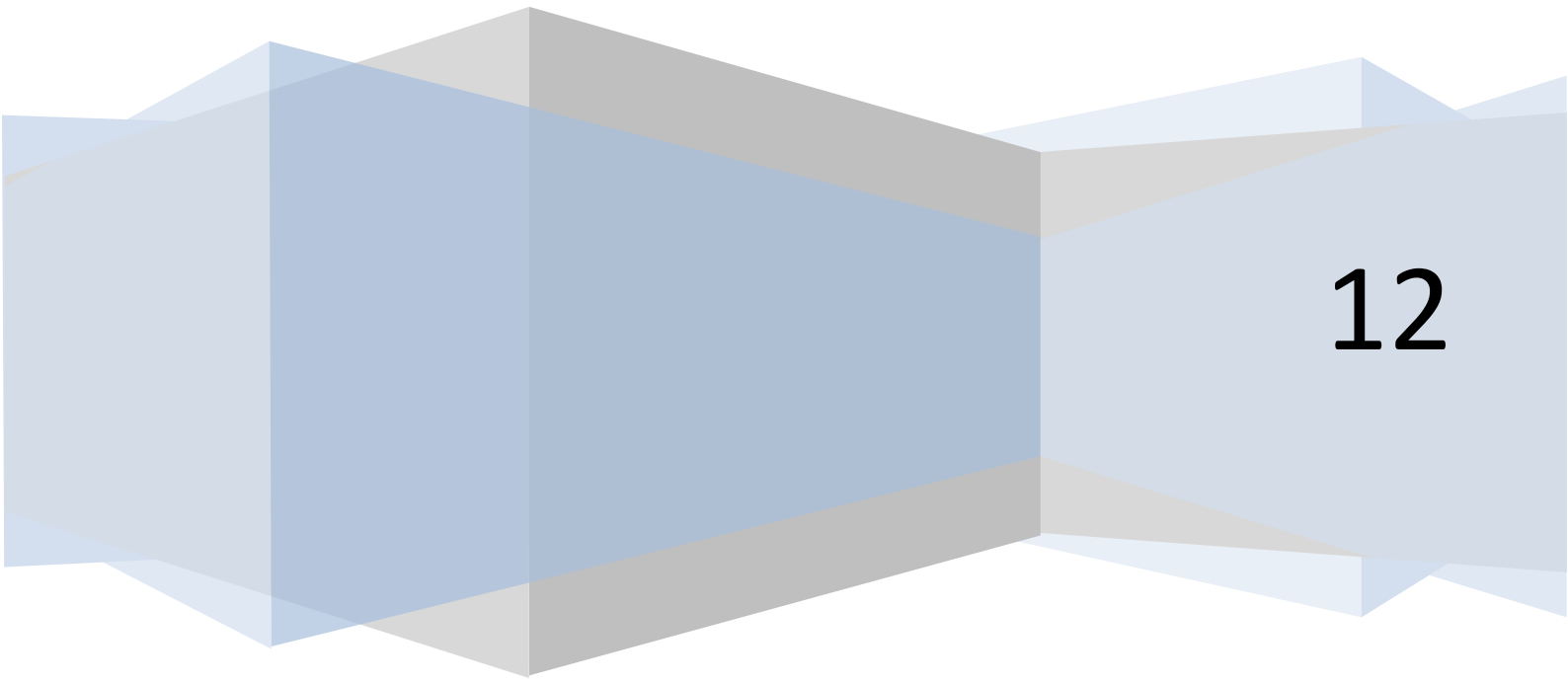
Julian Cribb and Associates

Meeting the C21st food challenge

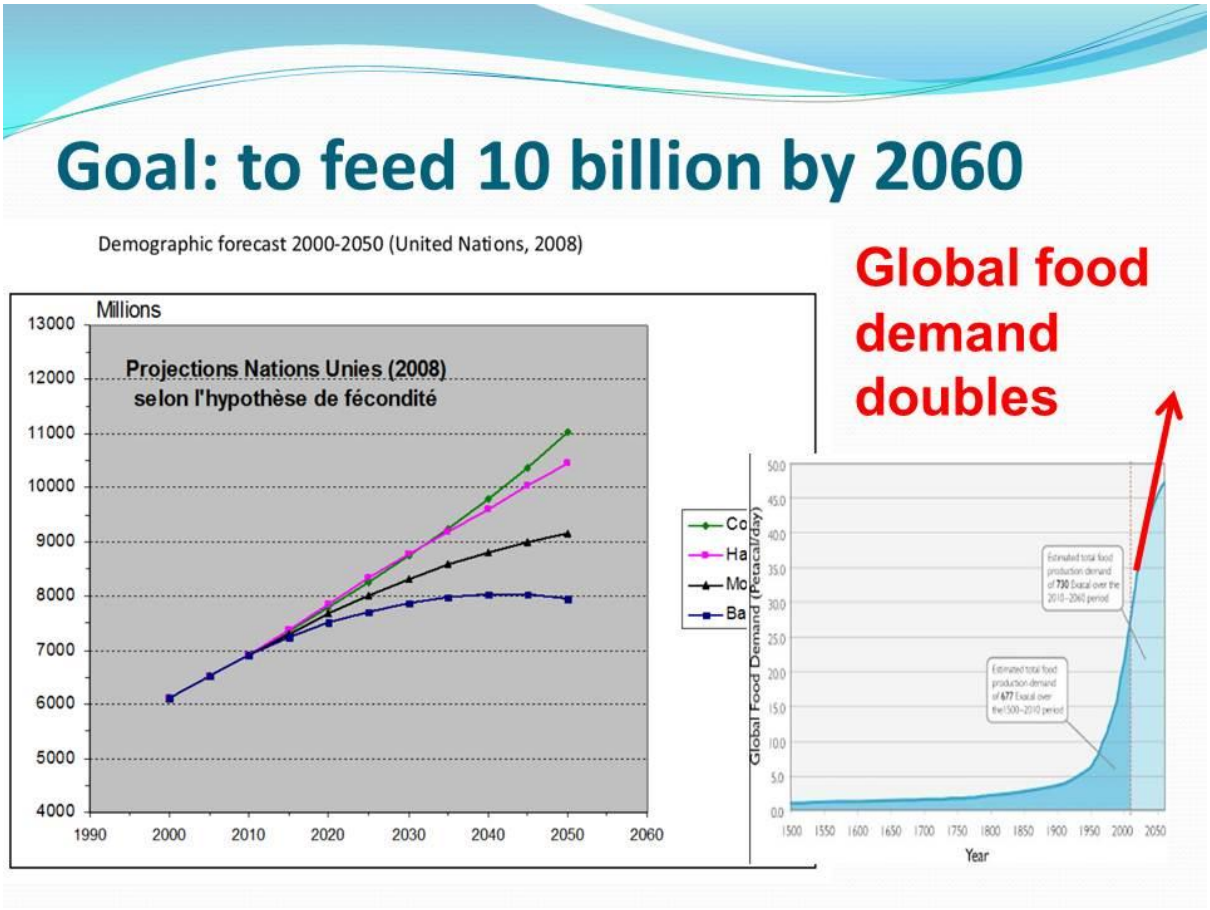
Address to Goulburn-Broken CMA, Aug 30-31 2012

Julian Cribb FTSE

Feeding 10 billion people sustainably in the mid-late 21st century is the greatest challenge humanity has ever faced. While food demand will double by 2060, scarcities are emerging of almost all resources required to satisfy it. This challenges us to rethink food itself and how we produce it, and to create diets and foods for the future that are safe, healthy, nutritious and tread less heavily on the planet.



Slide 2: demand



We are facing the greatest challenge in human history – how to feed ten billion people sustainably for more than half a century.

Tonight there will be 216,000 more people to dinner than there were last night.

While its growth rate is slowing, the human population continues to expand. It is likely to reach 10 billion people in the 2060s as more babies are born and *older people live longer*.

In line with economic growth, consumers in China, India, Brazil and other advancing economies will demand more meat and high protein foods.

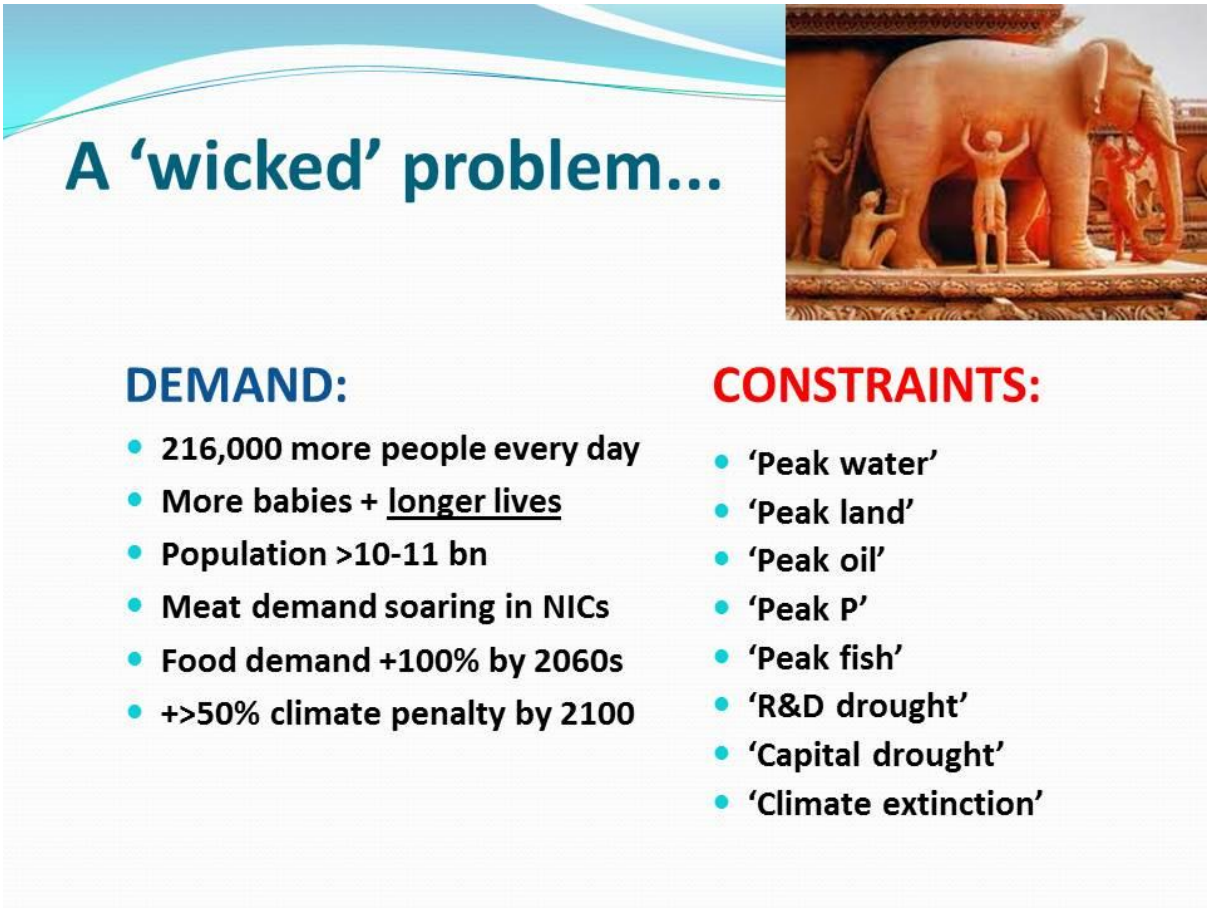
Together these factors will double global food demand.

In recent years demand has grown nearly twice as fast as production, driving very high food prices.

By the 2060s we will need around 600 *quadrillion* calories every single day.

My first point is that the central issue in the human destiny in the 21st century is whether we can achieve *and sustain* such a mighty harvest.

Slide 3: wicked problem



What has changed since last century is that our food systems now face *critical* limitations.

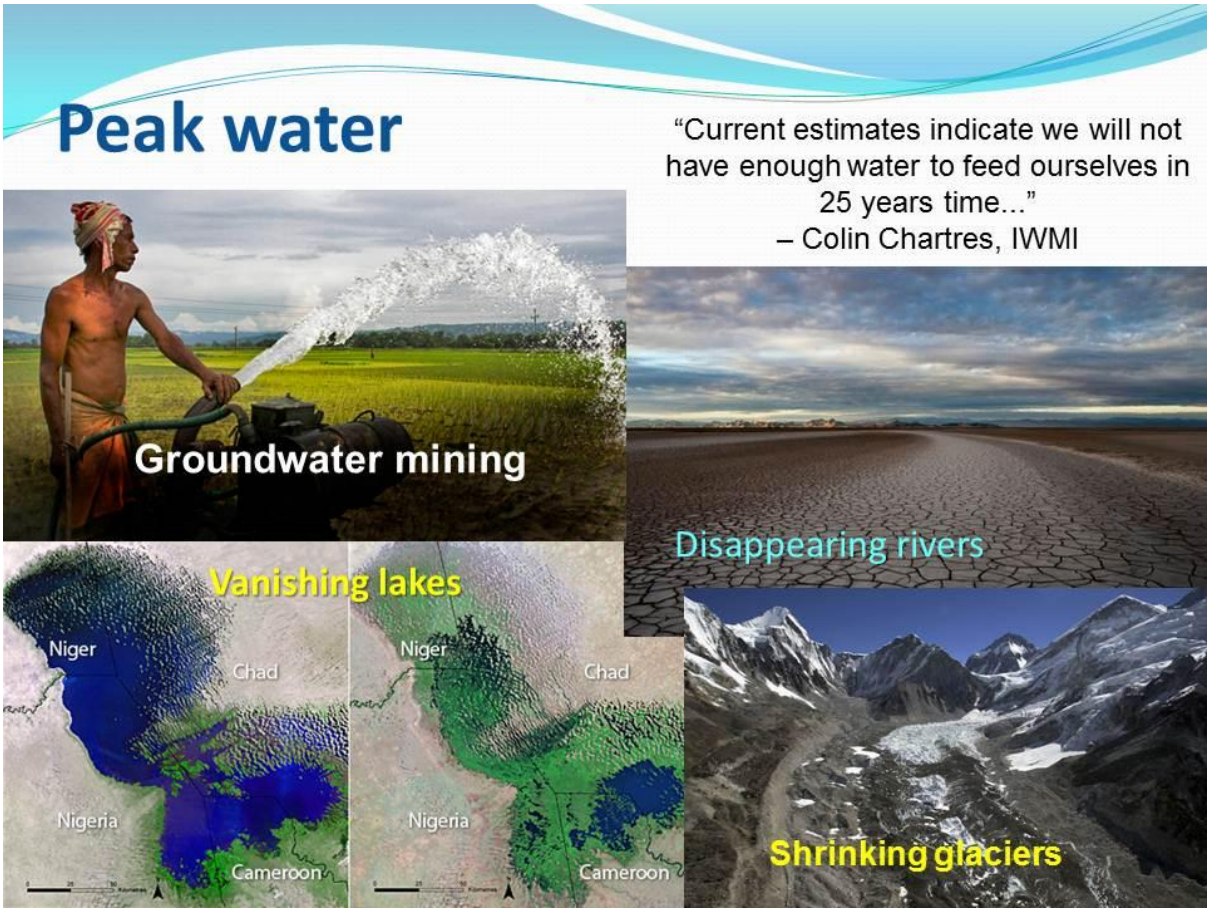
There are emerging scarcities of almost everything we need to produce good food – water, land, nutrients, oil, technology, skills, fish, finance and stable climates.

Each of these scarcities affects all the others.

So this is not a simple problem that can be easily solved with technofixes or national policy changes.

It is a *wicked* problem.

Slide 4: water

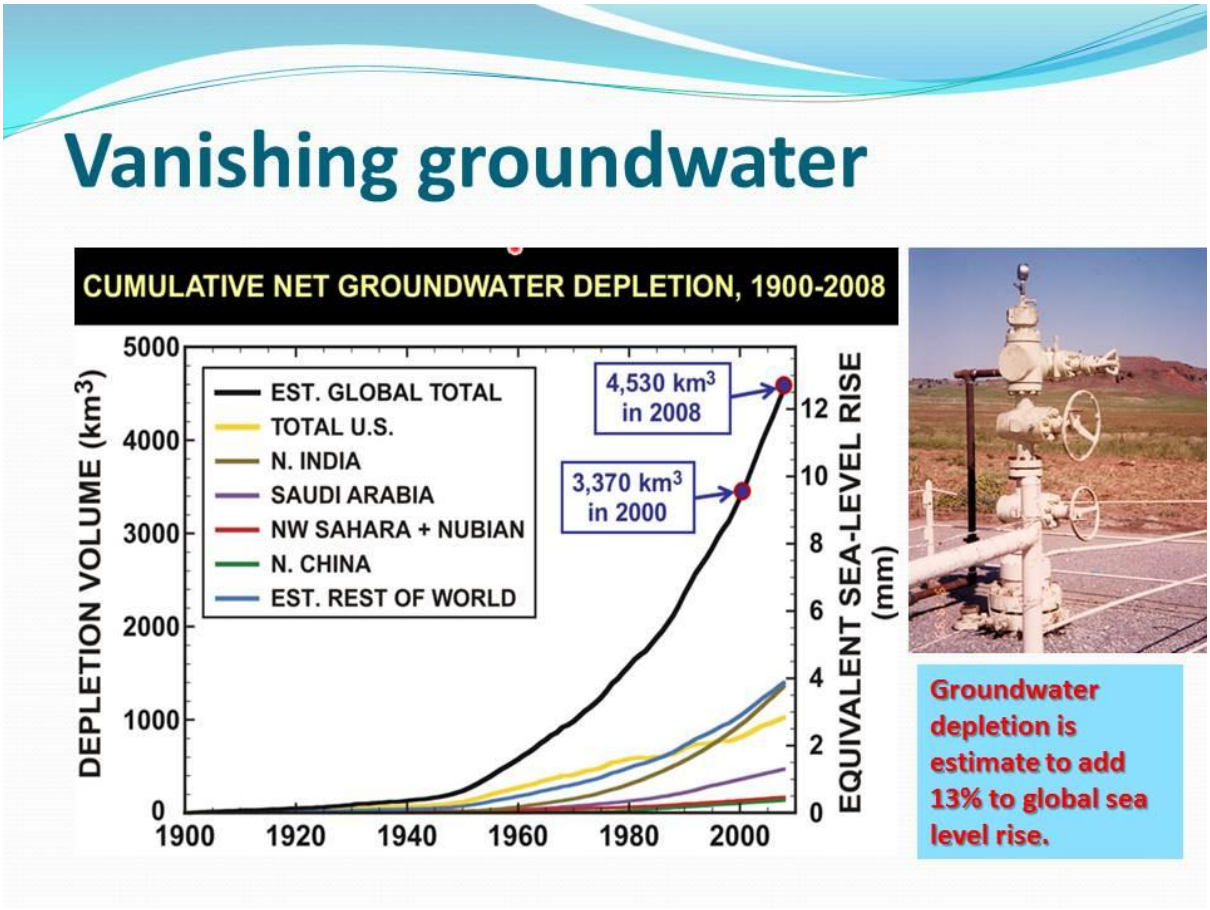


The world is becoming acutely short of clean, fresh water. In China, India and the US, groundwater is seriously depleted.

Climate change is robbing rainfall over the great grain bowls, snowpack on high mountains, lakes, rivers and aquifers in dry lands.

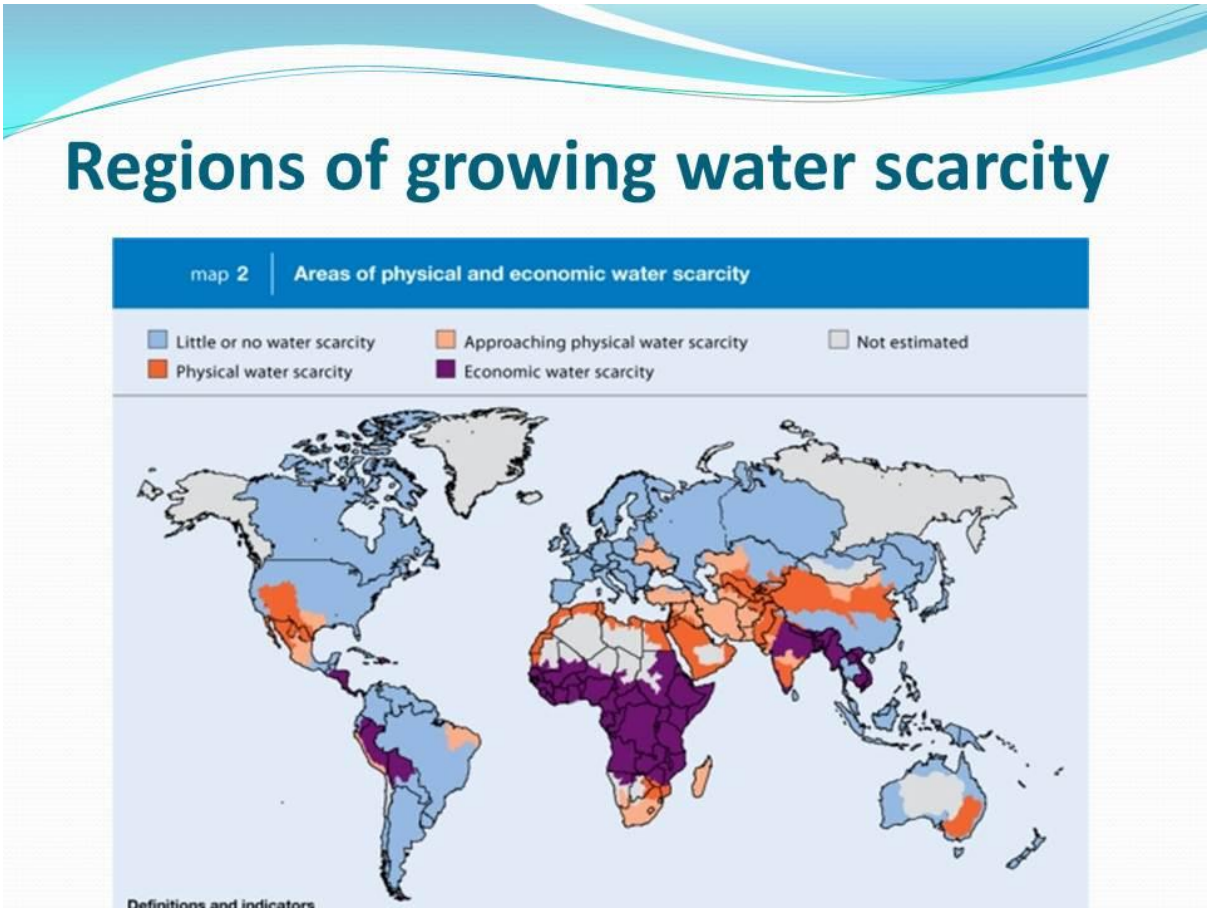
Yet demand for irrigation water is likely to double.

Slide 5: groundwater



Groundwater makes up 90 per cent of the earth's reserves of fresh water. This vast resource is being mined unsustainably in most countries. Rates of extraction have increased by 50% in the last decade.

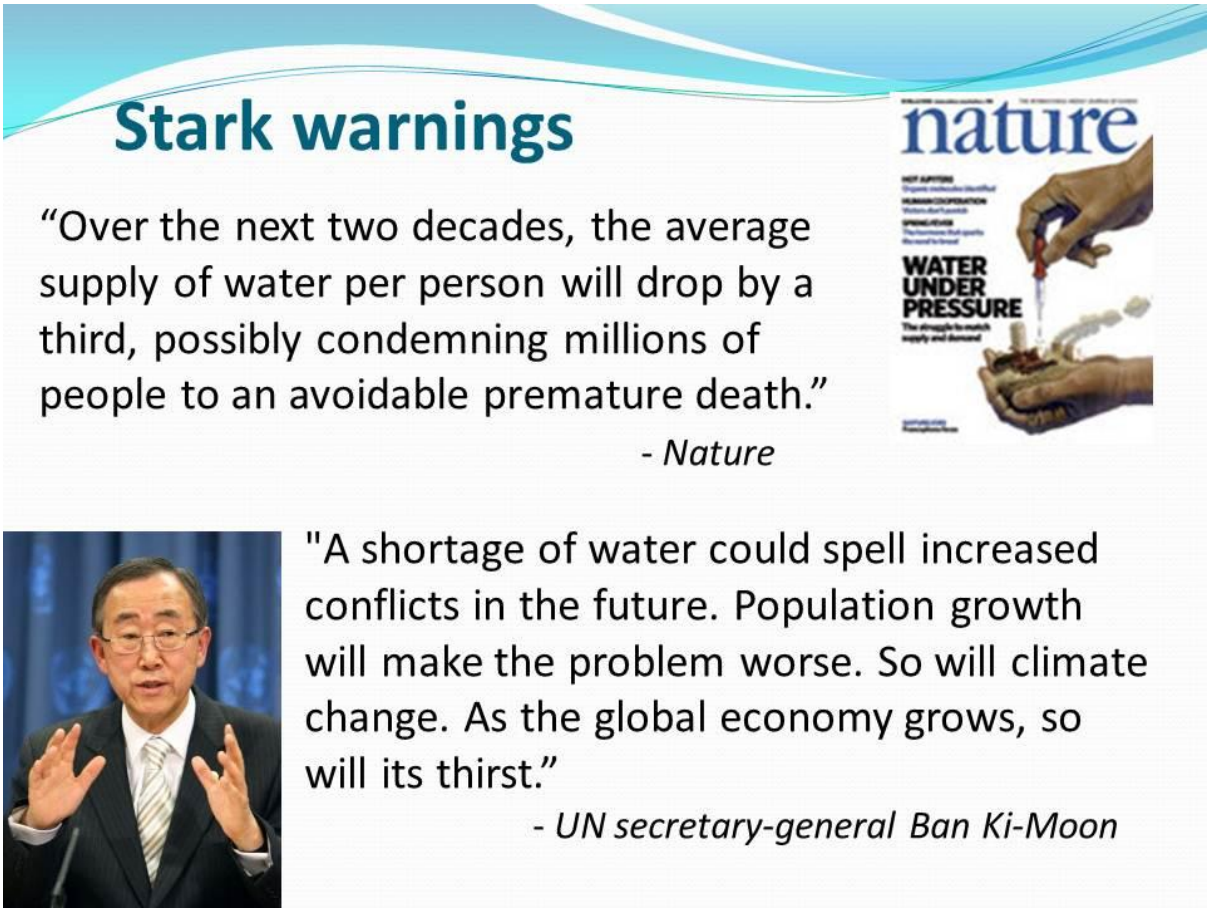
Slide 6: scarcity



Experts such as the International Water Management Institute warn that the world will start facing acute water scarcities from the 2030s onwards.

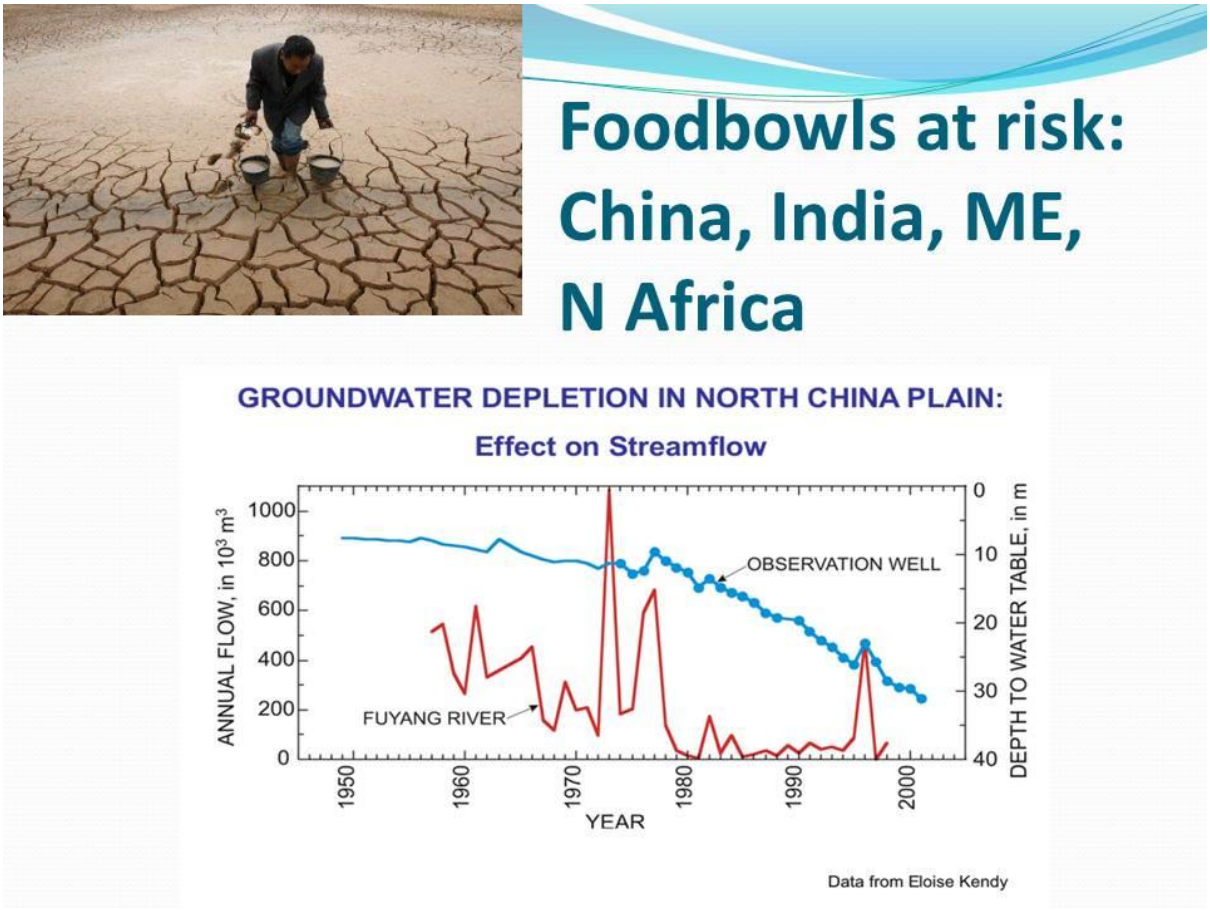
Only this week the world's leading water scientists warned there will not be enough water to feed 9 billion people – and said that the world may have to give up eating meat.

Slide 7: Moon/Nature



The warnings are being voiced by the highest and most respected sources. They cannot be ignored any longer.

Slide 8: foodbowls

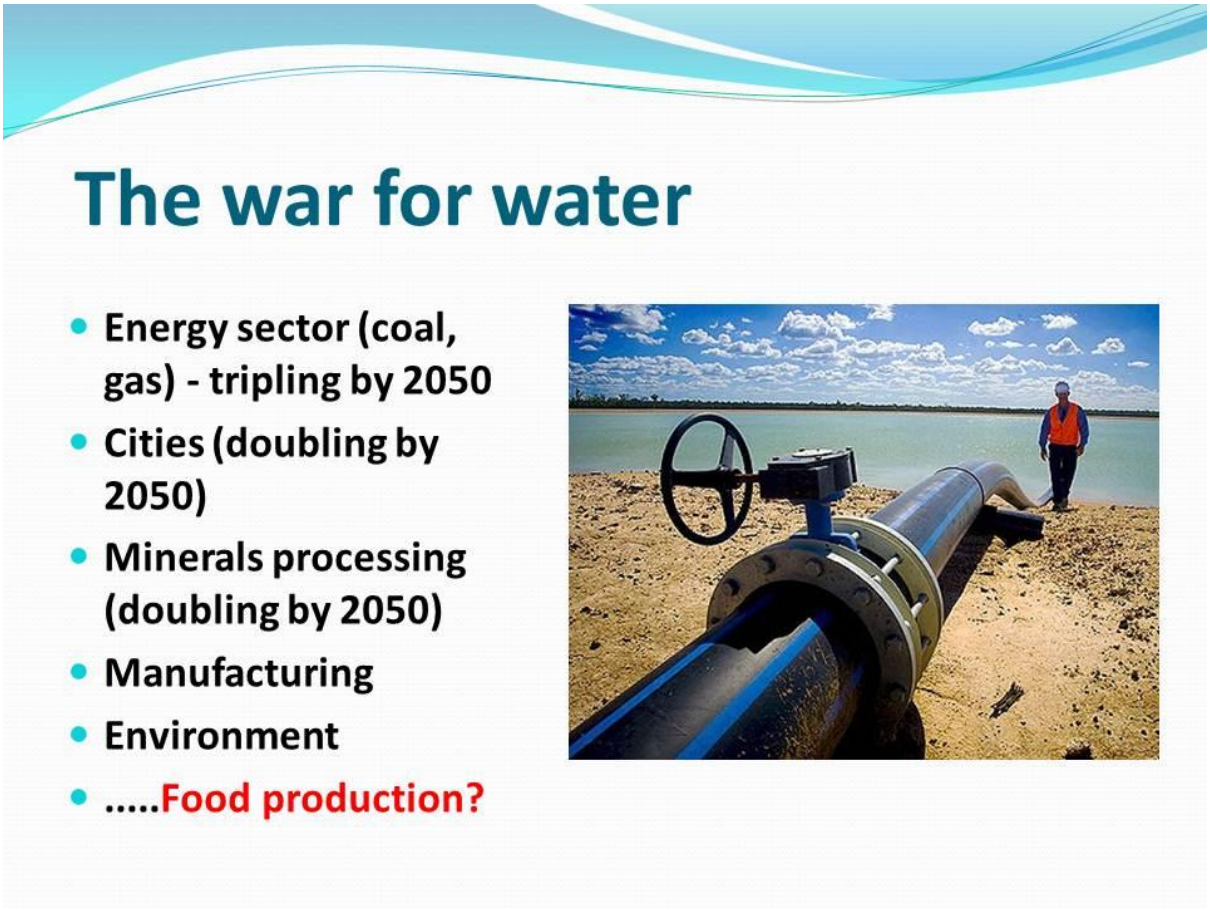


See the dramatic decline in the water tables on the N China Plain.

The greatest danger is that a major foodbowl, such as north China, the Indo Gangetic region, North Africa or the Middle East could simply collapse for lack of water to grow enough food.

This would result in the overthrow of governments, regional wars and tens of millions of desperate people pouring out of the affected area and trying to resettle in place like Australia.

Slide 9: water wars



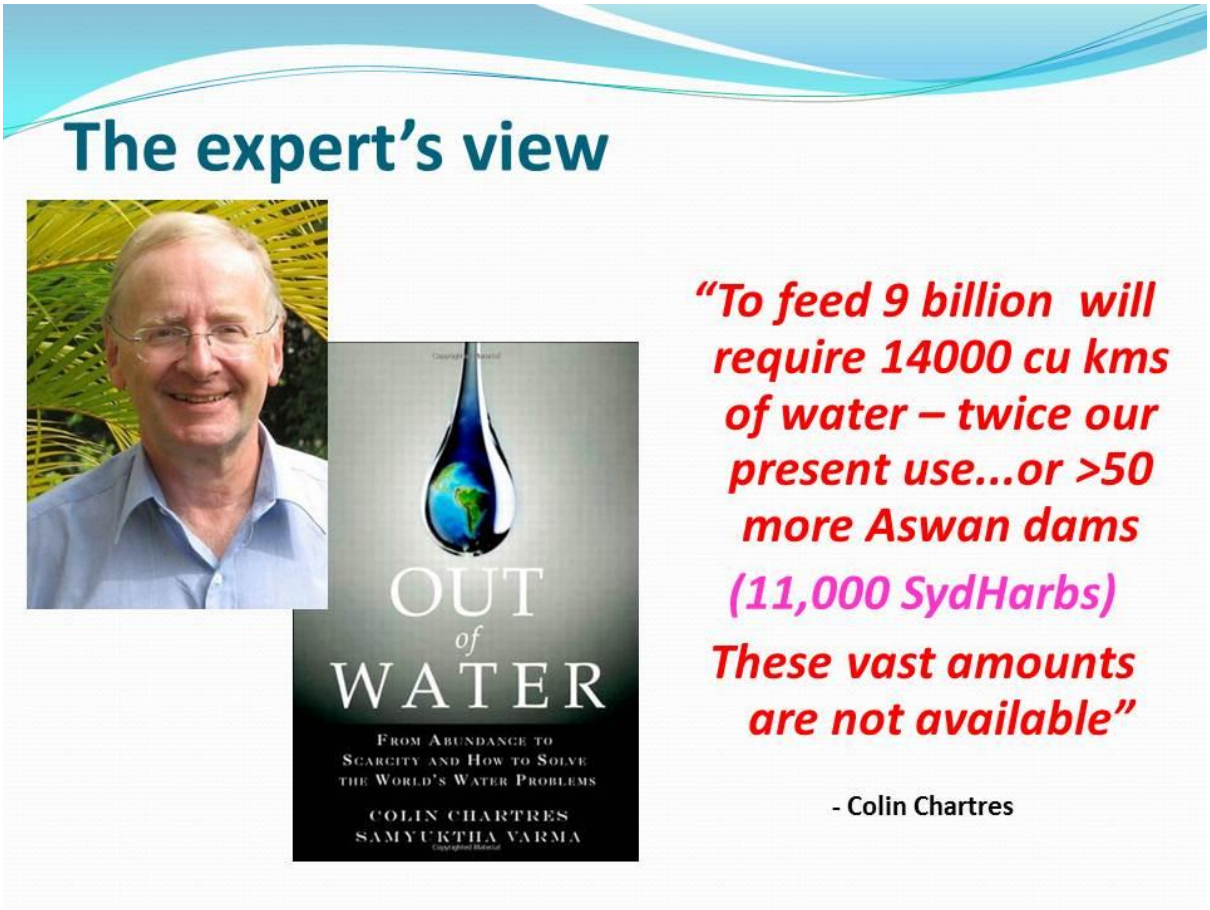
At the same time there is vast and growing competition from the energy sector for farmers' water.

By the 2050s the megacities will be home to 7-8 billion people – their water demand will also double.

Farmers need double the water to grow double the food – but they are not going to get it. This is a fight they almost always lose. So they must try to double yields – on half the water.

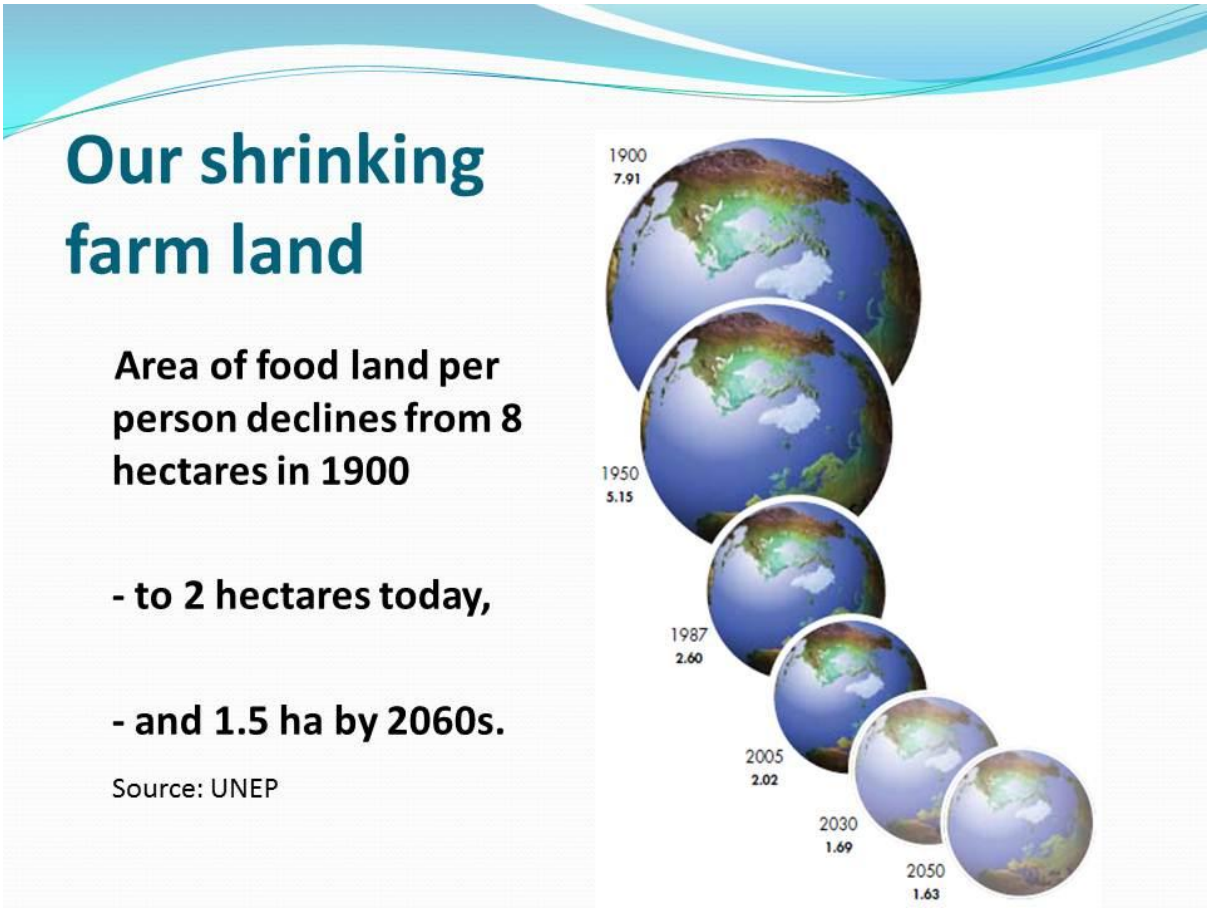
It is already plain the world does not have enough fresh water to go round.

Slide 10: Chartres



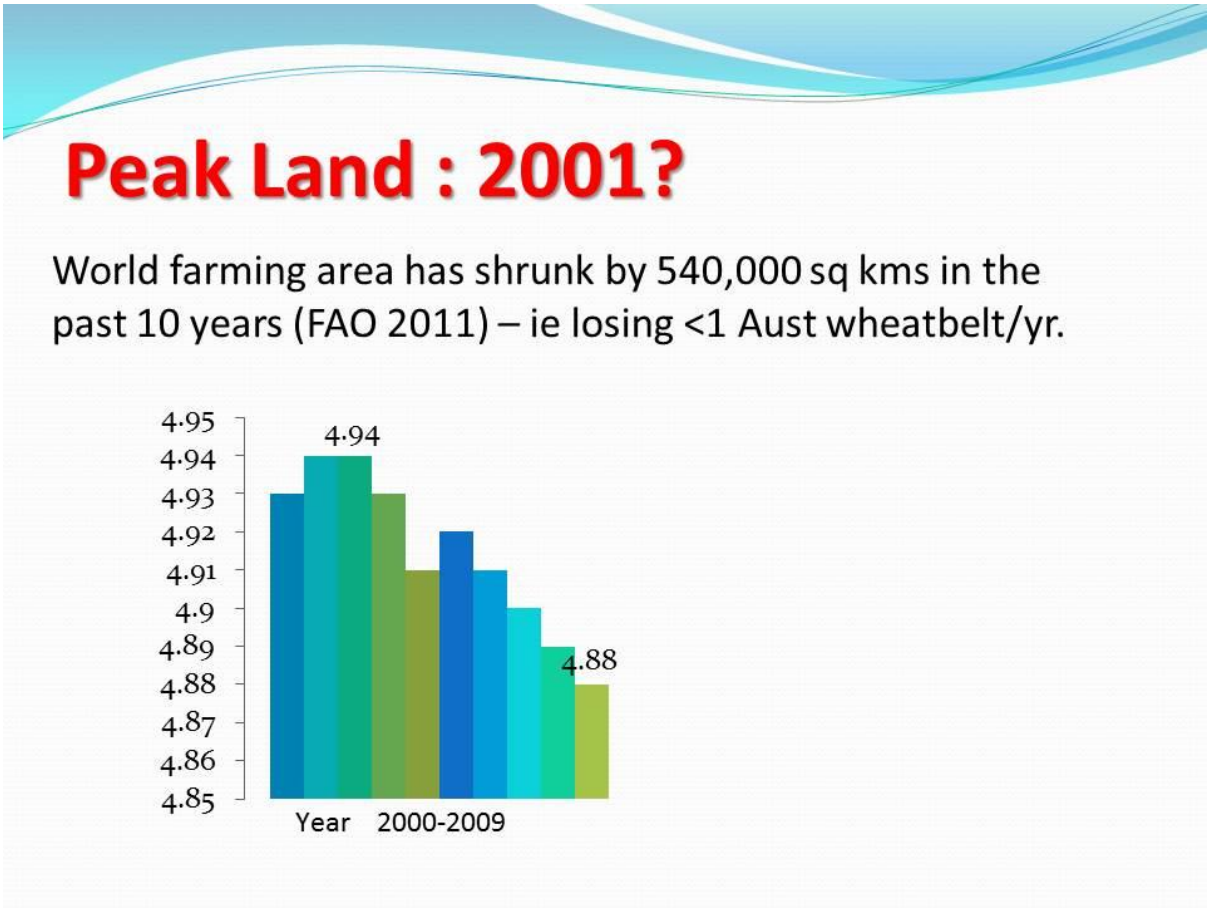
Australian water scientist Colin Chartres estimates we need about 11,000 Sydney Harbours of fresh water to grow the word's food in 2050. Where is it to come from?

Slide 11: land



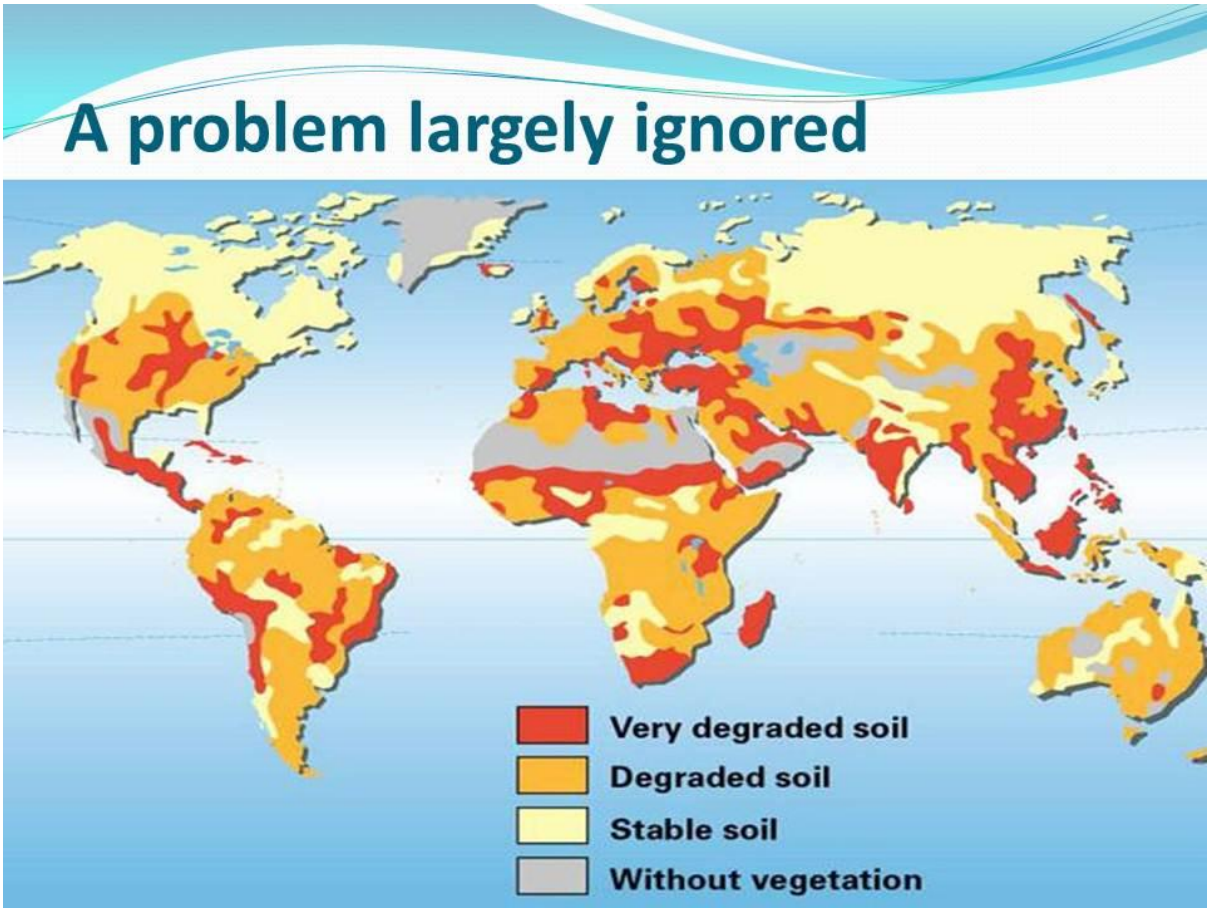
The area of farm land available per person in 2050 will be half what it was in the 1970s, partly due to technical advances in agriculture. Can we sustain them?

Slide 12: peak land



There is early and disturbing evidence from FAO that the world has already hit 'peak land' that the area of cropping, grazing and horticulture worldwide is already declining – despite an ongoing cycle of food crises.

Slide 13: soil degradation



Land degradation is the sleeping giant, menacing the human future.

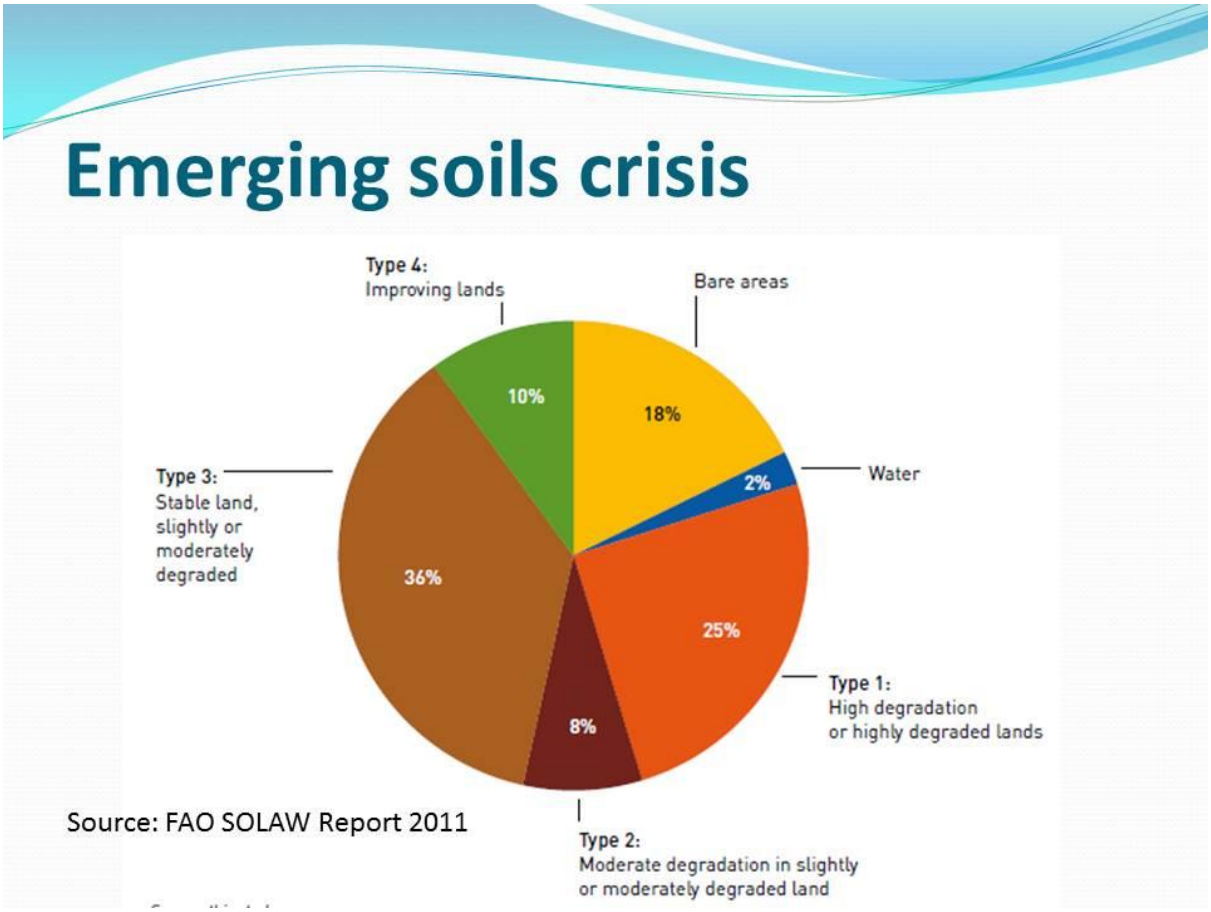
Slide 14: Unsustainable

The world is presently losing between 75-100 billion tonnes of topsoil and about 1 per cent of its farm land every year.

Even in very well-farmed land, such as Iowa, they are losing 12 tonnes/acre/year.

If this continues, some experts warn, the world will run out of arable topsoil within 50-70 years.

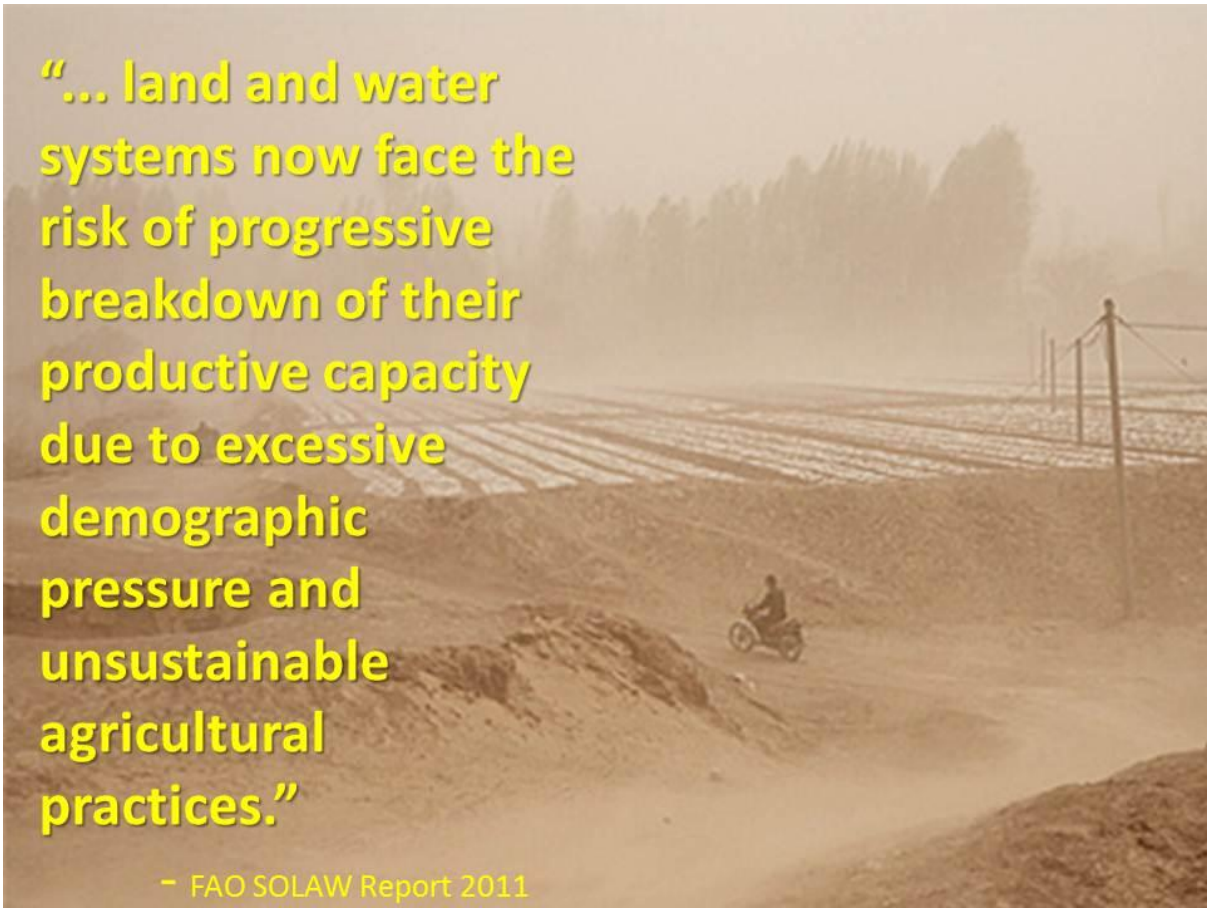
Slide 15: Solaw



etc

The UN FAO's latest assessment indicates more than half the Earth's land area is degraded or degrading – and only a tenth is actually improving.

Slide 16: solaw quote



Land and water systems risk progressive breakdown... is the unambiguous warning of the world's agricultural experts, the UN FAO.

Clearly much remains to be done and clearly also, governments worldwide have lost focus on this vital issue. In Australia we have abandoned much of the science we once devoted to it.

Slide 17: megacities

By 2050 many cities will have 20, 30 and even 40 million inhabitants and together they will occupy more than 9 million square kilometres, an area the size of China.

Currently these giant cities grow almost none of their own food.

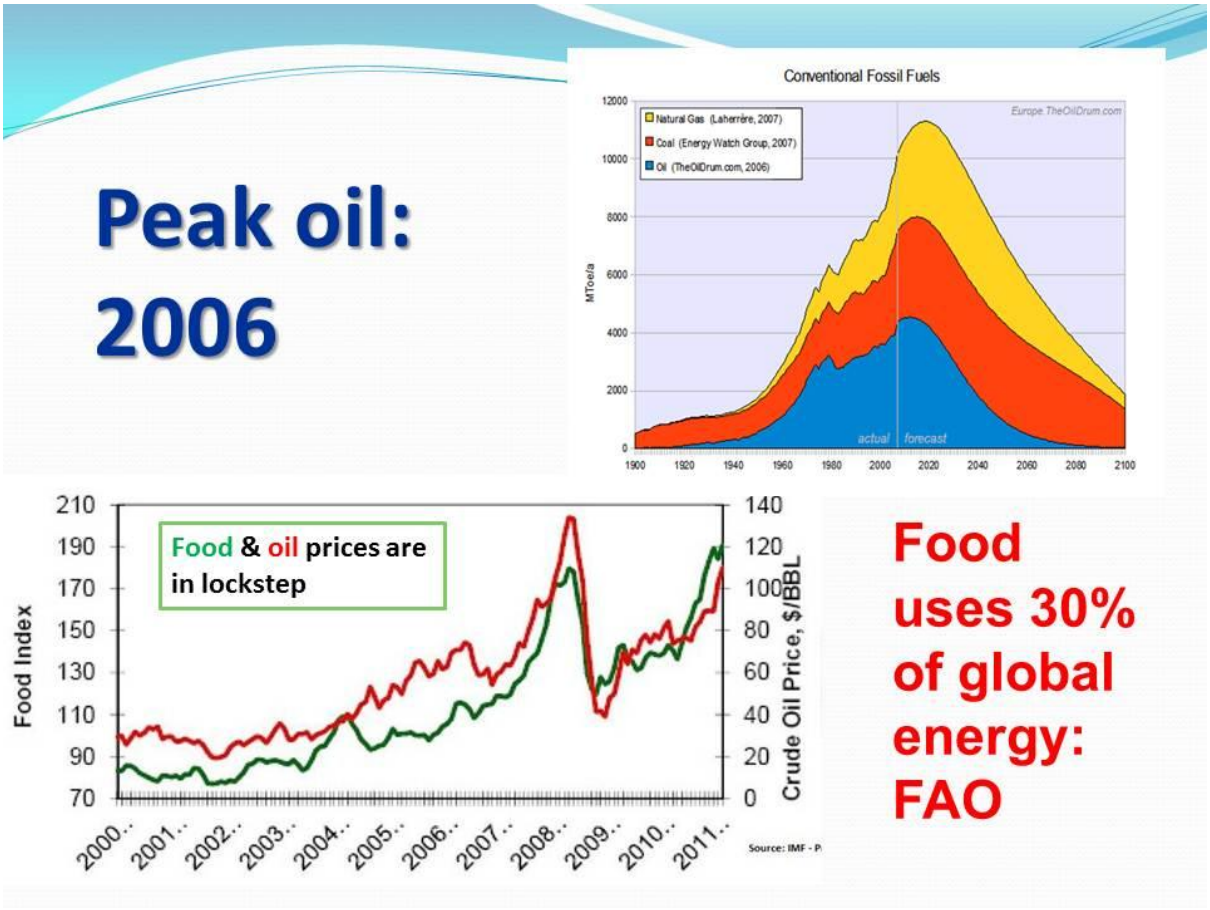
They rely on a mighty river of trucks flowing every night to restock the shops and supermarkets.

What will happen if - due to an oil crisis, a local war or natural disaster - that river of trucks fails to arrive?

The modern metropolis cannot survive without oil and without food.

One of the most urgent issues of the 21st century will be to redesign the city for sustainable food production.

Slide 18: oil



Global peak oil is already behind us, according to the International Energy Agency.

Yet 61 million new cars will hit the world's roads this year and the global vehicle fleet is forecast to grow from 750 million to around 1.2 billion in 2030.

This brings closer the time when oil will be unaffordable for either general transport or for agriculture.

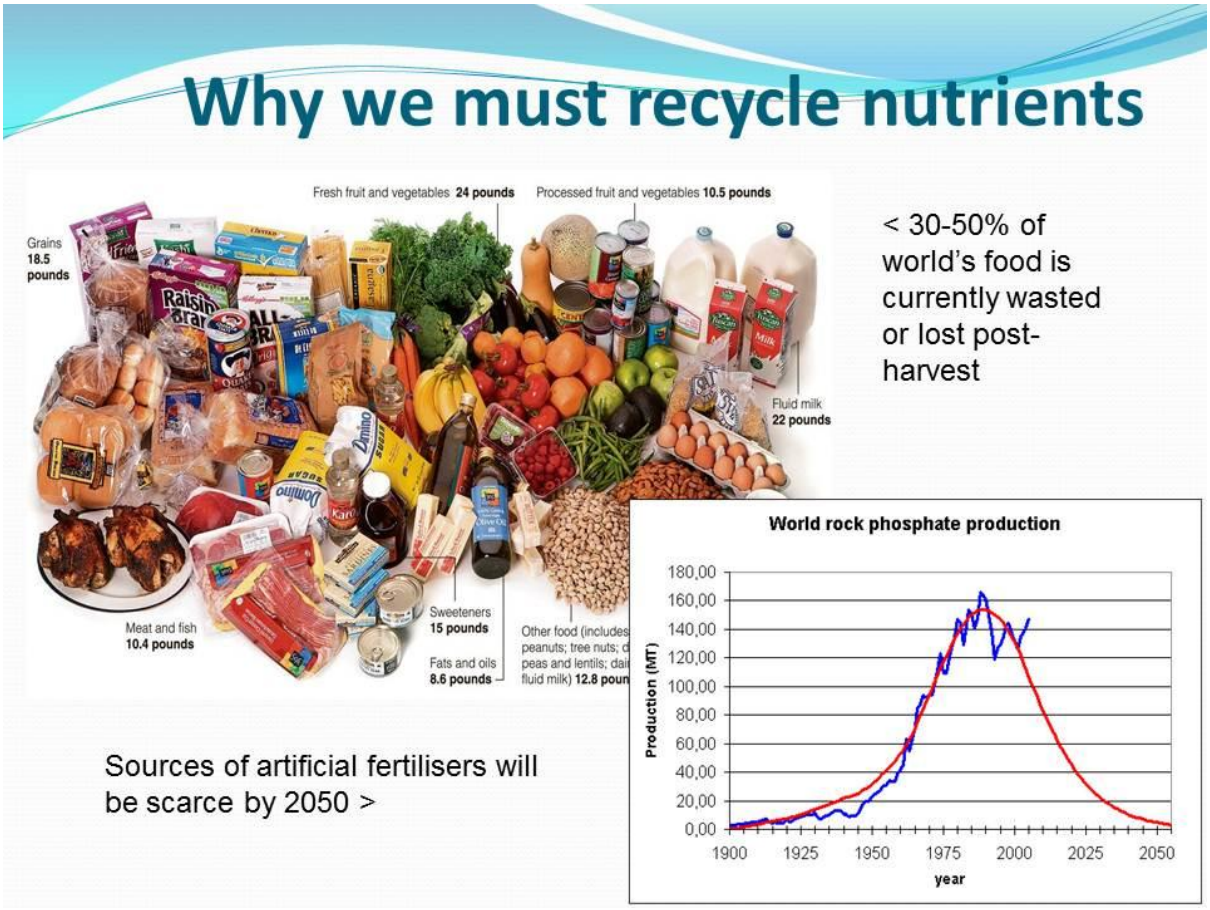
Yet the modern food system is utterly dependent on oil. Food accounts for almost a third of world energy use.

We each 'eat' about 66 barrels of oil a year.

Food prices and oil prices are inextricably locked together.

So one of our most urgent priorities is to establish a sustainable fuels sector for agriculture.

Slide 19: nutrients



We are the first generation in history to throw away up to half our food.

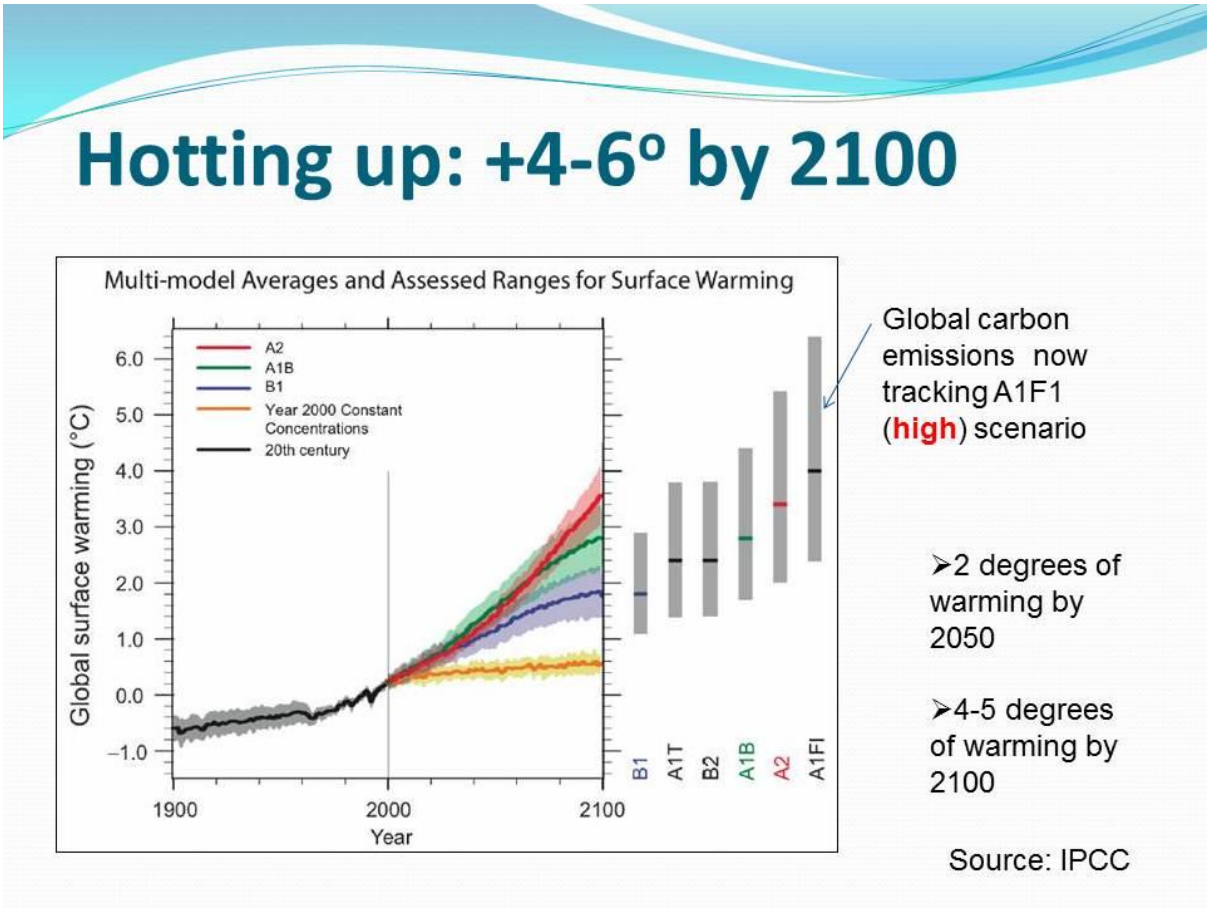
Half of the farmers' efforts go to landfill in advanced societies, a scandalous waste that is neither moral, nor economic nor sustainable

Add together the farm losses, food chain losses and waste stream losses and the world is presently wasting close to 90 per cent of its nutrients.

Phosphorus, potash and natural gas are all finite and will become scarce and prohibitively costly by mid-century.

The answer to this issue is to start recycling all our nutrients, on farm, in the factory, in society and in the sewage system. That way, we never run short.

Slide 20: climate 1



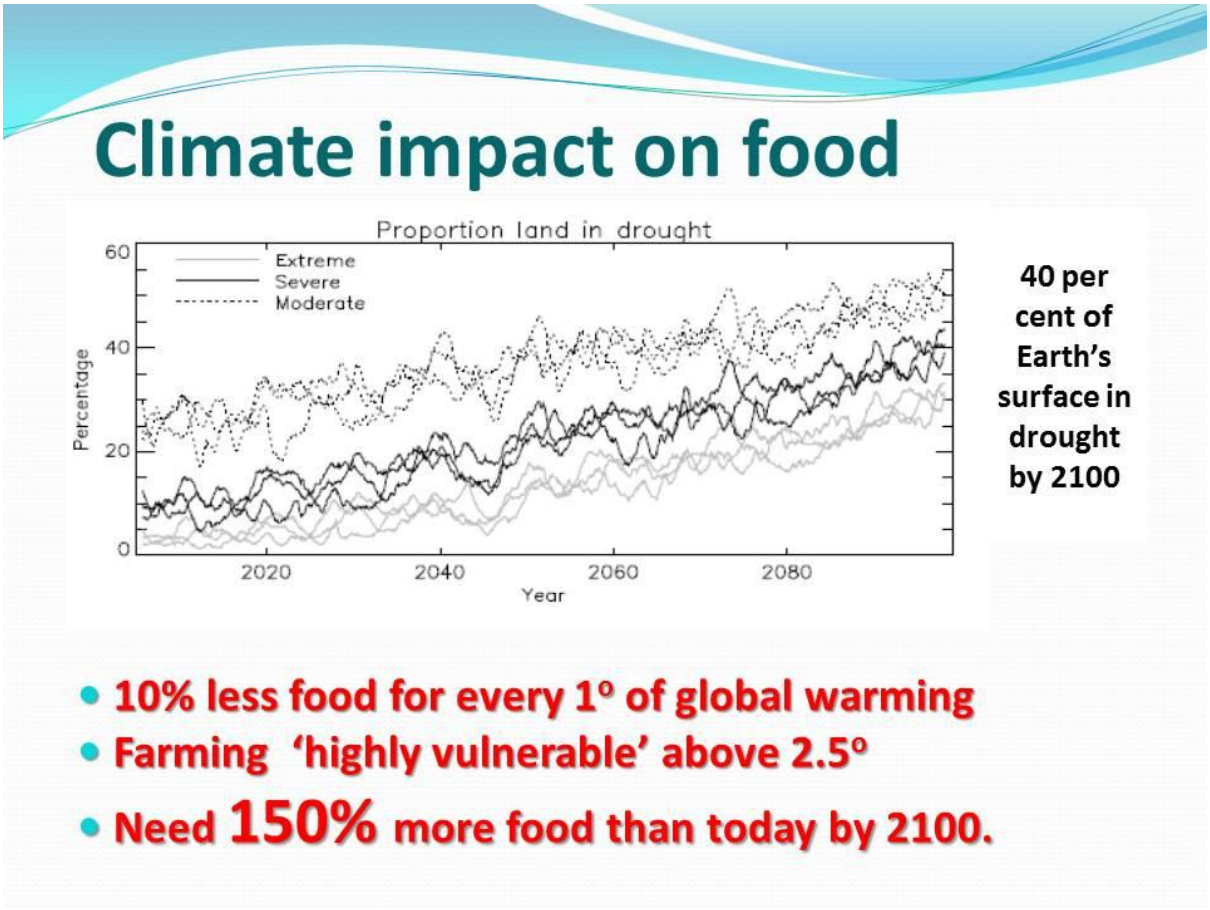
The climate in which agriculture was born is changing – maybe forever.

If present rate of growth in CO2 emissions is maintained, by the end of the century the Earth will be 4-5 degrees Celsius warmer.

Two degrees by 2050 is already locked-in and unavoidable.

Above two degrees, things become very challenging for traditional agriculture.

Slide 21: climate 2



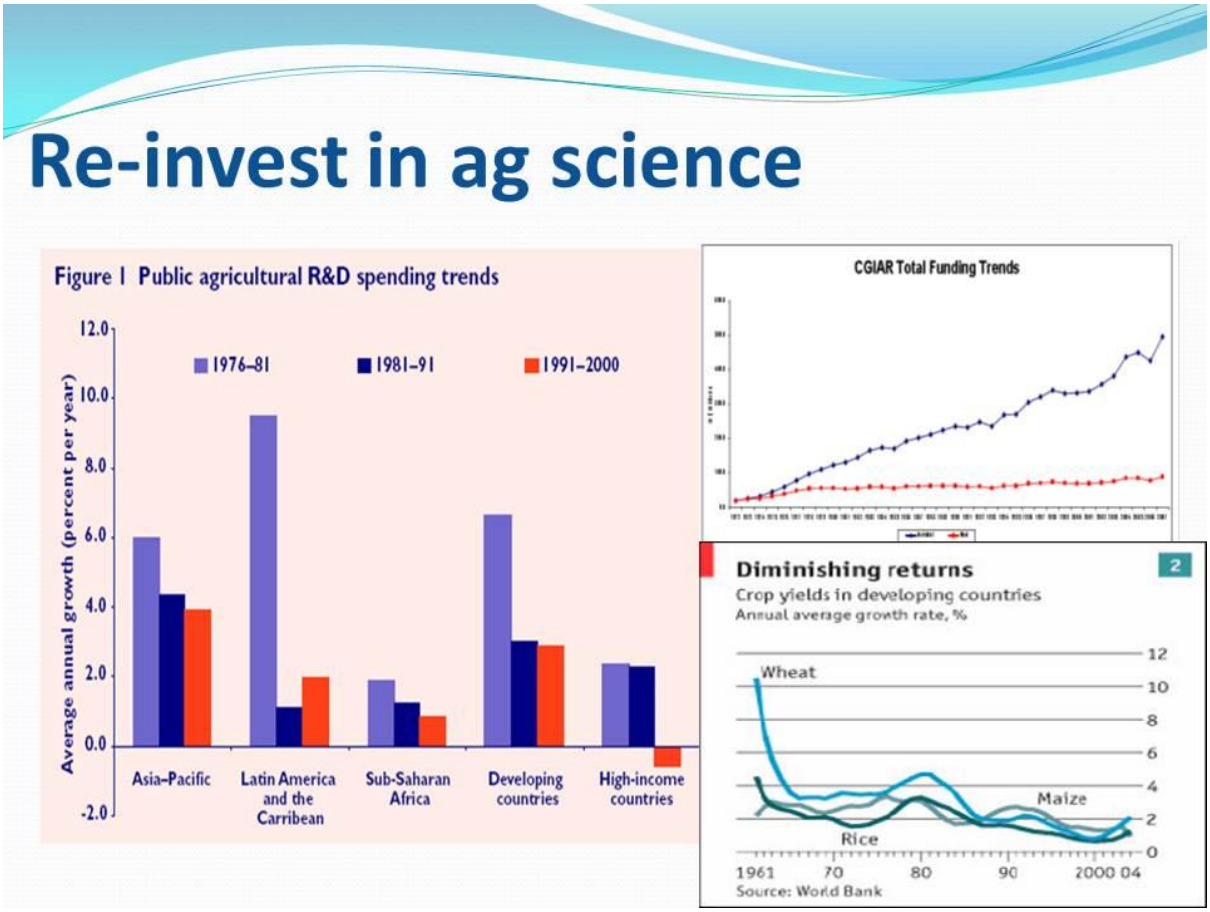
As droughts and floods take an ever bigger bite out of the world food supply, shortages will emerge and prices will soar.

The best scientific estimates indicate that, for every degree of global warming, we stand to lose about 10 per cent of world food output.

Of course, we won't lose it. Agriculture will adapt.

But the point is that by 2100 we not only need to compensate for climate losses by adaptation – we also have to double total food output to meet demand on top of that. In effect that means increasing global food output by 150 per cent.

Slide 22: R&D



Meanwhile we have completely taken our eye off the ball.

National governments, aid donors and academic institutions, have frozen or cut funding for domestic and international agricultural research and extension over three decades.

This explains why crop yield gains are stagnating, or even going backwards, globally.

It explains why food production is not keeping up with growth in food demand - and why food prices are rising.

The world spends about $50 billion a year on food and farming science, public and private.

That's about the same as we were investing when there were only 3.5 billion people on Earth.

Today the world also spends $1,600 billion a year on new weapons. Fifty times more on killing ourselves than feeding ourselves.

Humanity needs to wake up. There must be massive reinvestment in agricultural and food science and technology – and especially in crop sciences, soil science and new farm industries.

Slide 23: challenge

So here's the challenge facing everyone in agriculture in the coming half century.

It is a big one.

But it is also filled with magnificent opportunity for all those involved in food.

It is the challenge of our Age.

Slide 24: food

Food system 'in crisis'

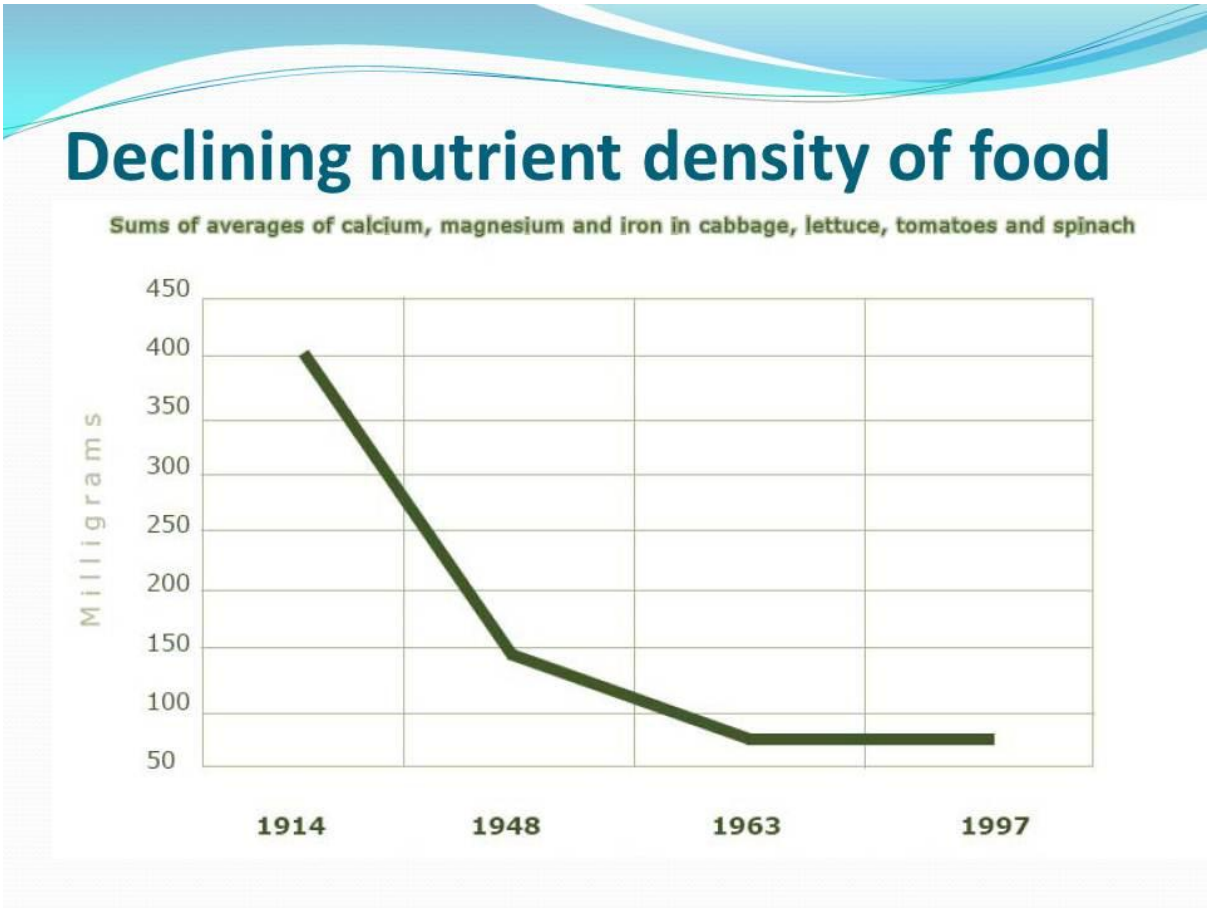
- "The incidence of obesity, and of other lifestyle-related diseases, is both a **commercial success and a catastrophic food system failure**...
- "...leading to a **health system failure** in Australia and around the world.
- "Particularly affects the most disadvantaged. Climate change is likely to exacerbate this.
- **> half of all Australians now "die by their own hand" (the one holding the fork!) - JC**

Public Health Association of Australia, 2012

Part of the challenge is that one out of every two people today doe by their own hand – the hand holding the fork. Today's modern diet is killing half of consumers by diet related diseases such as heart disease, cancer, stroke, diabetes, obesity, liver and kidney failure

As Australia's Public health Association says, it may be an economic success – but it is a health system failure.

Slide 25: nutrient density

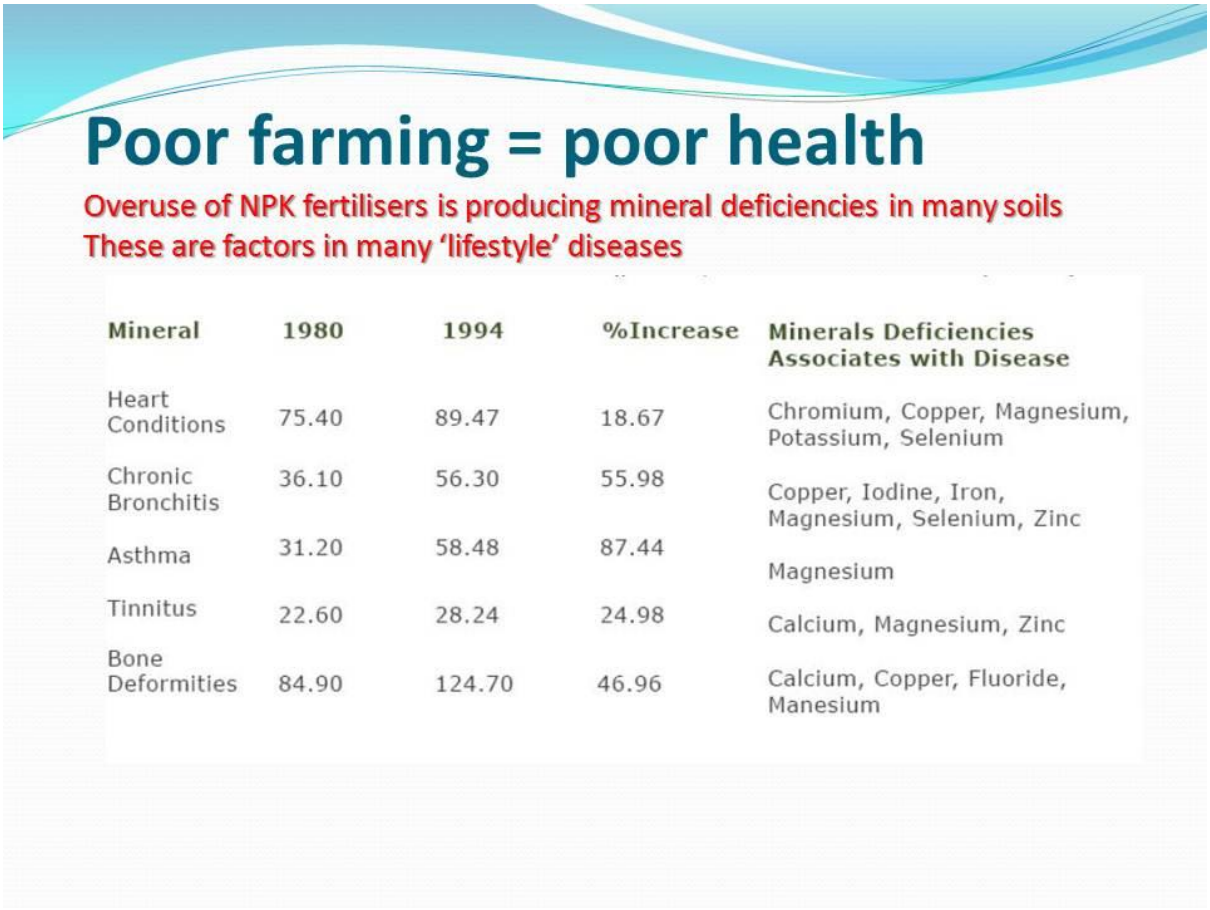


Part of the solution lies on the farm, in how we nourish our crops and livestock.

This graph shows how the mineral content of fresh fruit and veg has declined in the past three generations, due to industrialised agriculture.

Essentially you have to eat five tomatoes for every one your grandparents ate, to get the right nutrition.

Slide 26:



Many of these mineral deficiencies are associated with today's "killer diet" and lifestyle diseases.

The message is that good health begins on the farm.

Slide 27: solutions

Here are the solutions.

To reinvent food production, on farm and off.

To massively reinvest in new knowledge, both discovery and sharing.

To design a healthier, more sustainable diet for a world of 10 billion people.

And to create cities which recycle their water, their nutrients and energy back into food production.

Slide 28: future farm

The future farm will be a blend of the very best ideas from modern advanced farming and organic production – using systems which are evidence-based and scientifically proven. It will be highly automated.

It will weave together soil biology, crop science, nutrient recycling, soil, water, energy & carbon conservation with new thinking about sustainability, on permaculture lines, and robotics.

It will embody new concepts in landscape-scale management, and it will introduce new approaches to production - such as solar farming with salt water in desert regions.

Slide 29: urban farms

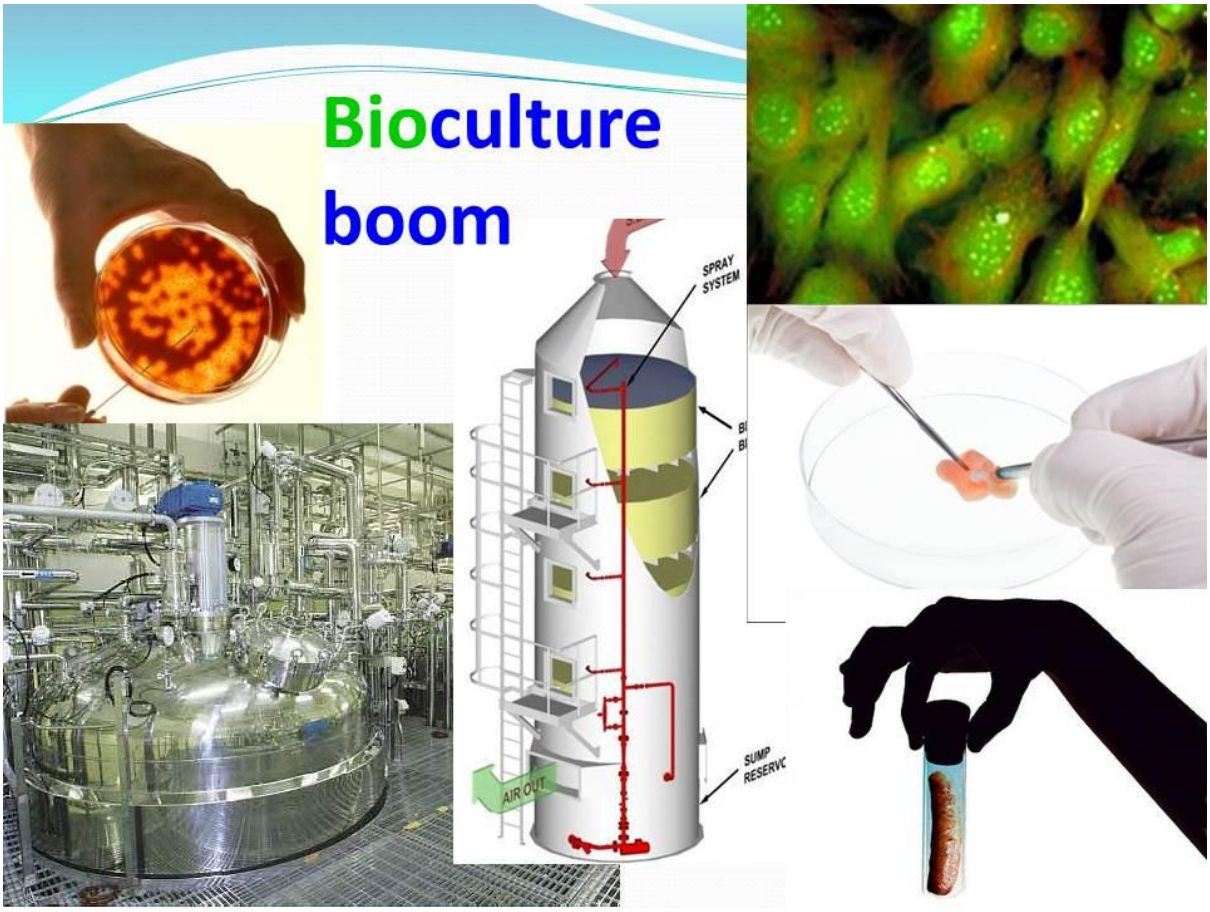
To avert the risk of urban famines, food production will begin moving back into the world's cities and help to green them. This is already happening – in Europe, America, Canada and countries round the world.

Slide 30: green cities

Giant vertical farms and forests are already being planned and built in farsighted cities in Sweden, the Netherlands, Italy and the United States. This is a great diversification opportunity for today's rural farmers – because urban farms are, by definition, largely climate proof. But they need good farming skills to run them.

They will use hydroponics, aquaponics and similar intensive approaches, as well as smallholder agriculture, to revolutionise urban food production.

Slide 31: biocultures



At the same time entirely new food industries will arise that feed organic wastes to vegetable, microbial, fungal and animal cells in biocultures and turn them into healthy and novel foods.

Last year saw the world's first synthetic sausage created at the University of Maastricht, Netherlands. This year they have promised us the world's first synthetic hamburger, grown from animal muscle cells in vitro.

So biocultures too represent an enormous potential opportunity for future food production that uses far less land, water, energy and inputs than do agricultural systems.

Slide 32: plants

Presently humanity at large eats fewer than 300 different plants - and just five grains account for the bulk of our diet.

However Tasmanian scientist Dr Bruce French is compiling a database that already lists more than 25,000 edible plants globally.

In short, we have barely begun the exploration of Planet Earth in terms of what is interesting, healthy and nutritious to eat.

Based on the rich diversity of plants alone, our diet has potential to be vastly more interesting, nutritious, healthy and diverse than it is at present.

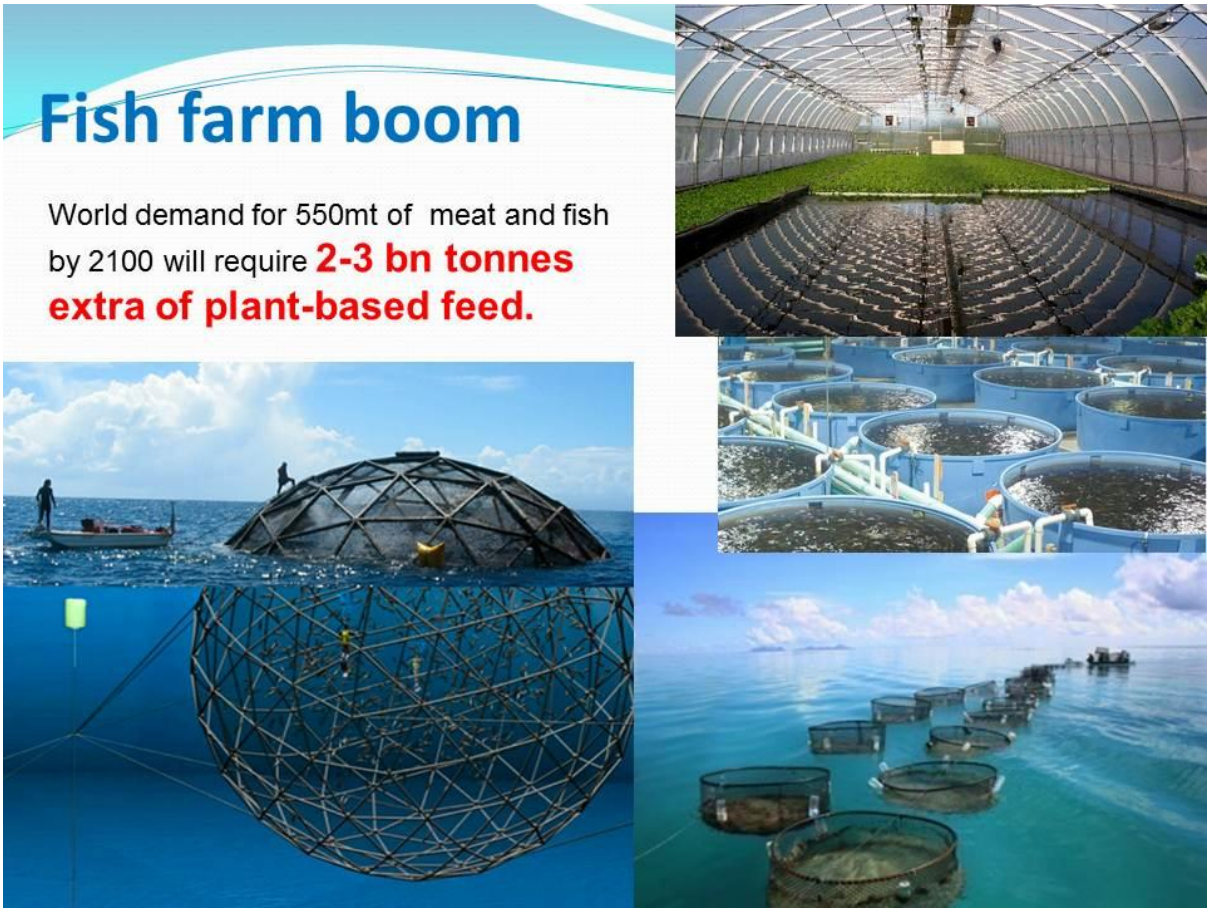
We are on the brink of a great culinary adventure – one that brings with it abundant opportunities for novel farming ventures.

Slide 33: Oz plants

Australia alone, for example, has 6100 edible native plants – of which we regularly farm and eat just five or six.

I envision a day when Australian foods and flavours will play as large a role in a healthy world diet as do foods originating in the Americas.

Slide 34: aquaculture



As ocean fish catches wane, aquaculture is poised for major expansion that could make it the biggest livestock sector by 2050. There is enough suitable land in the North alone for a fish farming industry worth $5 billion or more.

World demand for meat and fish combined will total 550 million tonnes by 2050 - and this will require an additional 2 to3 billion tonnes of stockfeed.

That's equal to the grain harvest crop of 3 more North Americas.

With the climate changing, that probably cannot come from grain. So algae farming will probably emerge as world's main source of stockfeed, as well as producing transport fuels, fertiliser, chemicals and plastics and human food.

Slide 35: algae farming

Algae could become our biggest farming industry ever.

At current oil yields, we could produce the WHOLE of Australia's liquid transport fuel needs from an area no larger than a single large pastoral sheep station – 600,000 ha – in an industry worth around $25 billion a year. This would almost double the value of agricultural production.

It is time we began to see water plants in the same light as land plants – as opportunities to produce food, fuel, fibre, feed, plastics and other products once we get the agronomy sorted out and the varieties we need. Australia has the ingredient that is most important – more sunlight than any other continent on earth.

Slide 36: Aust opportunity

The challenge of meeting the world's future food need is great.

But the opportunities which flow from it are greater still.

By sharing knowledge globally and redoubling research, Australia can develop new science-based eco-farming and food production systems

We can build healthier and more sustainable diets.

We can design cities that do not waste.

And we can pay farmers, fishers and food producers a fair price so they can safeguard the Earth that feeds us.

This is our chance to show real global leadership.

Slide 37: CMAs

And, among Australians, CMAs are perhaps the groups best equipped with knowledge, skills and dedication to make all this happen.

To make our existing farming industries more sustainable, our diet and landscapes healthier, and to pioneer many of the new ventures outlined.

You are already leaders in thinking about this problem – but you need to convert that into being business leaders, to export Australian food knowhow to a hungry world.

To be among, and think like, world leaders as humanity rises to this mighty challenge.

Thank you

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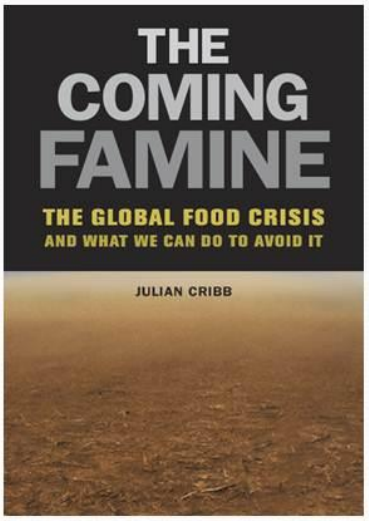

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