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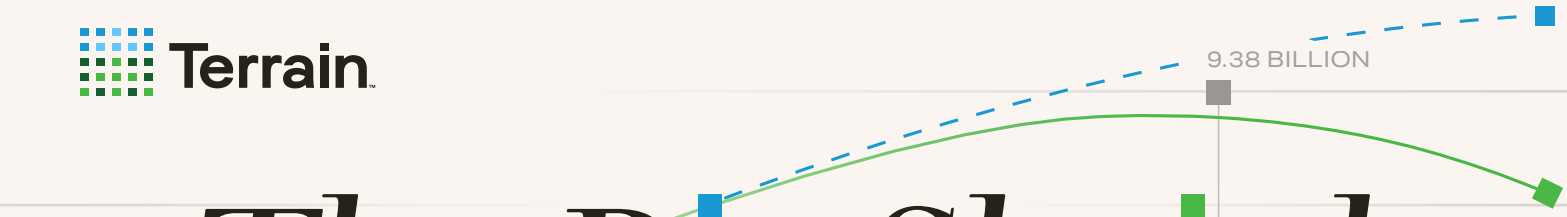


The Big Shrink

How Will Agriculture Navigate the Baby Bust?

By Matt Woolf, Ph.D., and Don Close

SITUATION

Since 2017, the United Nations has revised its global fertility and population projections downward. Initially, in 2017, the organization projected that the global population would continue to increase throughout the 21st century without reaching a peak. However, with more observable data indicating a significant decline in fertility rates, these estimates have been consistently adjusted downward.

By the 2022 update, the population peak was identified at 10.4 billion in 2086, marking the first prediction of population decline in the 21st century. The most recent release in 2024 further revised the peak to 2084, with a slightly lower maximum of just under 10.3 billion.

In many countries and regions, population decline has already arrived. Europe has been in decline since 2020, China and South Korea since 2021, and Japan since 2010, U.N. data show. Whether the timing of peak population is exact or not, the reality of a sustained contraction is incredibly profound, as humanity has never consistently been in population decline.

As we enter unknown waters, predicting outcomes is challenging. Still, it is likely that falling population levels will result in many complications for governments and consumer demand in certain industries. Other repercussions, like labor shortages and an aging consumer base, are already manifesting and likely to accelerate well before the population has reached its peak.

Agriculture will experience significant implications from diminishing population growth. Since the 1970s, the sector has operated on the premise that more people will require more food, notably in the form of exports. This idea is captured by the mantra "Feed the World," which is often displayed at farming conferences and repeated in the speeches of policymakers. In a world where the population is contracting, however, it is unlikely that producing more for a world that demands less will be a winning strategy for many reasons.

While it may seem like a distant reality, U.S. farmers must take population decline seriously as they consider what their family farm operations look like now and in the future.

THE BABY BOOM

The origins of the “Feed the World” approach to agriculture are often linked to Earl Butz, who served as secretary of agriculture from 1971 to 1976. Butz is credited with steering U.S. agricultural policy away from price-stabilizing and surplus-minimizing principles behind programs such as the Agricultural Adjustment Act of 1933 to the income-supporting and export-promoting ones that exist today. Butz’s new paradigm was, put simply, to maximize productive capacity on the supply side, where he encouraged farmers to plant “fencerow to fencerow,” and leverage export markets on the demand side.

Numerous influences drove Butz's point of view, notably the prospect of overpopulation and agriculture's

capacity to meet the moment. In 1960, with a substantial portion of the global population enduring extreme poverty, it was a widespread view among academics and policymakers that overpopulation would be their biggest challenge. The publication of Paul Ehrlich's "The Population Bomb," which predicted mass famine as early as the 1970s, brought these concerns into public consciousness. Butz appears to have shared overpopulation concerns, which likely inspired his approach in government.

Ultimately, advances in agriculture, globalization, and a decline in the fertility rate prevented the catastrophe earlier predicted. Agricultural productivity in the U.S. today is nearly three times what it was in 1960, and the nominal value of U.S. agricultural exports has increased nearly 25 times since 1970, according to the USDA. Simultaneously, fertility rates have declined universally, even in developing countries where it was once seen as highly unlikely.

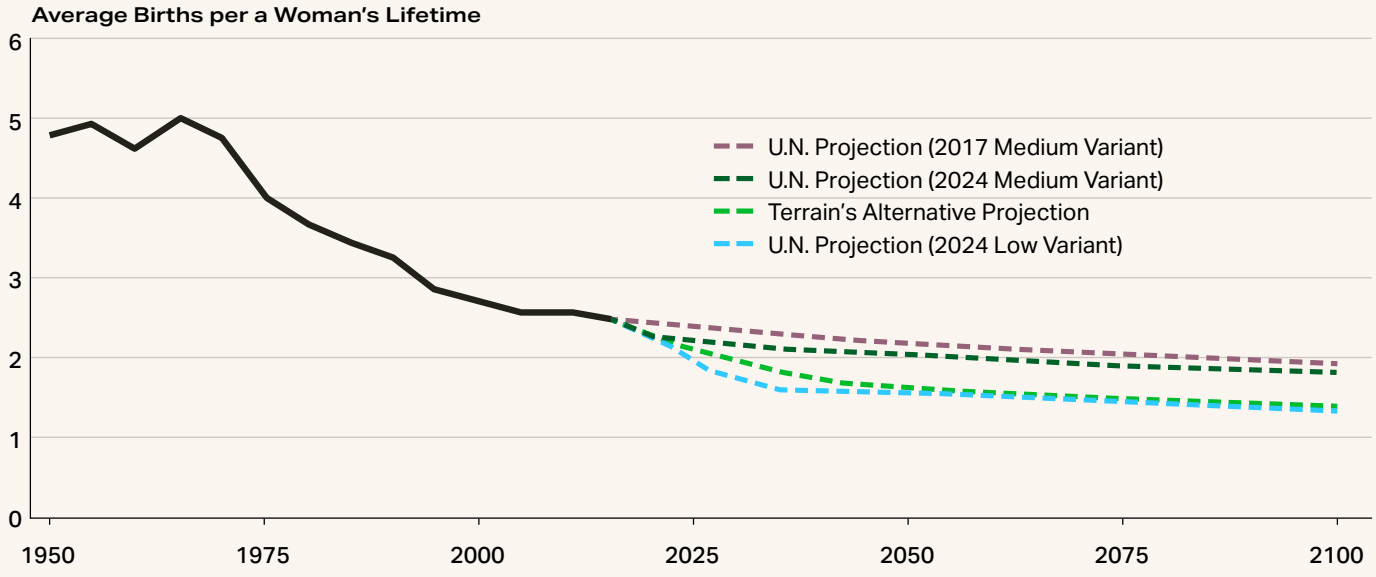
As GDP per capita and women's education levels have risen in the very poorest parts of the world, declining fertility rates have become one of the most consistent patterns observed. As a result, whereas the percentage of the global population that lives in extreme poverty was nearly 50% in 1960, it was 10% as of 2018, according to Our World in Data.

Though commodity markets tend to be volatile, and costs have been on the rise, the desire to feed the world created opportunities for U.S. farmers and ranchers. Farm receipts have risen steadily from decade to decade, driven by the increase in production, the development of export markets, and the rise in renewable energy sources derived from agricultural products. At the same time, farmland values across the country have appreciated rapidly, increasing the equity position of many farmers. Whereas the average value of farmland in the U.S. was $921 per acre in 1960 (in 2023 dollars), it was just over $4,000 in 2023, according to the USDA.

THE BABY BUST

While the U.S. agricultural industry poised itself for growth by enhancing productivity, the very factors that have contributed to its successes in the last half-century are likely to become significant obstacles in the not-so-

Fertility Projections May Be Optimistic



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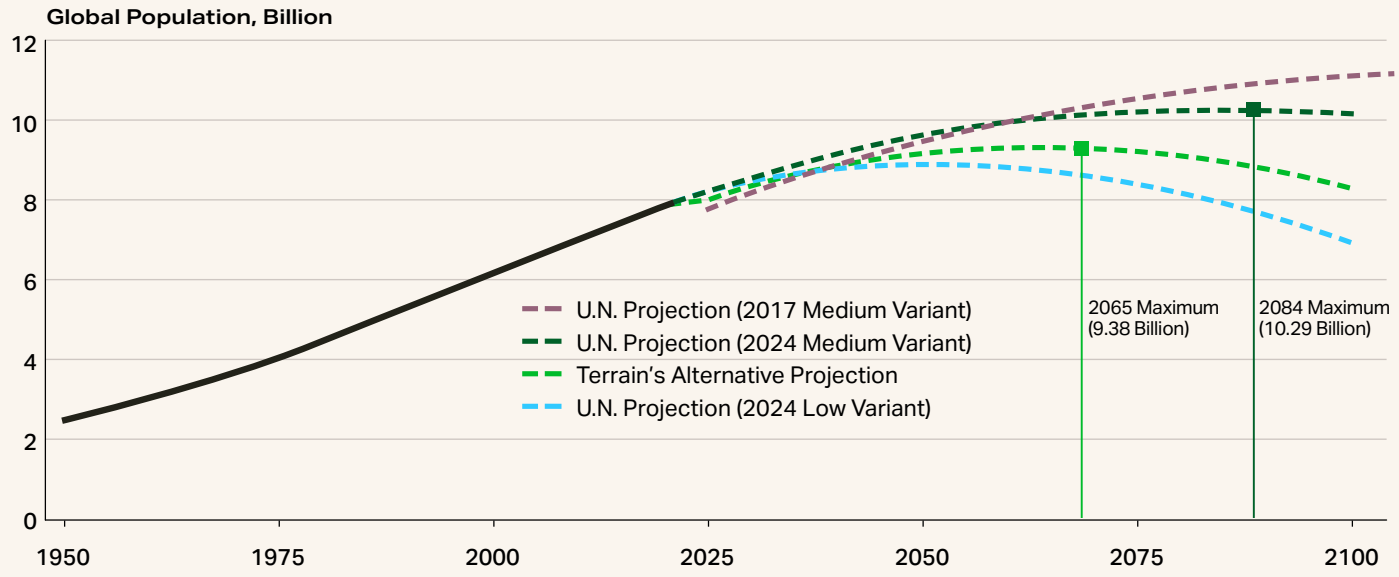
Sources: United Nations, Terrain

Global Population May Peak by 2065



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Sources: United Nations, Terrain

distant future. The U.N. projects not only that the global population will max out at 10.3 billion by 2084 but also that it will sink to just under 10.2 billion by the end of the century. It's also worth noting that the International Institute for Applied Systems Analysis in Austria as well as a team at the Institute for Health Metrics and Evaluation at the University of Washington predict an earlier and lower peak than the U.N.'s numbers.

Terrain's own analysis does this as well. In constructing our own projection, we adopt the U.N.'s methodology of estimating based on fertility and mortality rate assumptions. We utilize the U.N.'s data to calibrate our own model under an alternative fertility scenario. Whereas the U.N. 2024 fertility estimates project 2.09 births per woman by 2050 and 1.84 births by 2100, our estimates suggest fertility rates could be as low as 1.65 per woman by 2050 and 1.43 per woman by 2100, approximately 20% lower than the U.N.'s medium variant estimates but almost exactly in line with its low variant estimates.

Given these lower fertility levels, our model projects the world's population level reaches 9.21 billion in 2050 and will peak at 9.38 billion between 2065 and 2070. This is much sooner than the U.N.'s projection of 9.7 billion by 2050 and a peak population level of 10.3 billion in 2084, but still higher than the U.N.'s low variant outcome for population level. While our model indicates population decline in every continent, some reach peak much sooner.

A population that is approaching its peak sooner will affect agriculture. Though the details of each effect on the industry will be covered in later reports, effects appear to exist on both the supply and demand side. On the demand side, changes to consumption patterns could soon accelerate as the population ages and the composition of food demand evolves. Globally, continued productivity gains in agricultural output around the world will make export markets more competitive at a time when many populations may be in sustained decline. Competition creates uncertainty, and uncertainty can yield increased volatility.

On the supply side, farmers are unlikely to experience an easy solution to labor challenges, which may accelerate the trend of consolidation, since larger farms can often

Some Continents Reach Peak Population Sooner Than World

	2024 U.N. Medium Variant Projection Peak Date	2024 U.N. Medium Variant Projection Peak Number	Terrain Projection Peak Date	Terrain Projection Peak Number
World	2084	10.29 billion	2065-2070	9.38 billion
Africa	After 2100	After 2100*	After 2100	After 2100*
Asia	2054	5.29 billion	2045-2050	4.96 billion
Europe	2020	750 million	2020-2025	759 million
Latin America and the Caribbean	2053	731 million	2050-2055	693 million
Northern America	After 2100	After 2100*	2055-2060	435 million
Oceania	After 2100	After 2100*	2075-2080	58 million

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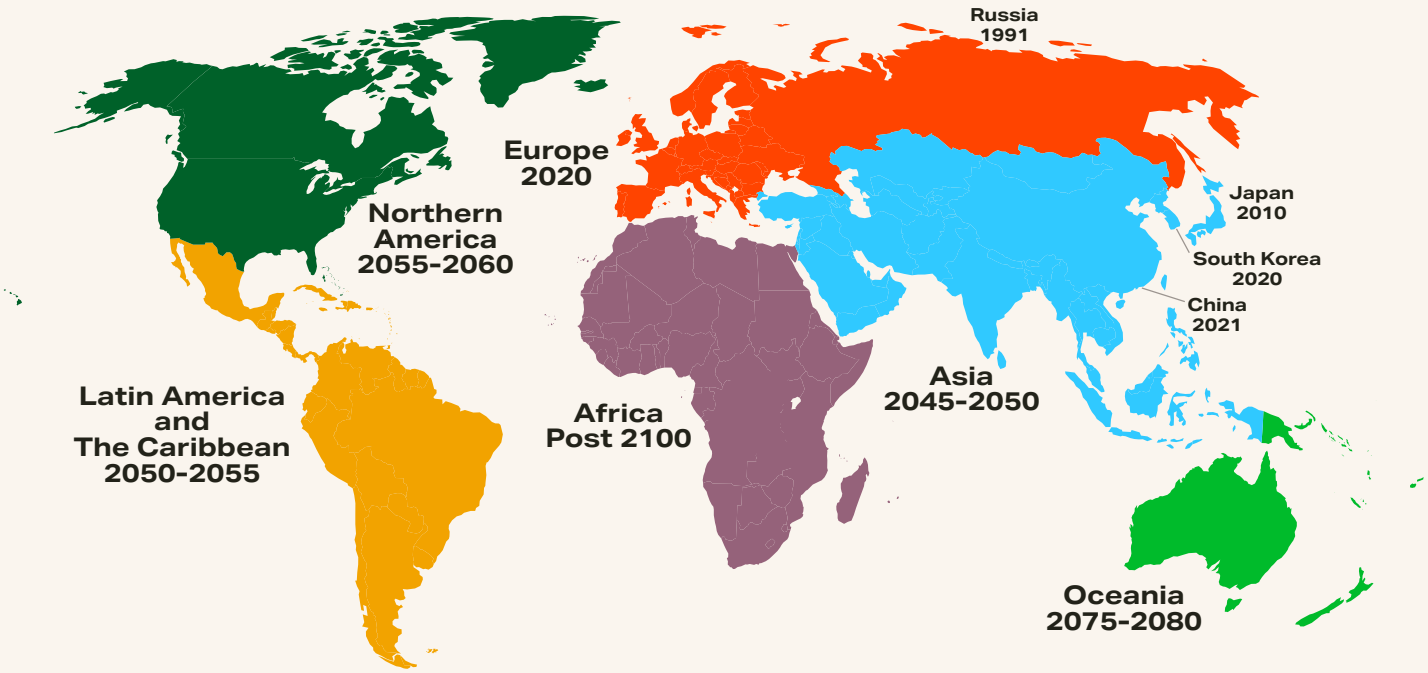
*"After 2100" in the peak number columns means there is no further defined projection.
Sources: United Nations World Population Projections 2024, Terrain

Peak Is Just Around the Corner

Peak Year According to Terrain Projection



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Sources: United Nations World Population Projections 2024, Terrain

exercise their economies of scale to adapt to productivity challenges. The populations in rural America are also likely to face challenges due to demographic shifts. From 2000 to 2020, more than half of the counties in rural America lost population, which could impede access to childcare, healthcare and economic opportunities in the communities farmers and ranchers call home.

WHAT'S NEXT?

The U.S. agricultural sector has seized the economic opportunities associated with rising global population and income levels. But in only a few decades, and possibly within the lifetime of farmers and ranchers in business today, U.S. agriculture will have to face the prospect of a shrinking global population that will demand less from the industry. How farmers respond to these new challenges should they materialize remains to be seen, but U.S. agriculture has faced down challenges before. Farmers innovate out of necessity, and forthcoming reports from Terrain will consider potential implications of population decline and discuss how farmers can successfully navigate the future.

ABOUT THE AUTHORS

Matt Woolf, Ph.D., is Terrain's specialty crop analyst, focusing on tree nuts, fruits and vegetables. He is a native of California's Central Valley, where his family grows almonds, pistachios and a variety of row crops. Matt has an extensive academic, teaching and research background, including a Ph.D. in economics from the Australian National University.

Don Close is a senior animal protein analyst at Terrain. His prior experience includes his work as a senior animal protein analyst at Rabobank and as a market director for the Texas Cattle Feeders Association. In his three decades of professional experience, Don has been a licensed commodity broker, handled risk management and pricing for large cattle operations, managed a grain procurement program, and published market updates and outlooks for cattle and hogs.

ABOUT TERRAIN

Terrain's expert analysts distill vast amounts of data to deliver exclusive insight and confident forecasting for a more resilient agricultural economy. Terrain is an exclusive offering of AgCountry Farm Credit Services, American AgCredit, Farm Credit Services of America and Frontier Farm Credit.