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INDEPENDENT STRATEGIC ANALYSIS OF AUSTRALIA'S GLOBAL INTERESTS

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Global Food and Water Security in 2050: Demographic Change and Increased Demand

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Key Points

- A larger global population, rising incomes and the global shift towards a "Western diet" are likely to be the main drivers of increased food and water demand in the years up to 2050.
- Without sustainably intensifying food production and reducing food wastage, it is likely that agriculture will have a greater impact on the natural environment.
- It is possible to feed the estimated population of about ten billion in 2050 using current agricultural techniques. That will probably require most people to accept radical dietary changes, however, which are unlikely to be popular.
- The sustainable intensification of agricultural production, lifting food production in under-utilised regions, reducing food waste and adopting new technologies, such as precision agriculture, are likely to play a larger role in increasing the global food supply.

Summary

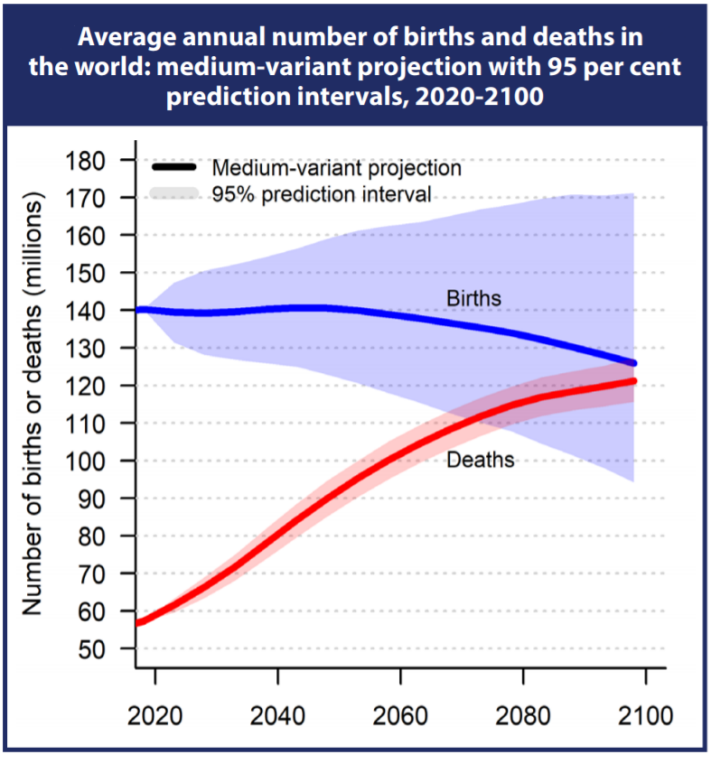
The global population is expected to increase to almost ten billion by 2050. Global wealth is also expected to increase over the next 30 years and contribute to a shift in global diets that will see increased demand for meat and dairy products, which require a greater amount of crop and water resources to produce than other food products. The world has managed to increase agricultural production without significantly increasing agricultural land use before. It is likely to be difficult to do that again, particularly with the uncertainties of climate change and much of the world's most productive agricultural land possibly already being utilised at close to its limit. Adopting agricultural technologies and methodologies, such as

precision and regenerative agriculture, could ensure that any additional pressure on the natural environment is minimal.

Analysis

Global agriculture faces some physical constraints. About 70 per cent of the fresh water withdrawn each year is used to grow crops, feed livestock and process ingredients for food production. It is projected that, by 2050, demand for water will increase by 20 to 30 per cent, due to higher demand from a larger global population. Food and fibre production also uses more than half of the world's ice-free land. To overcome these constraints and limit the impact of agriculture on the natural environment the world needs to use fewer resources to produce more food (sustainably intensify production) and better utilise the food that it already produces (reduce waste).

With the exception of some regions, such as Sub-Saharan Africa, fertility levels have generally been in decline for the last two decades. The population growth rate is the lowest since 1950 and is expected to continue to slow. The global population is expected to continue to increase for the remainder of this century, however, with the largest rise in population expected to occur over the next 30 years. The United Nations predicts that the global population will increase from 7.7 billion in 2019 to 9.7 billion in 2050 and reach 10.9 billion in 2100. More than half of that growth is likely to occur in India, Nigeria, Pakistan, the Democratic Republic of the Congo, Ethiopia, Tanzania, Indonesia, Egypt and the United States.



Source: UN Department of Economic and Social Affairs

Small differences in fertility during that time could, however, result in major differences in the long-term population size, structure and distribution. Population projections are based

on a number of assumptions about the future, chiefly that the number of births will remain stable until 2050 before starting to decline. The number of deaths, meanwhile, is projected to rise each year for the rest of the century as the global population continues to age.

Population growth forecasts have contributed to concerns about the world's ability to produce enough food to feed the larger number of people who are expected to inhabit the planet in 2050. A 2011 study suggests that global crop production will need to more than double by 2050 to ensure that there is enough food to feed the population of almost ten billion, based on crop production in 2005. Global food production has increased at a greater rate than forecast, however, and it is likely that crop production will only need to increase by 25 to 70 per cent from 2014 levels. Between 2005 and 2014 global cereal production increased by 24 per cent while oil crops increased by 39 per cent, due to yield improvements and the expansion of cropped area.

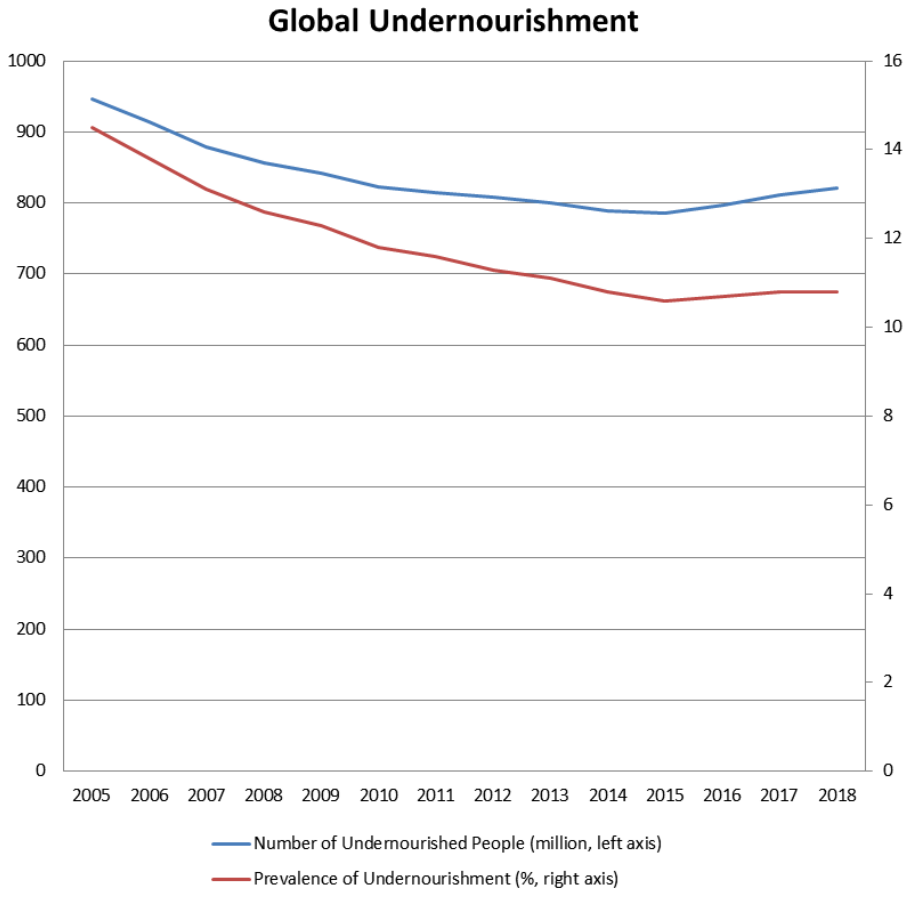
Changes in global food systems have led to nutritional transitions as populations have shifted away from traditional diets towards globalised consumption patterns. A greater proportion of the global population consume a diet based on energy dense, processed foods. Low- and middle-income countries are adopting the "Western diet," which is high in refined carbohydrates, added sugars, fats and proteins derived from animals. Urbanisation and rising incomes are the main drivers of this global transition.

There is still enough uncultivated land available to bring into production to produce the food for the world's future population. It is estimated that there is 450 to 1,400 million hectares of non-forested and unprotected land that is suitable for crop agriculture. Most of that land is concentrated in Sub-Saharan Africa, Latin America, Eastern Europe and Central Asia and is often far away from ports and roads, however, which would make it difficult to develop.

Increased food demand and dietary changes are likely to contribute to an intensified use of fertiliser, pesticide and irrigation. To avoid the negative consequences of that intensification, such as the spread of marine hypoxic "dead zones," pesticide resistance and increased water competition, sustainable forms of agriculture need to be adopted. Water insecurity is not caused by a limitation in global freshwater sources (one estimate suggests that there is about 8.4 million litres of water for each person on earth). As the global population and water supplies are unevenly distributed, however, some regions are more water scarce than others.

At the extremes, responses to those concerns fall into two broad camps: "techno-optimists" and "apocalyptic environmentalists". The former believe that human ingenuity will always be able to create new technologies that overcome food production limitations, mainly by finding greater efficiencies. The latter suggest that there are planetary boundaries to food production and that any efficiency gain could come at the cost of the natural environment, which will eventually start to undo or threaten any gain. A review of the scientific literature that focusses on three global food security factors, food production, demand and population, indicates that techno-optimism has become the dominant lens through which to view global food supply challenges over the last 50 years. Population, which was the primary concern in the early 1970s, is now the least researched of those three factors.

During the twentieth century new agricultural technologies and growing techniques, which collectively became known as the Green Revolution, lifted crop yields far enough to significantly reduce global hunger. The number of undernourished people has declined by 85 million since 2000. Since 2015, however, the number of undernourished people has increased each year. Currently, about one out of every nine people experience extreme hunger at least once per year. East Africa, the Caribbean and South and West Asia experience the highest prevalence of undernourishment. More than 700 million people were exposed to severe levels of food insecurity in 2018. An additional 1.3 billion people experienced moderate food insecurity, meaning that they did not have regular access to nutritious and sufficient food.



Source: Food and Agriculture Organization

The continuation of hunger in some parts of the world is often explained by difficulties in the distribution of food or a failure to fully adopt the practices or technologies associated with the Green Revolution. There were unintended consequences associated with the Green Revolution, however, as it relied on the application of greater amounts of nitrogen-based fertiliser and water, which has degraded soils and contributed to the overuse of water in some parts of the world.

Several studies (here, here and here, for example) suggest that it is possible to feed ten billion people using current agricultural technologies and techniques and without using more land, water or fertiliser. It will require more people making significant changes to their diet, mainly by adopting a plant-based diet, however, which is unlikely to be popular. Other

options are more likely to reduce the environmental impact of intensified agricultural production.

One of the main rationales behind reducing meat consumption is the large amount of human-edible food that is believed to be fed to livestock. It is claimed that one-third of the world's cereal crops are fed to livestock, but a recent FAO investigation found that 86 per cent of that is made of material that is not currently eaten by humans. The study states that the world's 'livestock rely primarily on forages, crop residues and by-products that are not edible to humans'. It also suggests that some livestock systems 'produce more highly valuable nutrients for humans, such as proteins, than they consume.' As livestock production does not consume as much human-edible food as once thought, other measures, such as a reduction of food loss and waste, are likely to play a larger role.

It is expected to become more difficult to increase crop yields by 2050. Food production shocks have become more frequent since the 1960s, mainly due to extreme weather events and geopolitical crises. Climate change is expected to result in more volatile growing conditions that are less conducive to food production. Droughts in Africa, where more than half of the world's population growth is set to occur by 2050, have increased from an average of one every 12.5 years over 1982-2006 to one every 2.5 years over 2007-2016. More than 80 per cent of the economic damage and loss caused by drought is absorbed by the agricultural sector and that is most pronounced in developing countries.

Existing agricultural land could be made more productive through sustainable intensification. That would help to close the "yield gap" between realised and achievable yields. Agricultural yields have been increased without a significant increase in agricultural land use in the past. Between 1961 and 2000, for example, the global population more than doubled and per capita cereal consumption increased by 20 per cent, the harvested area of cereals increased by only seven per cent, however, largely because of increased cropping intensity. While that intensification was assisted by an increase in the use of fertiliser and water, the adoption of new technologies, such as precision agriculture, which utilises resources more accurately and reduces wastage, could ensure that fertiliser and water is better utilised by soils and crops to avoid overuse and runoff.

Ensuring that there is enough food to supply the demand that is expected to accompany population growth to 2050 is one of the major challenges of the first half of the twenty-first century. Rising global incomes are expected to contribute to dietary changes that are likely to increase demand for resource-intensive agricultural products. Past increases in agricultural production have had unintended consequences for the natural environment, which must be limited. The adoption of farming technologies and methodologies, such as precision and regenerative agriculture, could ensure that any additional pressure on the natural environment is minimal.

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