



Scenarios of Global Food Consumption: Implications for Agriculture

Ronald D. Sands, Birgit Meade, James L. Seale, Jr., Sherman Robinson, and Riley Seeger

What Is the Issue?

The global land base is under increasing pressure to provide food for a growing population. Rising incomes have historically implied increasing consumption of animal products, along with an increased need for feed. To date, steady increases in agricultural productivity have allowed agricultural production to keep up with a growing population and per capita increases in food consumption. This report describes how changes in population, income, and agricultural productivity may affect the production and consumption of crops and food products by 2050 and addresses:

- How do increasing population and income affect global demand for crops and food products by 2050?
- What is the effect of agricultural productivity growth on food prices and cropland area expansion?
- How do alternative assumptions about population growth affect the size of the world agricultural system in 2050?

This study addresses the future of food consumption considering both physical output measures and the economics of production, consumption, and land use.

What Did the Study Find?

Primary (crop) calories are produced from the land before processing into food products. Crop calories are greater than food calories, due primarily to losses that occur as feed crops are converted to food products such as meat, dairy products, and eggs. Production of crop calories is a more complete measure of the agricultural system than food calories because it also includes these conversion losses. Research highlights are:

- Production of crop calories is a useful indicator of pressure on the land base. Crop calories are the product of population, per capita food calories available for consumption, and crop calories required per calorie of food. With an income-driven diet and population growth of 39 percent, available food calories grow by 44 percent, and crop calories grow by 47 percent from 2011 to 2050. Growth in crop calories reflects income-driven shifts to greater total food calories per person and an increasing share of animal products in food consumption.

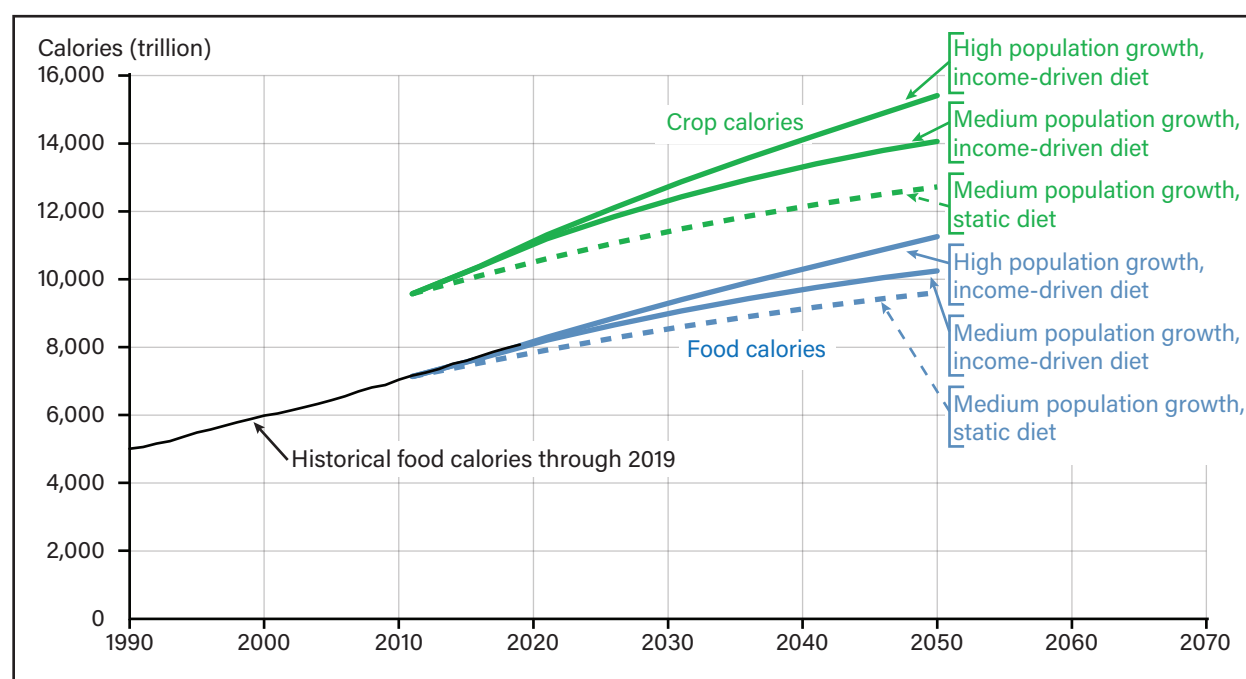


ERS is a primary source of economic research and analysis from the U.S. Department of Agriculture, providing timely information on economic and policy issues related to agriculture, food, the environment, and rural America.

- When moving from a low-productivity scenario to a high-productivity scenario, the decline in consumer food prices leads to an increase in world crop calorie production of 1.8 percent.
- Across scenarios, the largest expansion in cropland occurs with high population growth and low agricultural productivity growth. The largest increase in crop yield occurs with high population growth and high agricultural productivity growth.
- Using United Nations projections of world population, the production of crop calories would grow by 33 percent (low population growth), 47 percent (medium population growth), and 61 percent (high population growth) from 2011 to 2050.

The world production of calories across three scenarios is illustrated in the figure. Crop calories, an indicator of pressure on the land base, are greatest in the high population scenario.

Projections of world food calories and crop calories, 2011–50



Note: Three illustrative scenarios are shown: a static diet (per capita consumption of food calories remains constant at 2011 levels in all world regions) with medium population growth; an income-driven diet with medium population growth; and an income-driven diet with high population growth. The static diet is a point of comparison to quantify the effect of income growth on food consumption. Historical food calories in 2019 are slightly higher than the medium-population scenario in the Future Agricultural Resources Model (FARM). This indicates that food consumption continues to respond strongly to increases in per capita income. FARM simulations begin in 2011.

Source: USDA, Economic Research Service using historical food calories through 2019 from the Food and Agriculture Organization (FAO) of the United Nations and World Population Prospects 2017, United Nations. USDA, Economic Research Service simulations using FARM.

How Was the Study Conducted?

The authors simulated the effect of a static diet, income-driven diets, and other drivers on world agricultural production, prices, and land use from 2011 to 2050 across 10 “what-if” scenarios. The scenarios are designed to isolate the impacts of population growth, income growth, and growth in agricultural productivity. Crop calories are the unit of agricultural production, which allows aggregation across multiple crop types, comparison to calories consumed as food, and provide an indicator of cropland requirements. Scenarios are simulated in the Future Agricultural Resources Model (FARM), a global computable general equilibrium (CGE) model developed and maintained at the U.S. Department of Agriculture, Economic Research Service (USDA, ERS).