The Oil Drum: Australia & New Zealand
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

# Is There Enough Food Out There For Nine Billion People ?

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Science has a paper on the changes to the current global food system required to support the expanded global population we'll see in a couple of decades time, noting that radical changes to agriculture will be required to support 9 billion people - "Food Security: The Challenge of Feeding 9 Billion People". The full text of the article is available here.

> A threefold challenge now faces the world: Match the rapidly changing demand for food from a larger and more affluent population to its supply; do so in ways that are environmentally and socially sustainable; and ensure that the world's poorest people are no longer hungry. This challenge requires changes in the way food is produced, stored, processed, distributed, and accessed that are as radical as those that occurred during the 18th- and 19th-century Industrial and Agricultural Revolutions and the 20th-century Green Revolution. Increases in production will have an important part to play, but they will be constrained as never before by the finite resources provided by Earth's lands, oceans, and atmosphere. ...
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> Recent studies suggest that the world will need 70 to 100% more food by 2050. In this article, major strategies for contributing to the challenge of feeding 9 billion people, including the most disadvantaged, are explored. Particular emphasis is given to sustainability, as well as to the combined role of the natural and social sciences in analyzing and addressing the challenge.

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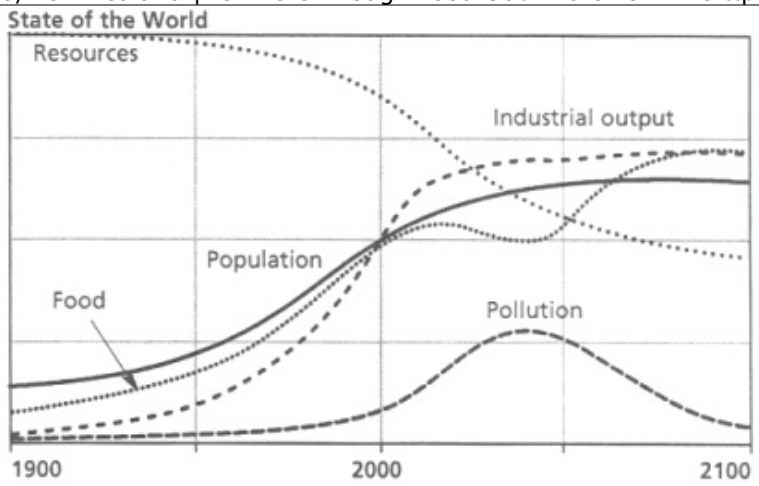
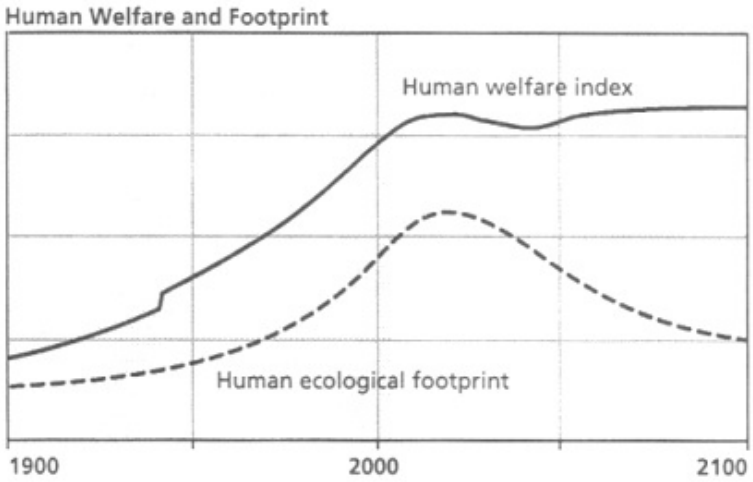
The following is a scenario from the Limits to Growth (not from the Food Security report introduced above) It illustrates what may happen, if the goal of producing adequate food for 9 million people is attained.




The Food Security report notes that while global food prices (a good indicator of food availability for those who can afford it and have access to world markets) have generally fallen over past decades they have been punctuated by price spikes like that caused by the 1970s oil crisis and the 2008 price spike (which subsided when the world went into recession).

Given that the amount of new land that could be brought under cultivation is limited (especially when competition for other uses already poses a threat to some existing agricultural land, as do losses of land due to desertification, salinisation, soil erosion, and other consequences of unsustainable land management), the report focuses on ways of increasing food production from existing land (and the oceans).

The primary recommendations of the report are:

* "Closing the Yield Gap" (achieving "best practice" results everywhere)

> The yield gap is not static. Maintaining, let alone increasing, productivity depends on continued innovation to control weeds, diseases, insects, and other pests as they evolve resistance to different control measures, or as new species emerge or are dispersed to new regions. Innovation involves both traditional and advanced crop and livestock breeding, as well as the continuing development of better chemical, agronomic, and agro-ecological control measures. The maximum attainable yield in different regions will also shift as the effects of climate change are felt. Increasing atmospheric CO2 levels can directly stimulate crop growth, though within the context of real agricultural production

systems, the magnitude of this effect is not clear. More important will be the ability to grow crops in places that are currently unsuitable, particularly the northern temperate regions (though expansion of agriculture at the expense of boreal forest would lead to major greenhouse gas emissions), and the loss of currently productive regions because of excessively high temperatures and drought.

* Increasing Production Limits

The Green Revolution succeeded by using conventional breeding to develop F1 hybrid varieties of maize and semi-dwarf, disease-resistant varieties of wheat and rice. These varieties could be provided with more irrigation and fertilizer without the risk of major crop losses due to lodging (falling over) or severe rust epidemics. Increased yield is still a major goal, but the importance of greater water- and nutrient-use efficiency, as well as tolerance of abiotic stress, is also likely to increase. Modern genetic techniques and a better understanding of crop physiology allow for a more directed approach to selection across multiple traits. The speed and costs at which genomes today can be sequenced or resequenced now means that these techniques can be more easily applied to develop varieties of crop species that will yield well in challenging environments. These include crops such as sorghum, millet, cassava, and banana, species that are staple foods for many of the world's poorest communities.

Currently, the major commercialized genetically modified (GM) crops involve relatively simple manipulations, such as the insertion of a gene for herbicide resistance or another for a pest-insect toxin. The next decade will see the development of combinations of desirable traits and the introduction of new traits such as drought tolerance. By mid-century, much more radical options involving highly polygenic traits may be feasible. Production of cloned animals with engineered innate immunity to diseases that reduce production efficiency has the potential to reduce substantial losses arising from mortality and subclinical infections. Biotechnology could also produce plants for animal feed with modified composition that increase the efficiency of meat production and lower methane emissions.

* Reducing Waste of Food

Roughly 30 to 40% of food in both the developed and developing worlds is lost to waste, though the causes behind this are very different. In the developing world, losses are mainly attributable to the absence of food-chain infrastructure and the lack of knowledge or investment in storage technologies on the farm, although data are scarce. For example, in India, it is estimated that 35 to 40% of fresh produce is lost because neither wholesale nor retail outlets have cold storage. Even with rice grain, which can be stored more readily, as much as one-third of the harvest in Southeast Asia can be lost after harvest to pests and spoilage. But the picture is more complex than a simple lack of storage facilities: Although storage after harvest when there is a glut of food would seem to make economic sense, the farmer often has to sell immediately to raise cash.

In contrast, in the developed world, pre-retail losses are much lower, but those arising at the retail, food service, and home stages of the food chain have grown dramatically in recent years, for a variety of reasons (41). At present, food is relatively cheap, at least for these consumers, which reduces the incentives to avoid waste. Consumers have become accustomed to purchasing foods of the highest cosmetic standards; hence,

> retailers discard many edible, yet only slightly blemished products. Commercial pressures can encourage waste: The food service industry frequently uses "super-sized" portions as a competitive lever, whereas "buy one get one free" offers have the same function for retailers. Litigation and lack of education on food safety have lead to a reliance on "use by" dates, whose safety margins often mean that food fit for consumption is thrown away. In some developed countries, unwanted food goes to a landfill instead of being used as animal feed or compost because of legislation to control prion diseases.

* Changing Diets (primarily eating less meat)

> The conversion efficiency of plant into animal matter is ~10%; thus, there is a prima facie case that more people could be supported from the same amount of land if they were vegetarians. About one-third of global cereal production is fed to animals. But currently, one of the major challenges to the food system is the rapidly increasing demand for meat and dairy products that has led, over the past 50 years, to a ~1.5-fold increase in the global numbers of cattle, sheep, and goats, with equivalent increases of ~2.5- and ~4.5-fold for pigs and chickens, respectively. This is largely attributable to the increased wealth of consumers everywhere and most recently in countries such as China and India.

* Expanding Aquaculture

> Aquatic products (mainly fish, aquatic molluscs, and crustaceans) have a critical role in the food system, providing nearly 3 billion people with at least 15% of their animal protein intake.
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> In many regions, aquaculture has been sufficiently profitable to permit strong growth; replicating this growth in areas such as Africa where it has not occurred could bring major benefits. Technical advances in hatchery systems, feeds and feed-delivery systems, and disease management could all increase output. Future gains may also come from better stock selection, larger-scale production technologies, aquaculture in open seas and larger inland water bodies, and the culture of a wider range of species. The long production cycle of many species (typically 6 to 24 months) requires a financing system that is capable of providing working capital as well as offsetting risk. Wider production options (such as temperature and salinity tolerance and disease resistance) and cheaper feed substrates (for instance, plant material with enhanced nutritional features) might also be accessed with the use of GM technologies.

## Right Room, Wrong Elephant

Looking at the issue from an Australian viewpoint, The New Matilda has a related article by James Arvanitakis on the debate prompted by the 2010 Intergenerational Report. The article points out that it is not the size of our population that matters, it's how we structure our economy to support the population in a sustainable way - Right Room, Wrong Elephant.

> In a parliamentary speech on global environmental issues delivered late last year, ALP

MP Kelvin Thomson said it was time to discuss the environmental elephant in the room. At the time, you'd have been forgiven for assuming he was fed up with the shortcomings of Kevin Rudd's climate policy as the Government focused all its attention on outmanoeuvring Malcolm Turnbull, rather than addressing the problems with its ETS.

Actually, the elephant Thomson wanted to talk about was population growth, both here and globally. Thomson read out a long list of global issues, from traffic congestion and waste, to global warming and terrorism, and explained how the population explosion was at the base of each of these problems.

Now, a couple of months later, the issue of population as a so-called "elephant in the room" is front and centre. Driven by the release of the 2010 Intergenerational Report — as well as by a Prime Minister who seems genuinely excited by the prospect of an Australian population of 35 million — everyone is talking about this particular elephant. Buying into the debate, entrepreneur Dick Smith and former NSW premier, Bob Carr, have both warned that this level of growth will lead to ecological disaster and that Australia is unlikely to be able to handle many more people.

For myself and many of my colleagues, however, this issue is far from being a new one. Population and sustainability are concerns that we see raised constantly in our work and we have seen that, while the motivations of those raising the concerns may vary significantly, the way the population question plays out is very specific. There's just one question we are asked again and again: "What is the right population number for Australia?"

Is it a valid question? Well, perhaps, but before we even try to answer it, we need to understand that there is another elephant in the room. This one has been pointed out by British social commentator George Monbiot, and it's one that Kelvin Thomson and his contemporaries have chosen to ignore: that those worrying most about population seem to be post-reproductive middle aged, comfortable white men who have reached a certain level of material success. Further, Monbiot reminds us, the population explosion is the one environmental problem that this high energy consuming sub-section of the population can not actually be blamed for.

In other words, to ask questions about an ideal population size completely misses the point.

*Photo courtesy flickr/photonquantique*

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