect both approaches to have similar rankings across countries. Donor agencies rely on these indicators to allocate resources and to prioritize resources across countries and within countries (Tandon et al., 2017).

Figure S1-3
For 2017, FIES estimates of severe food insecurity align with IFSA food insecurity estimates



Note: Countries in the Gallup World Poll data were selected to match the countries included in each region in the IFSA report.

Source: USDA, Economic Research Service using data from the 2017 Gallup World Poll.

Identifying Top Risks for Global Food Insecurity

A common conceptual model of food insecurity is Barrett's (2002) theoretical rational-choice model, which builds upon the household production model and includes food insecurity as an indicator of risk exposure. The model assumes that individuals maximize their utility by choosing levels of consumption, physical well-being, savings, and physical activity, subject to their budget, time, and production constraints.

Previous research has shown that poverty has the largest influence on whether an individual has adequate access to food. Early research emphasized the role played by economic growth in alleviating food insecurity. However, as discussed in the 2012 edition of FAO's *State of Food Insecurity in the World*, national economic growth is necessary but not sufficient for improving food security. Other factors, such as high food prices, income inequality, and the unequal distribution of food within countries and households, also affect food insecurity rates.

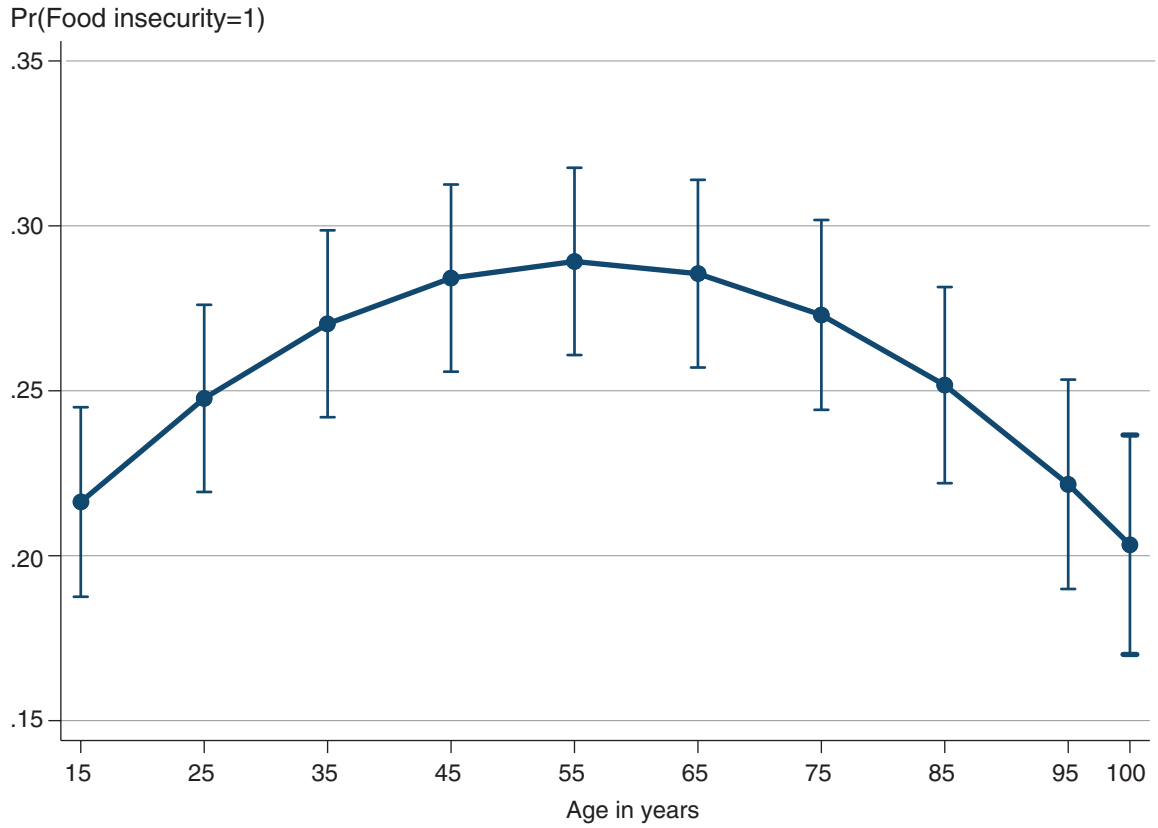
ERS researchers were the first to use the 2014 FIES measure to identify and examine the common determinants of food insecurity in 134 countries (Smith, Rabbitt, et al., 2017). Using a series of regression models that adjust for both individual- and country-level characteristics, they found that five characteristics are most strongly associated with the likelihood of experiencing food insecurity:

having low levels of education, weak social networks, limited social capital, low household income, and unemployment. "Social networks" refers to the respondent's ability to make new friends. "Social capital" refers to the ability to count on friends and family in times of need.

The results also revealed, for the first time, valuable internationally comparable information on the demographics associated with food insecurity around the world. For example, results show being female is associated with a higher likelihood of experiencing food insecurity. Gender and intra-household dynamics can play a large role in how households mitigate food insecurity risks. For example, households have been shown to react differently to changes in income depending on the gender of the person in control of household resources (Quisumbing, 2003). The literature shows that women traditionally place more emphasis on family and child welfare, often leading to better educational and food-related outcomes (Smith & Haddad, 2000). When women have more bargaining power and a larger share of household expenditures, the share of household resources spent on food increases, leading to more but also higher-quality foods (Sraboni, Malapit, Quisumbing, & Ahmed, 2014).

Age is also is an important factor for global food insecurity. The likelihood of experiencing food insecurity increases with age but decreases with old age—the slope of age is zero at 45 years old. This is most likely because those reaching older age have generally had opportunities that provide for a healthy life but may also be because the amount of food one needs declines with age.

Figure S1-4
Predicted probability of food insecurity over age



Source: USDA, Economic Research Service using data from the 2017 Gallup World Poll.

The findings also show that residing in a rural area, compared to living in a large city, is associated with an increase in the probability of experiencing food insecurity and severe food insecurity. This is consistent with previous research that demonstrates that rural food insecurity is often much higher than urban food insecurity (Smith, Ruel, & Ndiaye, 2005). Rural populations and smallholder farmers make up most of the food insecure in developing countries and are key to improving global food insecurity (FAO & IFAD, 2015). For example, smallholder farmers may be more susceptible to exogenous economic and weather-related shocks, such as droughts and floods, than the urban poor (Minot & Pelijor, 2010). Addressing food insecurity in rural areas requires greater access to assets such as land, education, and infrastructure, all of which are important determinants of rural income (Winters et al., 2009).

The ERS researchers uncovered significant heterogeneity in the determinants of food insecurity across countries with different levels of economic development. The associations between food insecurity and gender, the number of adults in the household, living in a rural area, and gross domestic product (GDP) per capita were all found to vary by development ranking. For example, living in a rural area puts an individual at a greater risk of food insecurity (than living in an urban area) in low- and middle-income countries such as Rwanda and Honduras but is associated with a lower risk of food insecurity in a high-income country like France. Women are more likely to experience food insecurity than men in middle-income countries, but gender is statistically insignificant in low- and high-income countries. An increase in GDP per capita is associated with a decrease in the likelihood of experiencing food insecurity in low- and high-income countries but is statistically insignificant in middle-income countries.

A Detailed Look at Food Insecurity Based in Latin America and the Caribbean Using the FIES

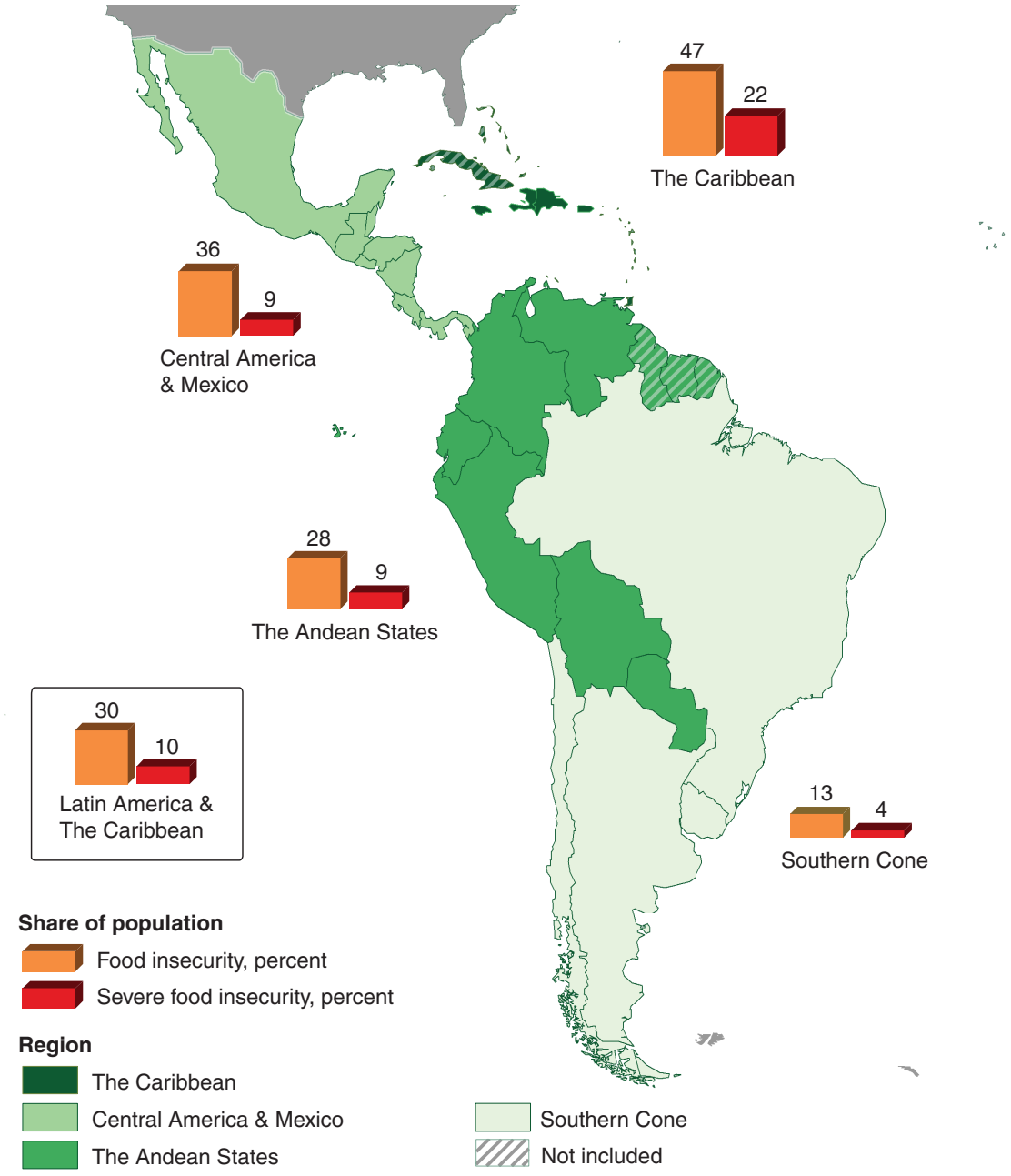
A second study using 2014 FIES data provides a more detailed look at food insecurity in Latin America and the Caribbean (Smith, Kassa, et al., 2017). Researchers from ERS, the World Bank, and the International Fund for Agricultural Development used the FIES data in combination with a broader set of Gallup World Poll data to analyze the prevalence and determinants of food insecurity in this part of the world.

Substantial efforts have been underway within Latin America and the Caribbean for decades to reduce poverty and food insecurity. For example, in 2003 Brazil launched the Fome Zero (Zero Hunger) program to alleviate poverty, eliminate hunger, and improve the livelihoods of the poor (Melgar-Quinonez, Nord, Perez-Escamilla, & Segall-Correa, 2008). Fome Zero brings together national and international governmental and non-governmental institutions to reduce food insecurity. Building on this program, Brazil has now launched Plan Brasil sem Miseria (Plan Brazil Without Poverty), with the goal of eradicating extreme poverty (Winters, Falconi, Martel, Miranda, & Paiva, 2015). Mexico launched Sin Hambre Cruzada Nacional (National Crusade Against Hunger), also to eliminate hunger and malnutrition. Both Guatemala (Pacto Hambre Cero) and Nicaragua (Programa Hambre Cero) have programs aimed at establishing policies to ensure food security. Some of the success in reducing food insecurity in Latin America and the Caribbean in recent decades is likely due to these ongoing efforts, but solid evidence of impact requires improved data and careful analysis.

FIES data revealed significant regional variation in the prevalence of food insecurity in Latin America and the Caribbean. For example, in 2014, the Caribbean region experienced more severe food insecurity (22 percent) than Central America (9 percent), the Andean States (9 percent), and the Southern Cone (4 percent).

Figure S1-5

Using the 2014 FIES, food insecurity in Latin America and the Caribbean region was highest in the Caribbean



Note: Average shares calculated using sample-weighted, individual-level data. The 2014 IFSA estimate of food-insecure people in Latin American and the Caribbean was 22 percent.

Source: USDA, Economic Research Service using data from the 2017 Gallup World Poll.

This study examined additional characteristics that may be associated with food insecurity (e.g., access to education, immigrant status, degree of religiosity, presence of the internet and/or cell phone in the respondent's home, and satisfaction with the local public transportation system). The top three characteristics associated with higher likelihoods of experiencing food insecurity in Latin America and the Caribbean were low levels of education, limited social capital, and living in a country with low GDP per capita. For example, adults with only elementary school education were 15.9 percentage-points more likely to experience food insecurity, compared to those with a college degree. Educated individuals often possess more assets and have access to opportunities for nonagricultural employment, reducing dependence on more volatile agricultural sources of income (Barrett, 2002).

Individuals with high levels of social capital had a 13.0-percentage-point lower probability of experiencing food insecurity. Social networks and social capital can provide the food insecure with private assistance in times of need that may help decrease the severity of food insecurity episodes (Berkman, Glass, Brissette, & Seeman, 2000; Cacioppo, Hughes, Waite, Hawkley, & Thisted, 2006; Cohen & Janicki-Deverts, 2009). In developing countries, however, this private assistance is often too small and uneven in coverage to offer adequate assistance (Barrett, 2010).

ERS researchers also explored the heterogeneity of the demographic determinants of food insecurity by gender and rural/urban status. This information gives a more detailed and comprehensive picture of who the food insecure are within Latin America and the Caribbean and can help policymakers focus programs aimed at ameliorating food insecurity.

Overall, the analysis showed that women, especially in rural areas—while not in the direst straits (severely food insecure)—were more likely to experience food insecurity. Being female was associated with a 1.5-percentage point higher probability of experiencing food insecurity, compared to being male, although this was not statistically significant for severe food insecurity. Previous research has found that women's empowerment is positively associated with calorie availability and dietary diversity (Sraboni et al., 2014).

Where women live affects food insecurity. In rural areas, being female was associated with a 3.1-percentage point higher probability of experiencing food insecurity. But in large cities, being female was associated with a 1.2-percentage-point lower probability of suffering severe food insecurity. This may be because governmental and other institutional support is available to women in urban settings that is not available in rural areas.

Consistent with the global study, the likelihood of experiencing food insecurity and severe food insecurity increased with age but levels off with middle age.

Overall, the results of these two studies further validate the FIES and confirms the virtues of self-reported experiential measures of food insecurity. Despite heterogeneity in global populations, differences in governments and policies, variations in local economies, labor markets, and agriculture, we can identify the characteristics of the typical food-insecure person around the world. The FIES represents an important complement to existing model-based measures of food security and other initiatives that quantify the magnitude of food insecurity within countries. Rather than duplicating model-based estimates of food insecurity, this research extends the field by developing a greater understanding of the food access dimension of global food insecurity among different populations.

Looking Ahead: Combating Food Insecurity

In most countries, the prevalence of food insecurity, as measured by ERS's IFSA and FAO's prevalence of undernourishment, has declined over the last several decades. Recent analysis by the FAO, however, shows that global food insecurity rose in 2016 and 2017. In 2017, the number of undernourished people is estimated to have increased to 821 million—about one out of every nine people on the planet (FAO, IFAD and WFP, 2018). The second U.N. Sustainable Development Goal aims to "end hunger, achieve food security and improved nutrition" for all people by 2030. Tracking progress toward this goal will require both national- and individual-level indicators, such as the FIES.

Effective policy interventions to address food insecurity require understanding questions of the whos, wheres, and whys concerning the food insecure. Experiential food insecurity measures such as the FIES are crucial for answering these questions. Such experiential measures allow for cross-country comparisons of the severity of food insecurity and insights into the characteristics and geographic concentration of the food insecure.

References

Ballard, T.J., A.W. Kepple, and C. Cafiero. 2013. "The Food Insecurity Experience Scale: Developing a Global Standard for Monitoring Hunger Worldwide. Technical Paper. Rome: FAO, 2013."

Barrett, Christopher B. 2002. "Food Security and Food Assistance Programs," *Handbook of Agricultural Economics* 2: 2103–90.

———. 2010. "Measuring Food Insecurity." Science 327 (5967): 825–28.

Berkman, Lisa F., Thomas Glass, Ian Brissette, and Teresa E Seeman. 2000. "From Social Integration to Health: Durkheim in the New Millennium." Social Science & Medicine 51 (6): 843–57.

Cacioppo, John T., Mary Elizabeth Hughes, Linda J. Waite, Louise C. Hawkley, and Ronald A. Thisted. 2006. "Loneliness as a Specific Risk Factor for Depressive Symptoms: Cross-Sectional and Longitudinal Analyses," *Psychology and Aging* 21 (1): 140.

Coates, Jennifer, Edward A Frongillo, Beatrice Lorge Rogers, Patrick Webb, Parke E Wilde, and Robert Houser. 2006. "Commonalities in the Experience of Household Food Insecurity across Cultures: What Are Measures Missing?" *The Journal of Nutrition* 136 (5): 1438S-1448S.

Cohen, Sheldon, and Denise Janicki-Deverts. 2009. "Can We Improve Our Physical Health by Altering Our Social Networks?" *Perspectives on Psychological Science* 4 (4): 375–78.

Food and Agriculture Organization. 2016. "Methods for Estimating Comparable Rates of Food Insecurity Experienced by Adults throughout the World." Rome: FAO.

FAO, and IFAD. 2015. "The State of Food Insecurity in the World 2015. Meeting the 2015 International Hunger Targets: Taking Stock of Uneven Progress." Food and Agriculture Organization Publications, Rome.

FAO, IFAD and WFP. 2014. "The State of Food Insecurity in the World 2014: Strengthening the Enabling Environment for Food Security and Nutrition." FAO, Rome.

———. 2018. "The Linkages between Migration, Agriculture, Food Security and Rural Development." Technical Paper. Rome: FAO.

Melgar-Quinonez, H.R., Mark Nord, Rafael Perez-Escamilla, and AnaMaria Segall-Correa. 2008. "Psychometric Properties of a Modified US-Household Food Security Survey Module in Campinas, Brazil," *European Journal of Clinical Nutrition* 62 (5): 665.

Minot, Nicholas, and Nidup Pelijor. 2010. "Food Security and Food Self Sufficiency in Bhutan."

Nord. 2014. "Introduction to Item Response Theory Applied to Food Security Measurement: Basic Concepts, Parameters, and Statistics." Technical Paper. Rome: FAO 2014.

Nord, Mark, Carlo Cafiero, and Sara Viviani. 2016. "Methods for Estimating Comparable Prevalence Rates of Food Insecurity Experienced by Adults in 147 Countries and Areas." 772:012060. IOP Publishing.

Quisumbing, Agnes R. (2003). Power and resources within the household: Overview. Household Decision, Gender, and Development: A Synthesis of Recent Research. International Food Policy Research Institute, Washington, DC.

Radimer, Kathy L., Christine M Olson, and Cathy C. Campbell. 1990. "Development of Indicators to Assess Hunger," *The Journal of Nutrition* 120: 1544–48.

Radimer, Kathy L, Christine M Olson, Jennifer C Greene, Cathy C Campbell, and Jean-Pierre Habicht. 1992. "Understanding Hunger and Developing Indicators to Assess It in Women and Children," *Journal of Nutrition Education* 24 (1): 36S-44S.

Rasch, Georg. 1960. "Probabilistic Models for Some Intelligence and Achievement Tests." Copenhagen: Danish Institute for Educational Research.

Sen, Amartya. 1982. *Poverty and Famines: An Essay on Entitlement and Deprivation*. Oxford N\ University Press.

Smith, Lisa C., and Lawrence James Haddad. 2000. *Explaining Child Malnutrition in Developing Countries: A Cross-Country Analysis*. Vol. 111. International Food Policy Research Institute.

Smith, Marie, T. Ruel, and Aida Ndiaye. 2005. "Why Is Child Malnutrition Lower in Urban than in Rural Areas? Evidence from 36 Developing Countries," *World Development* 33 (8): 1285–1305.

Smith, Michael D., Woubet Kassa, and Paul Winters. 2017. "Assessing Food Insecurity in Latin America and the Caribbean Using FAO's Food Insecurity Experience Scale," *Food Policy* 71 (August): 48–61.

Smith, Michael D., Matthew Rabbitt, and Alisha Coleman-Jensen. "Who Are the World's Food Insecure? New Evidence from the Food and Agriculture Organization's Food Insecurity Experience Scale.," by Michael D. Smith, Matthew Rabbitt, and Alisha Coleman-Jensen, *World Development*, 2017, vol. 93 (C), pp. 402–412.

Smith, Michael D., Matthew Rabbitt, and Alisha Coleman-Jensen. 2017. "Who Are the World's Food Insecure? New Evidence from the Food and Agriculture Organization's Food Insecurity Experience Scale." *World Development* 93: 402–412.

Sraboni, Esha, Hazel J Malapit, Agnes R Quisumbing, and Akhter U Ahmed. 2014. "Women's Empowerment in Agriculture: What Role for Food Security in Bangladesh?" *World Development* 61: 11–52.

Thome, Karen, Birgit Meade, Kamron Daugherty, and Cheryl Christensen. I*nternational Food Security Assessment, 2018-2028*. by Karen Thome, Birgit Meade, Kamron Daugherty, and Cheryl Christensen, GFA-29, U.S. Department of Agriculture, Economic Research Service. 2018.

Winters, Paul, Benjamin Davis, Gero Carletto, Katia Covarrubias, Esteban J Quiñones, Alberto Zezza, Carlo Azzarri, and Kostas Stamoulis. 2009. "Assets, Activities and Rural Income Generation: Evidence from a Multicountry Analysis." *World Development* 37 (9): 1435–52.

Winters, Paul, C Falconi, P Martel, J. A. Miranda, and M Paiva. 2015. "Background Paper for the Food Security Sector Framework Document. Prepared for the Inter-American Development Bank." Inter-American Development Bank.

Appendix–Food Security Assessment Model: Definitions and Methodology

The IFSA model used in this report projects food consumption (food demand), food access, and food gaps in 76 low- and middle-income countries through 2029. Food is divided into four groups covering 100 percent of food consumption: the major grain (determined by calorie share), other grains, root crops, and all other food.

The food security of a country is evaluated based on the gap between projected domestic food consumption (food demand) and a caloric target, which we set at 2,100 calories per capita per day—a caloric level necessary to sustain life at a moderate level of activity. The modeling projections of food demand are expressed in grain equivalent based on each food group's caloric content to allow aggregation across food groups; this grain equivalent is easily expressed in either kilograms or calories.

Three food security indicators are provided: (1) the share food insecure, which is the share of the total population unable to reach the nutritional target; (2) the number of food-insecure people; and (3) the food gap, which is the amount of food needed to allow each individual consuming below the threshold level to reach the caloric target. This caloric target indicates relative well-being and helps to quantify unequal food access within a country.

Projection results provide a baseline for the food security situation in each country, and the results depend on the model's specification and underlying assumptions. The simulation framework used to project food demand is based on partial-equilibrium models for each country in the assessment. Beghin et al. (2015a) introduce the methodology, and Beghin et al. (2017) provide more detail on price transmission and food security projections.

Each country model comprises a price-independent generalized log-linear (PIGLOG) demand system for each of the four food groups (Muellbauer, 1975). The demand system is calibrated on a 3-year-average of prices and incomes (2016-18), observed consumption levels, a measure of inequality, and income and price elasticities. Demand projections are based on projected prices and incomes; the model implicitly assumes that both the *preferences* represented by the demand system and the *income distributions* embedded in the calibration and projections are constant over time.

The distribution of consumption used to calculate food security measures is described by a constant coefficient of variation, which implies an increasing standard deviation of consumption as consumption rises over the projection period, but does not account for potential structural changes in an economy. The implied price and income elasticities evolve over the projection period as prices and incomes change; generally, food groups become more income-inelastic because incomes rise.

Structural Framework for Estimating and Projecting Food Demand in the Aggregate

Demand system definition and calibration

We specify demand q_i^h for a given food group *i* for income-decile *h* as:

$$q_i^h = \left(x_i^h / p_i\right)\left(A_i(p_i) + B_i(p_i)\ln\left(x^h\right)\right) \quad (1)$$

where p_i is the price (expressed in real local currency), and x^h is the decile-level income. We further specify $A_i(p_i) = a_{i0} + a_{i1}p_i$, and $B_i(p_i) = b_{i0} + b_{i1}p_i$.

The PIGLOG demand formulation allows for aggregation of income decile-level demands in (1) into average per capita market demand for each food group *i* (2).

$$\bar{q}_i = \left(\frac{x_i}{p_i}\right)\left((a_{i0} + a_{i1}p_i) + (b_{i0} + b_{i1}p_i)(\ln\left(\bar{x}\right) + \ln(\frac{10}{z})\right) \quad (2)$$

The latter is a function of average per capita income $\bar{x}$ and Theil's entropy measure of income inequality *z*.

We also define average expenditure share for food category *i* as:

$$\bar{w}_i = (a_{i0} + a_{i1}p_i) + (b_{i0} + b_{i1}p_i)(\ln\left(\bar{x}\right) + \ln(\frac{10}{z})) \quad (3)$$

The elasticity of average demand for good *i* with respect to average income (or total expenditure) is:

$$\varepsilon_{\bar{q}_i\bar{x}} = 1 + (b_{i0} + b_{i1}) / \bar{w}_i \quad (4)$$

The own-price elasticity of the average demand is

$$\varepsilon_{\bar{q}_i p_i} = -1 + \left(\frac{p_i}{\bar{w}_i}\right)\left(a_{i1} + b_{i1}(\ln\left(\bar{x}\right) + \ln(\frac{10}{z})\right)) \quad (5)$$

In each country, consumers at different income levels have similar underlying preferences over good *i* as embodied in parameters a_{i0}, a_{i1}, b_{i0}, b_{i1}, but their respective consumptions vary because their respective incomes vary.

With a system of three linear equations (equations 3, 4, and 5) with four unknown variables, one parameter remains free. The free parameter (chosen to be b_{i0}) is used to ensure that decile demands behave consistently with stylized facts of food security as follows: price sensitivity and income responsiveness decline with income levels; own-price elasticities must be negative; and food expenditure shares tend to fall with increasing income. A range of values of the free parameters allows ensuring these stylized facts are satisfied by the calibrated demand system. Here we pin down b_{i0} such that the ratio of price elasticities for the bottom and top deciles is equal to the ratio of the natural logarithm of their national income shares.

For any given free parameter value, the system of equations is solved for parameters b_{i1}, a_{i1}, and a_{i0} as a function of the free parameter. Once these three parameters are recovered, parameters $\tilde{a}_{i0}, \tilde{a}_{i1}, \tilde{b}_{i0}$, and $\tilde{b}_{i1}$, along with income x^h and price p_i are used to generate the consumption level of good *i* for each decile specified in equation (1). In this initial calibration, the quality of any good *i* is assumed constant across the income distribution.

For each country, we calibrate a demand system for each of the four food groups based on income, consumption levels, and prices from the 3 years preceding the projection period (2016-18). We determine the major grain (which varies across countries) based on caloric share in the diet. The other grains food group contains all other grains; the prices for this food group are weighted by its components' caloric shares. At the calibration stage, we either observe domestic food prices (including the components of a price index for other grains that is weighted by caloric share), or create synthetic prices.

For the food prices not observed in the calibration stage, we create a synthetic domestic price, p_i^{ds}, that is linked to the world price, p_i^w, and expressed in real local currency. The parameter θ is the price transmission slope, which we assume is 0.7. The parameter trc^{int} represents international transportation and market costs (e.g., cost, insurance and freight (CIF) and free on board (FOB)), which we assume are 10 percent, and trc^{dom} represents domestic trade costs, which we assume are $20 per ton in real terms.

$$p_i^{ds} = \theta^* p_i^w * \left(1 + trc^{int} trc_{int} / \theta\right) * \left(1 + tariff / \theta\right) + trc^{dom} \tag{6}$$

At this stage, we also calibrate a price transmission equation that links the domestic price p_i^{dom} (either observed or synthetic) to the world price. The generic price transmission equation is:

$$p_i^{dom} = \theta^* p_i^w + \hat{I} \tag{7}$$

During the calibration stage, we solve for the intercept, *I*, in real terms, and hold it constant during the projection period.

Projection of food demand calculation and food security indicators_

The IFSA food security indicators (share of food insecure population, number of food insecure people, and food gap) are derived from the levels of food demand projected using the calibrated demand system.

For each country, we use the demand parameters and projected income, x_t, and prices, p_{it}, to project food demand, q_{it}, for each of the four food groups *i* in each year *t* so that $q_{it} = \widehat{A_i}\left(x_t / p_{it}\right)\left((p_{it}\right) + \widehat{B_i}(p_{it}) \ln\left(x_t\right)$. We aggregate demand for the four food groups into total food demand expressed in calories, so that $\sum q_{it} = Q_t$, which we also refer to as food or calorie consumption. We use this measure of total demand to calculate food security indicators.

We follow FAO (2015) to estimate the distribution of calorie consumption beginning with a coefficient of variation (CV) of food availability, which characterizes consumption distributed with

a mean *m* and variance *v*, so that $CV = \left(\sqrt{v} / m\right)$.[4] Given the CV and the projected mean caloric consumption (Q_t), we can recover the variance, *v*, of the empirical distribution for a given year *t*.

Assuming food consumption *Qt* is distributed lognormal, then *ln(Qt)* is distributed *N(μ,σ2)* with $\mu = \ln\left(\frac{m^2}{\sqrt{v+m^2}}\right)$ and $\sigma^2 = \ln\left(1+v/m^2\right)$. Once μ and σ^2 are computed, we recover the proportion of the population that falls below the calorie target (2,100 calories per capita per day) using the standard normal CDF, Φ: $\Phi^{insecure} = \Phi\left(\frac{\ln\left(2100-\mu\right)}{\sigma}\right)$. Here, $\Phi^{insecure}$ indicates **the share of the population that is food insecure**. Using this share and total population in the respective country, we obtain the total **number of food insecure people** in this country.

Next, the expected average food intake of food insecure people, $q_{cal\ average}^{food\ insecure}$, can be recovered using the partial mean of the calorie availability below the target (2,100), which we calculate as $q_{cal}^{food} = e^{\mu-\sigma/\Phi\text{^}2100\left[\phi\left(\left(\ln(2100)-\mu\right)/\sigma\right]\right.}$, where ϕ is the standard normal density function.

The **food gap** is the difference between the caloric target of 2,100 and the average calorie availability for food insecure people. This provides a measure of the food gap in calories per day per food-insecure person (per capita food gap). The latter multiplied by the number of food insecure people and converted into grain equivalent per year yields a food gap measure based on annual grain volume (total food gap).

Data

The model is calibrated for each of the four food groups based on average prices and income from 2016-18. Prices are expressed in real local currency units. Quantities are expressed in grain-equivalent units.

Calibrated parameters and variables:

Demand Parameters ($\tilde{a}_{i0}, \tilde{a}_{i1}, \tilde{b}_{i0}$, and $\tilde{b}_{i1}$), Price Intercepts, Domestic Prices (Synthetic) Projections are based on data from the *ERS International Macroeconomic data set* and the *USDA Agricultural Projections to 2028*, and utilize the calibrated demand parameters and price transmission between world and domestic prices.

Endogenous projection variables:

Food Demand, Domestic Prices

Exogenous variables used in calibration and projection:

[4]See the appendix of Beghin et al. (2015b) for more detail.

Average Consumption per capita – Food and Agriculture Organization (FAO) of the United Nations Food Balance Sheet (most recent available)[5]

Grain Shares – FAO Food Balance Sheet[6]

Elasticities of Price and Income – unpublished calculations by Jim Seale using 2011 International Comparison Program (ICP) data, following the methodology in Muhammad et al., 2011[7]

Domestic Prices (Observed) – FAO Global Information and Early Warning System (GIEWS, annual average; market depends on reporting)

Tariffs derived from nominal farm prices – World Bank's World Integrated Trade Solution (WITS)[8]

Exchange Rates and Consumer Price Indices (CPIs) – *ERS International Macroeconomic Data Set*[9]

Population – U.S. Census Bureau

World Prices – USDA Agricultural Projections to 2028[10]

Per Capita Income – generated using GDP and population from ERS International Macroeconomic Data Set[11]

Income Distribution – World Bank Data Bank.[12] Assumed constant during the projection period.

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[5]Food Balance Sheets (FBS) are for 2013. There are no current FBS for Somalia, Eritrea, Burundi, DR Congo. We use grain consumption levels and share of grains in total calories as reported in the FAO-GIEWS *Cereal Supply and Demand Balance for Sub-Saharan African Countries: situation as of November 2016* report to generate per capita consumption for each food group. We bring forward the reported consumption of all food groups using information from FAO's grain supply data and changes in caloric intake.

[6]For Somalia, we use an FBS from the original Food and Agriculture Organization Statistical Database, which is no longer maintained. We use the FBS of neighboring countries (Burundi-Rwanda; DR Congo-Congo; Eritrea-Ethiopia) to approximate the shares of grains and roots and tubers in total calories for the other countries.

[7]Elasticities are not available for all countries. We use estimates from neighboring countries (Somalia-Ethiopia; Eritrea-Ethiopia; Algeria – avg. Tunisia and Morocco; Afghanistan - avg. Tajikistan and Pakistan; Turkmenistan- avg. Tajikistan, Kyrgyzstan, Kazakhstan; Uzbekistan-avg. Tajikistan, Kyrgyzstan, Kazakhstan). We use less elastic values for major grain in Vietnam, Philippines, Indonesia, India, Pakistan, and Bangladesh, and for other grain in India.

[8]Tariffs are available through 2017. Somalia, Turkmenistan, Eritrea, and North Korea tariffs are not available. For Eritrea, we use the Common Market for Eastern and Southern Africa (COMESA) average. Somalia has imposed a 12.3 percent tariff on commercial imports (LCU Logistics). Turkmenistan has no tariff but imposes excise taxes that have historically been 10 percent. North Korea does not import on the open market, so we assume zero tariffs and do not quantify other trade frictions.

[9]We modeled Ecuador and El Salvador in U.S. dollars instead of local currency as in the ERS International Macroeconomic Dataset, based on data from IMF and Oxford Economics. We constructed projections for Somalia, North Korea, and Zimbabwe using data from International Monetary Fund, IHS Markit, and Oxford Economics.

[10]The world price series are maize (US gulf #2 yellow); rice (Thai, B, fob Bangkok); sorghum (US Gulf, #2 yellow); wheat (gulf, #2 HRW); barley (EC, French, Rouen); Oats (US Farm); roots and tubers (cassava; tapioca, hard pellets, Rotterdam, fob); other food (represented by soybean oil, Dutch fob, ex-mill). World price projections are not available for all cereals represented in the FAO Food Balance Sheets and the FAO GIEWS price database. We use the world price of wheat to represent rye; and sorghum to represent all other cereals (e.g. millet, teff, fonio).

[11]Projections were constructed using information from IMF, Oxford Economics, and IHS Markit for Zimbabwe, Somalia, and North Korea.

[12]Income distributions are not available for all countries. We use Eritrea-Ethiopia; Somalia-Ethiopia; Zimbabwe-Zambia; North Korea-Mongolia; and Afghanistan-avg. Uzbekistan, Pakistan, Tajikistan.

Coefficient of Variation (CV) of Food Consumption – FAO State of Food Insecurity (FAO, 2015). Assumed constant during the projection period

Modeling Staple Cereal Production

Agricultural production is decomposed into yield (production per hectare) and area for grains. Production (*PR*) for a given country *c* in year *t* is obtained by multiplying projected yield (*YL*) and area (*AR*).

$$PR_{ct} = AR_{ct} * YL_{ct}$$

The projections cover the period 2019-29. They are based on producer price projections in local currency units and world price projections from the USDA Agricultural Projections.

Yield

Yield projections are based on parameters estimated econometrically using panel data and are calibrated to observed yields for 2016-18. Yields respond to expected relative return ratios per hectare (RR), autonomous technical change over time (T), and include a country-specific effect.

$$YL_{ct} = f(RR_{ct}, T_{t)}$$

The return ratios are the ratio of the return per hectare (price, *p*, times yield) divided by the price of fertilizer, $RR_{ct} = p_{ct} Y_{ct} / p_t^{fert}$. The expected return ratios include a contemporaneous and a long-term expectation component and are expressed in real local currency (rlcu). We use USDA Agricultural Projection (to 2028) prices for superphosphate and the major grain by production volume (for grain). We express the international price in rlcu, and then use the transmission equation $p^{domestic} = 0.7p^{world} + 0.3I$ to model the domestic price. The intercept, *I*, is the mean of the price over the regression time period (1985-2016). The production data is from FAO.

Modeling area

Following the typical older Nerlovian specification, we specify area as a function of lagged area and of expected relative prices (output price and fertilizer price).

$$AR_{ct} = f(p_{ct}, p_{ct}^{fert}, A_{ct-1}, T)$$

The expectation takes the average of contemporaneous and lagged relative prices. We also include a time trend in area to capture non-price shifters in area decisions, and a country fixed effect. We numerically calibrate the area equation to the base-year average of 2014-16 using consensus estimates for price and lagged acreage responses.

Modeling IASR

The Implied Additional Supply Required (IASR) quantifies the total grain demand in each country that is not projected to be met through domestic production. Total grain demand (TD) is comprised of food demand (FD), generated by our demand-driven model, and nonfood use (NFD), which is

comprised of seed, feed, processing, and other uses. The IASR for grains thus can be expressed as: IASR=TD-PR.

We assume that demand for grain for processing, seed, and other uses grows at the same rate as production. The demand for grain feed grows at the average rate observed from 2006 to 2016.

References

Beghin, John, Birgit Meade, and Stacey Rosen. 2015a. *A Consistent Food Demand Framework for International Food Security Assessment.* TB-1941, U.S. Department of Agriculture, Economic Research Service, June.

Beghin, John, Birgit Meade, and Stacey Rosen. 2015b. *A Consistent Food Demand Framework for International Food Security Assessment.* Iowa State University Economics Working Paper WP #14023, February.

Beghin, John, Birgit Meade, and Stacey Rosen, 2017. "A Consistent Food Demand Framework for International Food Security Assessment*," Journal of Policy Modeling* 39(5): 827-842.

Food and Agriculture Organization of the United Nations (FAO). 2015. "The State of Food Insecurity in the World." Rome, Italy.

Muellbauer, John. 1975. "Aggregation, income distribution and consumer demand," *The Review of Economic Studies* 42(4): 525-543.

Muhammad, Andrew, James L. Seale, Birgit Meade, and Anita Regmi. 2011. *International Evidence on Food Consumption Patterns: An Update Using 2005 International Comparison Program Data*. TB-1929, U.S. Department of Agriculture, Economic Research Service.

Appendix: Food Security Measures for IFSA Countries, 2019 and 2029

Appendix table 1

Summary information for 76 countries in the *International Food Security Assessment*

	Population		Population food insecure		Share of population food insecure		Food gap (per capita)		Food gap* (total)	
	2019	2029	2019	2029	2019	2029	2019	2029	2019	2029
	Million		*Million*		*Percent*		*Kcal/day*		*1,000 MT*	
GRAND TOTAL	3,762	4,329	727.7	399.0	19.3	9.2	394	471	33,456	21,891
Asia Total	2,396	2,647	333.2	92.6	13.9	3.5	281	329	11,078	3,601
Afghanistan	36	45	19.0	15.8	53.2	35.4	367	305	805	556
Armenia	3.0	2.9	0.1	0.0	3.3	0.2	175	131.4	2.2	0.1
Azerbaijan	10	11	0.3	0.1	2.8	0.6	161	135	6	1
Bangladesh	161	176	28.7	7.8	17.8	4.4	271	209	793	165
Cambodia	17	19	3.2	0.6	19.2	3.3	295	215	100	14
Georgia	5	5	0.3	0.0	5.1	0.7	198	156	7	1
India	1,312	1,448	141.6	7.8	10.8	0.5	235	158	3,622	135
Indonesia	265	284	21.1	4.3	8.0	1.5	246	195	580	93
Kyrgyzstan	6	6	0.4	0.1	6.7	1.4	207	168	10	2
Laos	7	8	0.9	0.1	12.7	0.9	234	159	25	1
Moldova	3	3	0.1	0.0	2.1	0.0	148	102	1	0
Mongolia	3	3	0.5	0.1	15.6	1.7	254	178	16	1
Nepal	30	32	3.1	0.4	10.3	1.2	241	178	86	8
North Korea	26	27	14.6	11.1	57.3	41.6	418	356	696	448
Pakistan	211	240	36.9	8.9	17.5	3.7	298	225	1,332	243
Philippines	108	124	18.5	6.0	17.2	4.8	297	234	609	156
Sri Lanka	23	24	3.4	0.7	14.9	2.8	242	182	91	14
Tajikistan	9	10	3.0	1.6	33.8	16.4	377	307	138	62
Turkmenistan	5	6	0.2	0.0	3.9	0.6	190	154	5	1
Uzbekistan	30	33	2.4	0.1	8.0	0.5	205	144	63	3
Vietnam	98	105	10.6	1.2	10.9	1.1	269	195	303	25
Yemen	29	35	24.3	26.0	83.1	74.0	615	540	1,788	1,673
LAC Total	171	188	29.8	15.7	17.4	8.3	341	330	1,151	587
Bolivia	11	13	3.5	1.7	30.7	12.8	317	252	136	51
Colombia	49	53	3.6	1.3	7.3	2.4	238	203	98	30
Dominican Republic	11	12	0.9	0.3	7.8	2.2	213	177	21	5
Ecuador	17	19	4.7	2.3	28.2	12.3	265	214	147	58
El Salvador	6	6	1.0	0.5	16.5	8.2	262	227	29	13
Guatemala	16	19	4.7	2.7	29.1	14.8	353	295	185	91
Haiti	11	12	5.2	4.6	47.2	37.6	632	577	342	279
Honduras	9	11	2.1	1.0	22.4	9.2	327	268	77	30
Jamaica	3	3	0.4	0.1	12.2	3.6	223	181	9	2
Nicaragua	6	7	0.9	0.4	14.8	5.6	313	262	32	11
Peru	32	34	3.0	0.9	9.4	2.5	220	180	76	18
North Africa Total	190	222	9.8	4.1	5.2	1.9	251	223	308	115
Algeria	42	48	3.1	1.8	7.3	3.7	257	232	103	53
Egypt	102	124	4.6	1.7	4.5	1.4	260	225	136	44
Morocco	35	38	1.6	0.5	4.5	1.4	246	212	50	14
Tunisia	12	12	0.6	0.1	5.2	0.9	244	197	18	3

Appendix table 1

Summary information for 76 countries in the *International Food Security Assessment* —continued

	Population		Population food insecure		Share of population food insecure		Food gap (per capita)		Food gap* (total)	
	2019	2029	2019	2029	2019	2029	2019	2029	2019	2029
	Million		*Million*		*Percent*		*Kcal/day*		*1,000 MT*	
Sub-Saharan Africa Total	1,004	1,273	354.9	286.5	35.3	22.5	509	530	20,919	17,588
Central Africa	**125**	**154**	**80.5**	**92.7**	**64.6**	**60.1**	**797**	**811**	**7,539**	**8,836**
Cameroon	26	34	3.8	2.0	14.6	6.0	268	227	123	55
Central African Republic	6	7	4.5	3.5	76.0	48.2	570	418	291	166
Congo	5	7	2.6	2.1	50.3	32.9	415	347	129	89
Congo, DR	87	107	69.6	85.1	79.8	79.6	864	862	6,996	8,526
East Africa	**353**	**446**	**142.4**	**90.0**	**40.3**	**20.2**	**445**	**407**	**7,458**	**4,306**
Burundi	12	17	8.6	11.5	70.4	68.5	516	505	518	673
Chad	13	15	7.7	6.9	61.1	46.5	679	589	643	505
Eritrea	6	7	5.8	5.0	96.4	74.5	803	511	580	319
Ethiopia	111	145	36.5	10.1	32.7	7.0	346	240	1,396	268
Kenya	49	56	14.3	3.7	29.1	6.6	311	223	530	98
Rwanda	12	15	4.1	2.0	32.8	13.7	399	316	190	74
Somalia	12	15	5.8	7.1	50.1	48.3	488	479	322	389
Sudan	39	46	21.9	13.9	56.8	30.4	470	359	1,248	602
Tanzania	57	74	21.1	19.6	37.0	26.4	479	429	1,137	944
Uganda	42	57	16.7	10.2	39.6	18.0	450	354	895	432
Southern Africa	**143**	**187**	**61.6**	**60.9**	**42.9**	**32.5**	**450**	**420**	**3,246**	**2,992**
Angola	31	44	11.9	20.1	37.8	45.9	387	421	571	1,052
Lesotho	2	2	0.2	0.0	11.7	2.2	256	197	7	1
Madagascar	26	33	14.2	13.0	53.8	39.6	403	348	590	467
Malawi	21	28	6.9	3.2	33.4	11.4	370	280	294	105
Mozambique	28	36	7.9	5.5	28.5	15.3	420	357	402	235
Namibia	3	3	1.1	0.8	41.1	24.4	317	264	41	24
Swaziland	1	2	0.4	0.3	25.6	16.1	289	255	12	7
Zambia	17	23	10.3	11.4	60.9	50.8	620	560	761	763
Zimbabwe	14	17	8.8	6.6	61.5	38.1	521	411	569	338
West Africa	**383**	**485**	**70.4**	**42.9**	**18.4**	**8.8**	**334**	**298**	**2,676**	**1,454**
Benin	12	15	1.8	0.6	15.2	4.1	297	236	58	16
Burkina Faso	21	28	5.4	4.0	25.5	14.2	447	387	303	194
Cabo Verde	1	1	0.1	0.0	14.0	4.4	257	209	2	1
Côte d'Ivoire	25	29	3.2	2.1	12.8	7.1	360	323	132	77
Gambia	2	3	0.4	0.1	18.1	5.4	282	223	12	3
Ghana	29	35	1.8	0.6	6.2	1.6	236	197	48	13
Guinea	13	17	2.4	1.5	18.4	8.8	347	297	88	47
Guinea-Bissau	2	2	0.5	0.2	27.2	8.5	326	249	17	5
Liberia	5	6	2.6	2.6	53.6	40.2	609	535	163	140
Mali	19	25	2.4	1.9	12.5	7.3	293	265	81	57
Mauritania	4	5	0.6	0.3	14.9	5.8	322	270	22	9
Niger	21	28	5.1	3.7	24.7	13.5	375	323	257	163
Nigeria	200	253	37.6	22.0	18.8	8.7	280	237	1,232	611
Senegal	15	19	1.8	0.4	11.4	2.3	220	170	46	9
Sierra Leone	6	8	2.7	2.0	41.3	24.1	457	381	134	84
Togo	8	11	2.1	0.9	24.8	8.4	327	256	81	28

*Measured in grain equivalent.
Source: USDA, Economic Research Service.