



THE UNIVERSITY OF
MELBOURNE

Global Food and Nutritional Security, Global Change and Climate Change

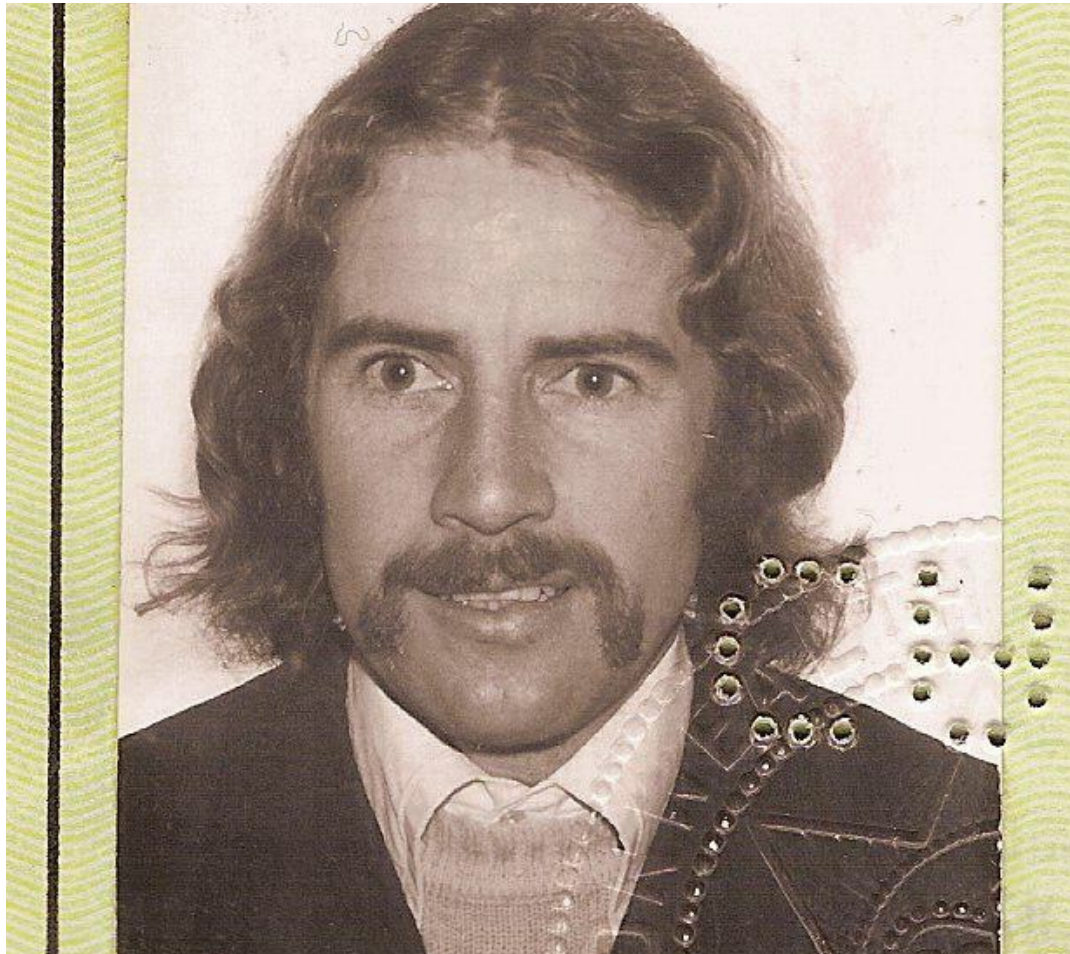
Professor Timothy Reeves FTSE Professor in
Residence

Dookie Campus

Faculty of Veterinary and Agricultural
Sciences



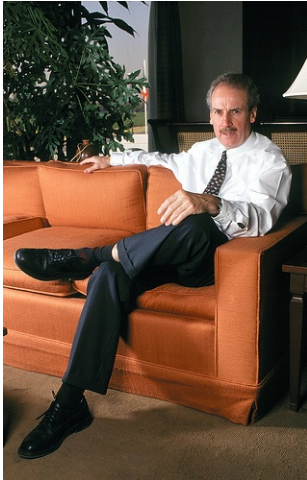
1967 – Things were very different...





DIRECTOR GENERAL

International Maize and Wheat Improvement Centre
CIMMYT, Mexico



'CIMMYT'S WORK HAS SAVED A BILLION LIVES...'





Climate Change – others are saying...

- Rome 2013 and 2014 and 2015 - CA
- Montpellier meeting 2012 – Rice marketing
- Bonn meeting 2011 – climate change
- India review 2009 – climate change
- Canberra 2006... ACIAR PAC

FAO Director General 2016

‘Climate change is no longer a future threat to agriculture and food production...

...because it is already affecting
current agriculture and food
production and often in
deleterious ways.....'

International Committee of the Red Cross (ICRC)

Climate change is exacerbating world conflicts, says Red Cross president

‘It’s obvious some of the violence we are observing ... is directly linked to climate change,’ says Peter Maurer



21 OCTOBER 2018

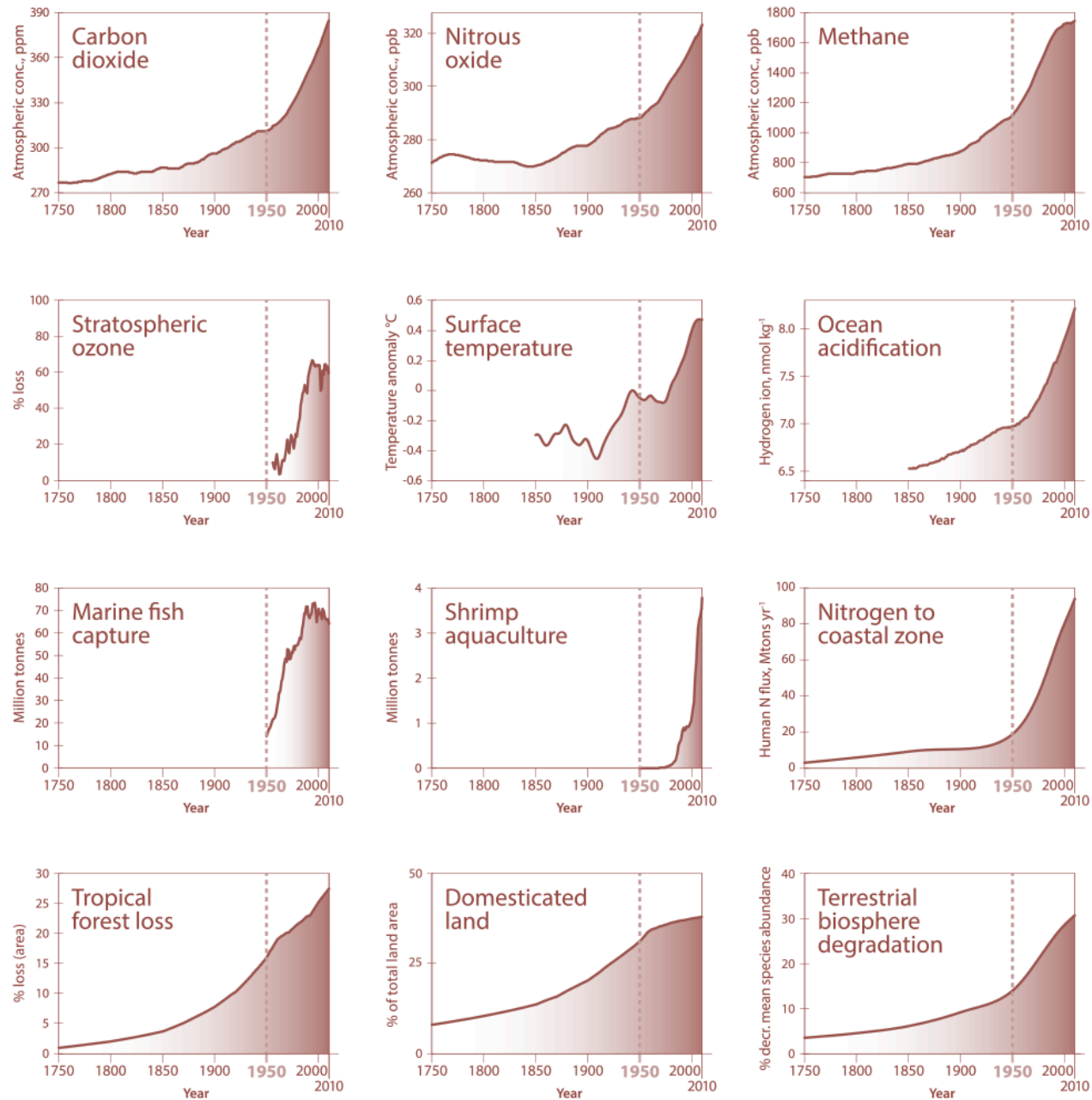
THE ANTHROPOCENE AGE...

“Unfortunately, scientific evidence indicates that human influence has altered Earth System processes to a point that we have begun transgressing planetary boundaries that have kept civilization safe for the past 10,000 years.

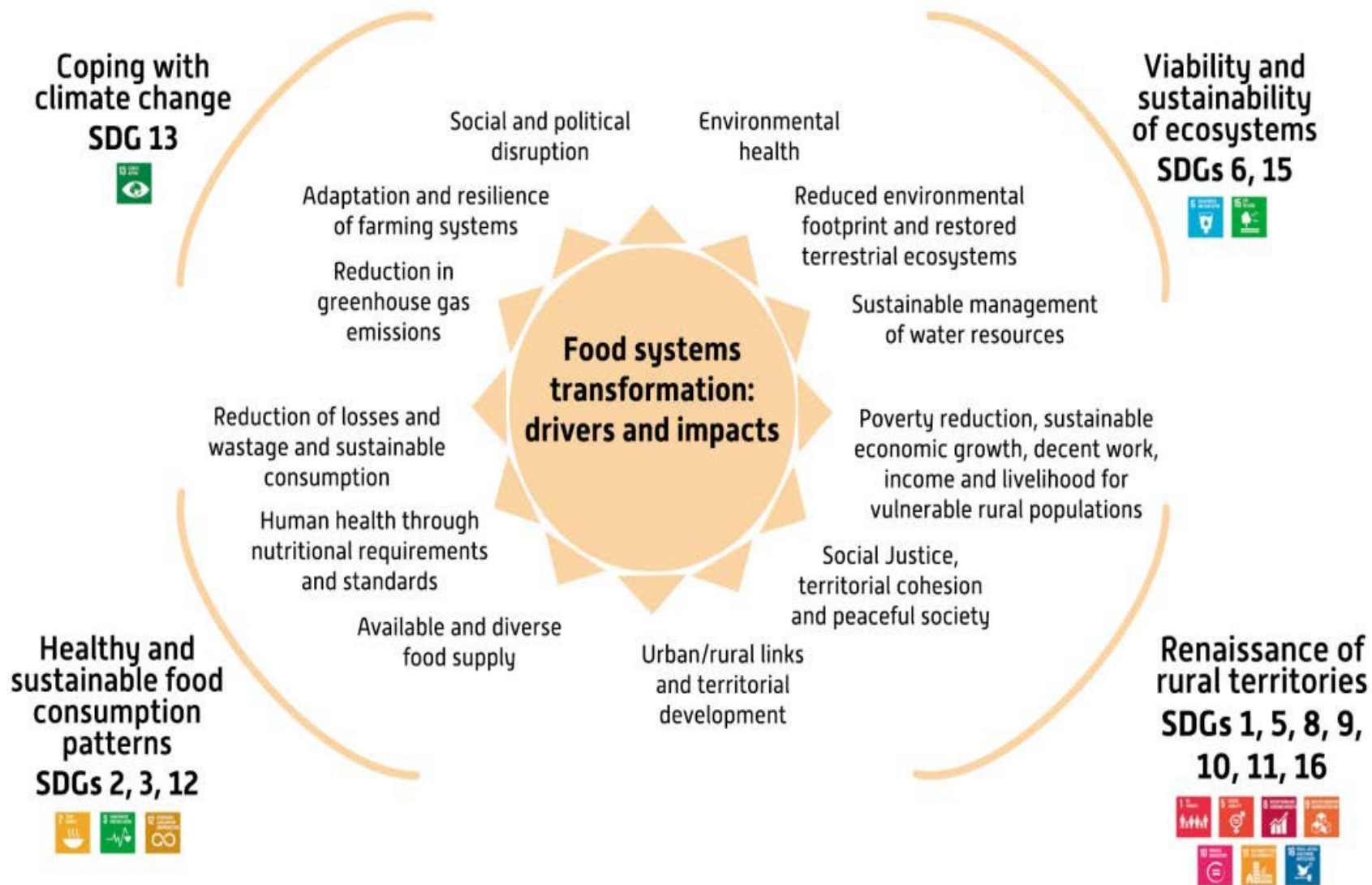
Humans are now the most significant driver of global change, potentially propelling the planet into a new geological epoch, the Anthropocene.

In this new situation, unsustainable patterns of production, consumption, and population growth are challenging the resilience of the planet to support human activity.”

Earth system trends



Food Systems are central to meeting SDGs



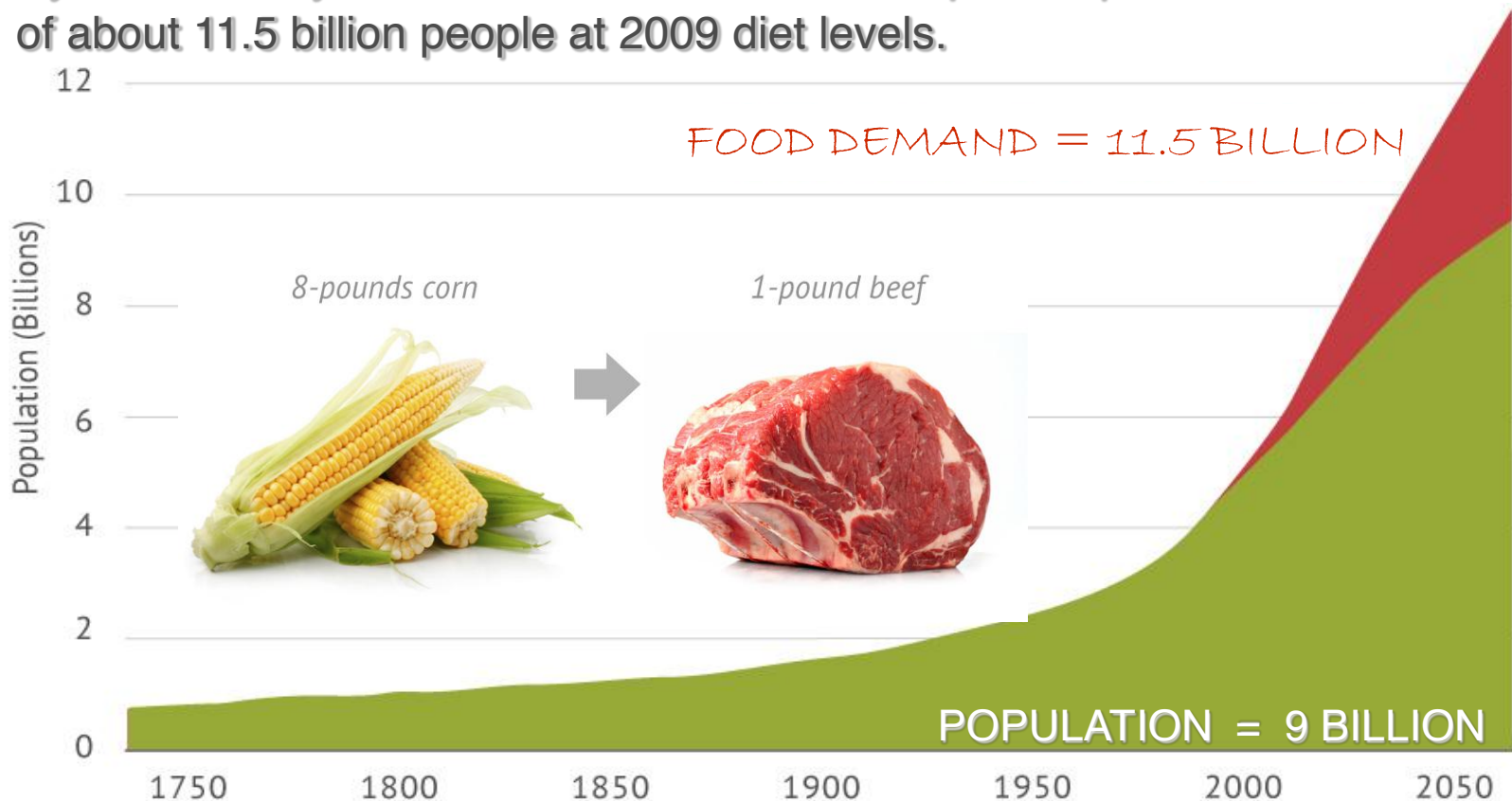
Source.

Caron, Patrick et al (2018). Food systems for sustainable development: proposals for a profound four-part transformation. *Agronomy for Sustainable Development* 38:41
<https://doi.org/10.1007/s13593-018-0542-4>

Why?

Food Demand

By 2050 dietary shifts will result in the consumption equivalent of about 11.5 billion people at 2009 diet levels.



Source: United Nations Estimates



Celebrating 35 Years

www.ifdc.org

Global Malnutrition



2 billion people lack key micronutrients like iron and vitamin A



155 million children are stunted



52 million children are wasted



2 billion adults are overweight or obese



41 million children are overweight



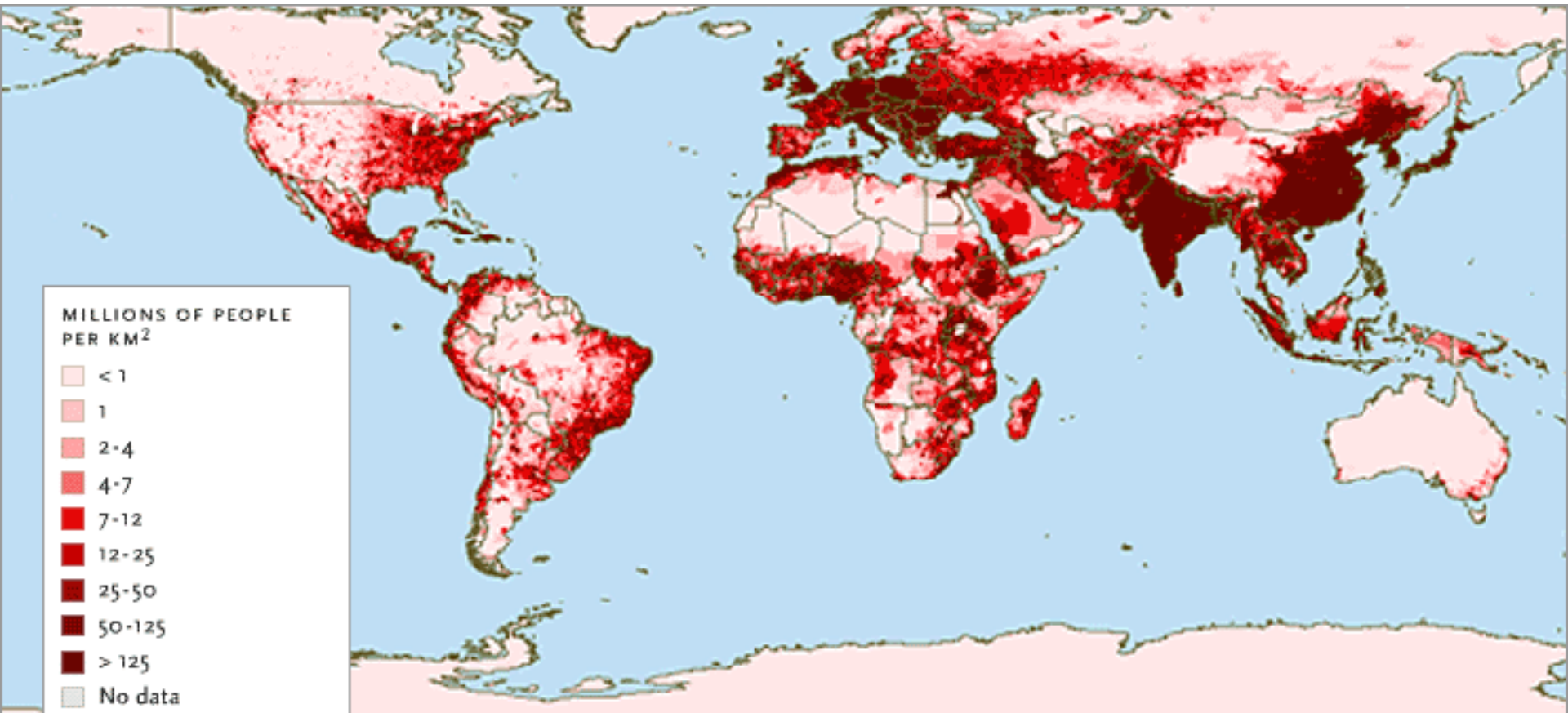
88% of countries face a serious burden of either two or three forms of malnutrition



And the world is off track to meet all global nutrition targets

Development Initiatives, (2017). Global Nutrition Report 2017: Nourishing the SDGs. Bristol, UK: Development Initiatives.

Population density 2000



<http://www.pbs.org/wgbh/nova/worldbalance/earth-01.html>

THE PERFECT STORM

Less water...
More people...

Less land...

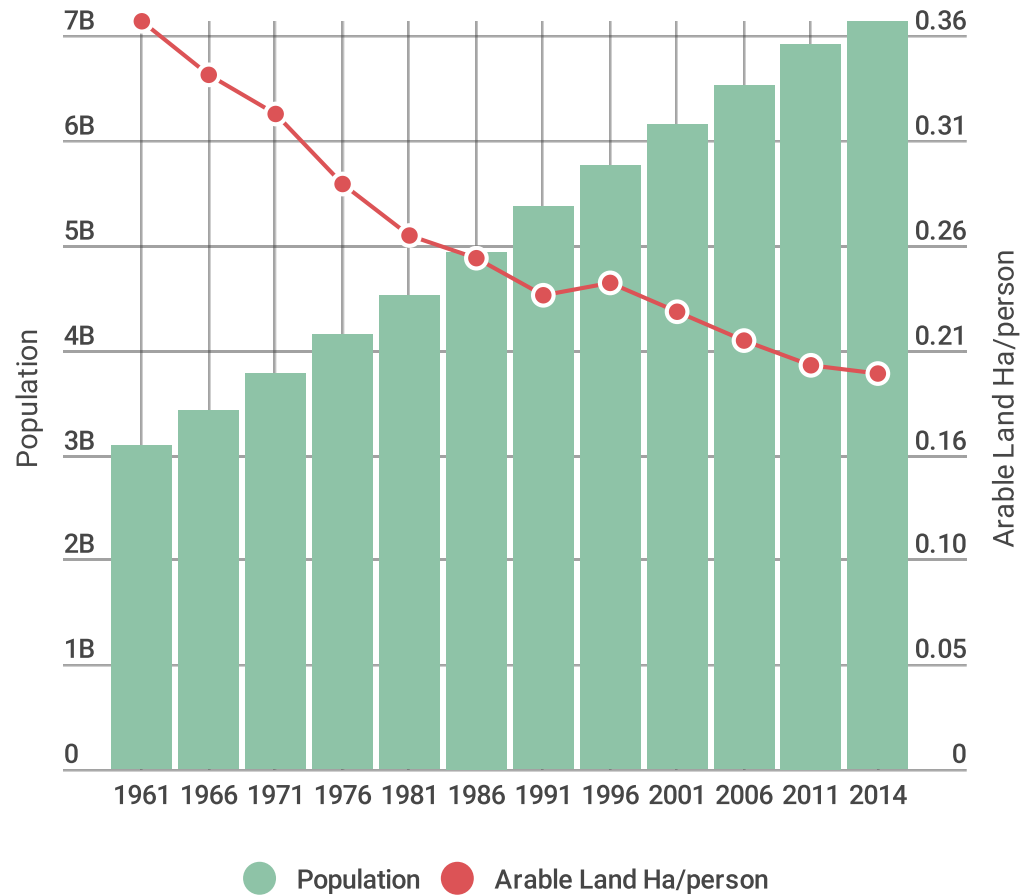
changing diets

Climate change 'multiplier'

GRAND CHALLENGES to FOOD and NUTRITIONAL SECURITY

1. Loss and degradation of our Natural Resources
2. Adaptation to Climate Change
3. Nitrogen (in)efficiency and losses
4. Food loss and waste
5. Neglect and erosion of rural communities

Population growth v Arable Land per capita 1961-2014





70% GLOBAL FRESHWATER USE - AGRICULTURE

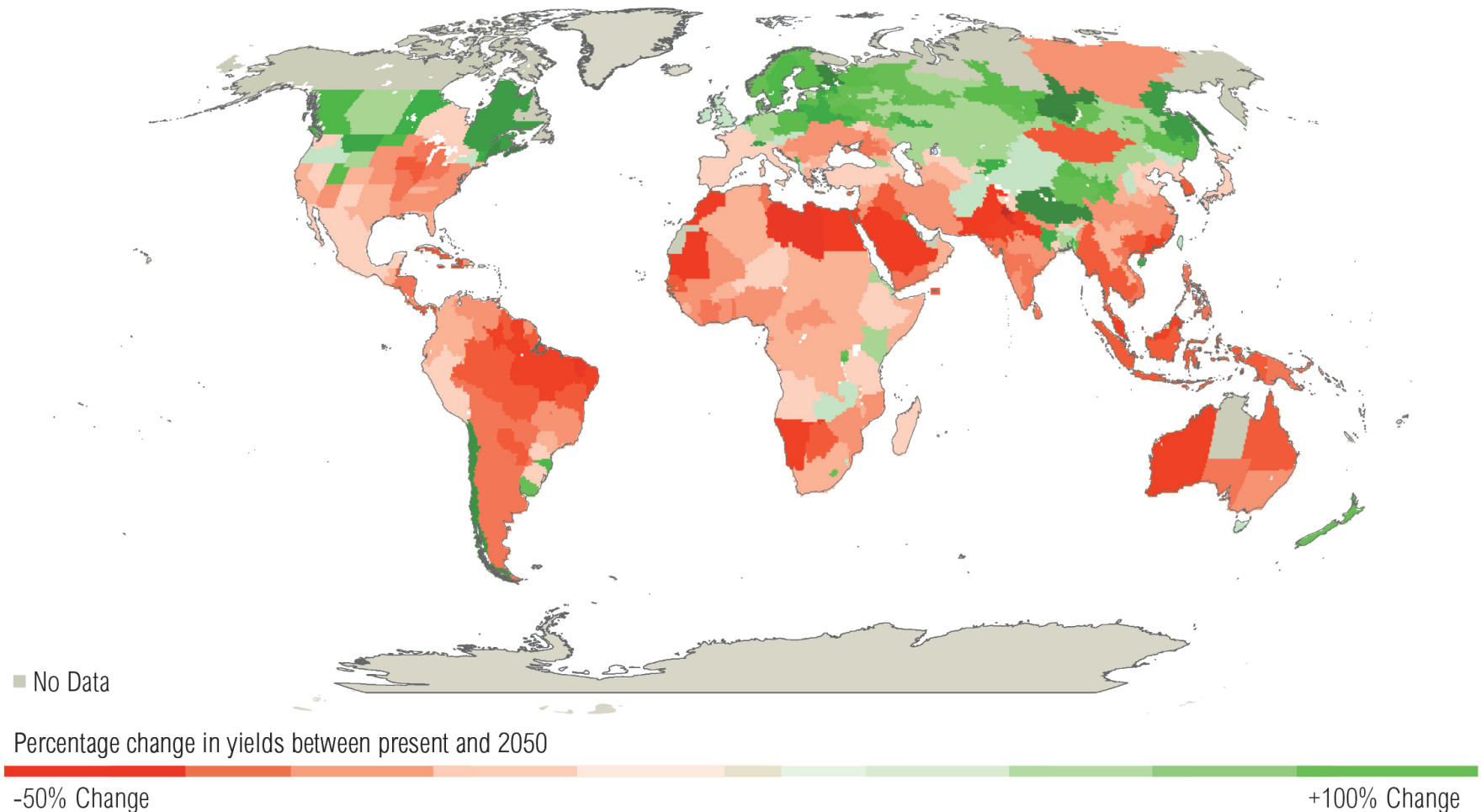
Pressure to reduce GHG emissions!

- Agriculture – circa 20% now...
+/- **70% by 2060!**
- Nitrous oxide ($300 \times \text{CO}_2$)
- Methane ($30 \times \text{CO}_2$)



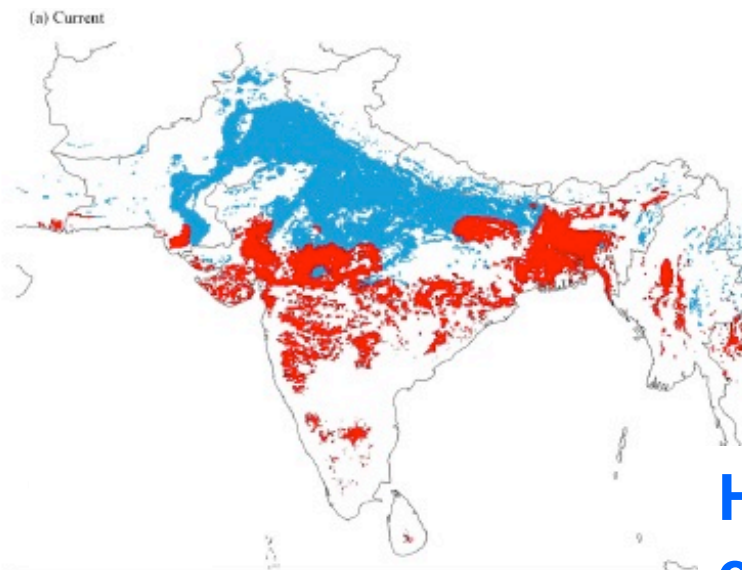
Most studies project net adverse impacts on crop yields due to climate change

(3° C warmer world)

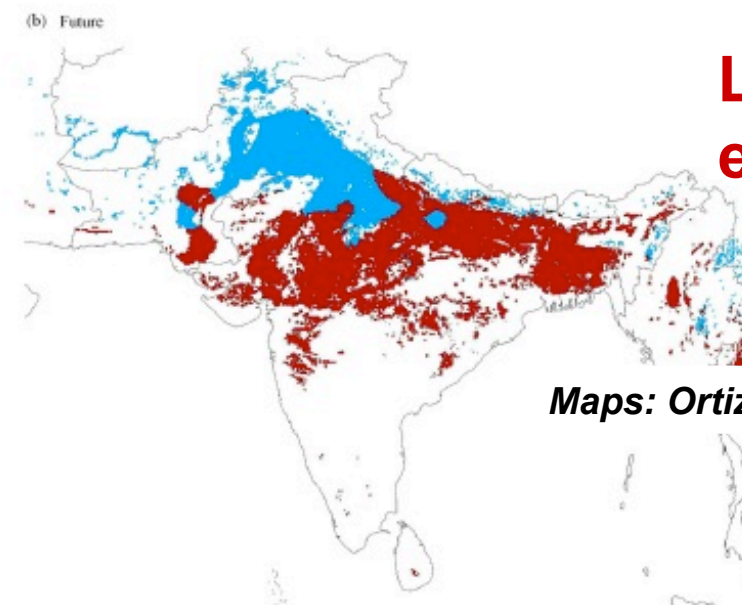




- Substantial loss of high-yield environment due to increasing temperature
- Reduced grain quality
- New disease & pest threats
- Yield stimulus from elevated CO₂
- Potential yield reductions from dimming and ozone



**High-yield
environment**



**Low yielding
environment**

Maps: Ortiz et al. 2008

Food loss and waste...



The Aboubakar family, Chad
Food expenditure for one week: **\$1.23**



The Melander family, Germany.
Food expenditure for one week: **\$500.07**



Current and Future Requirements

- 'Climate Smart' – dry, heat, frost
- Greater input use-efficiency
- More diverse
- Less energy-rich inputs
- Lower GHG emissions
- More productive, profitable and sustainable
- More nutritious and diverse food products

SUSTAINABLE INTENSIFICATION

- ‘Doing more with less’
- The foreseeable future...



FAO – ‘Save and Grow’

- Conservation agriculture with diverse systems – crops/forages/trees/shrubs/livestock
- Healthy soils
- Improved crops/varieties/livestock
- Efficient water management
- Integrated pest management



Soil health is critical!







Practice 3

Diversification

Wider range
of crops and
enterprises

Legumes and
biological
nitrogen!!!

Livestock

Shrubs and
trees



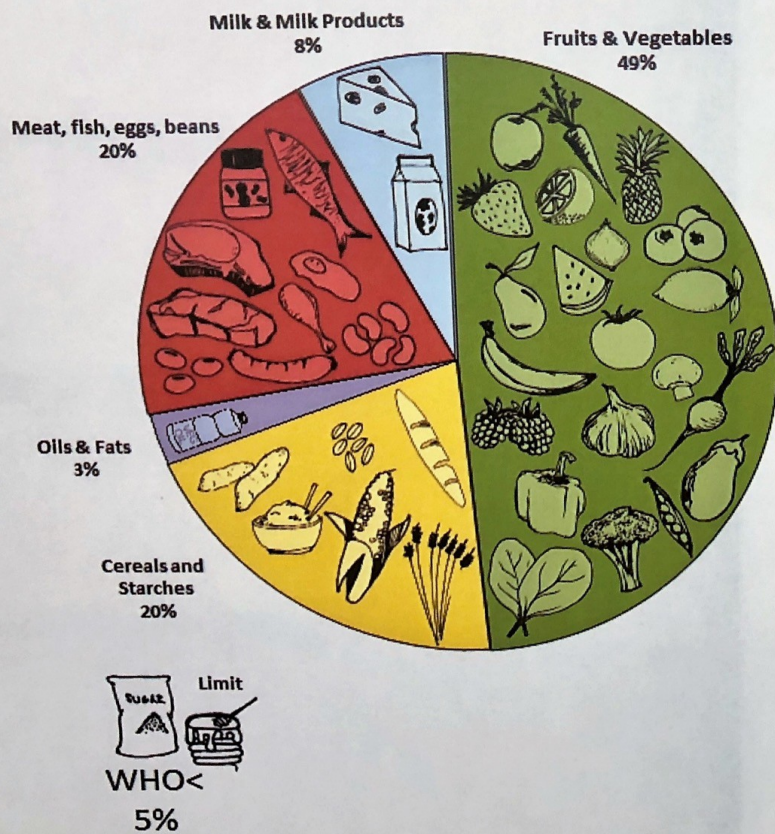


Push-Pull Strategy

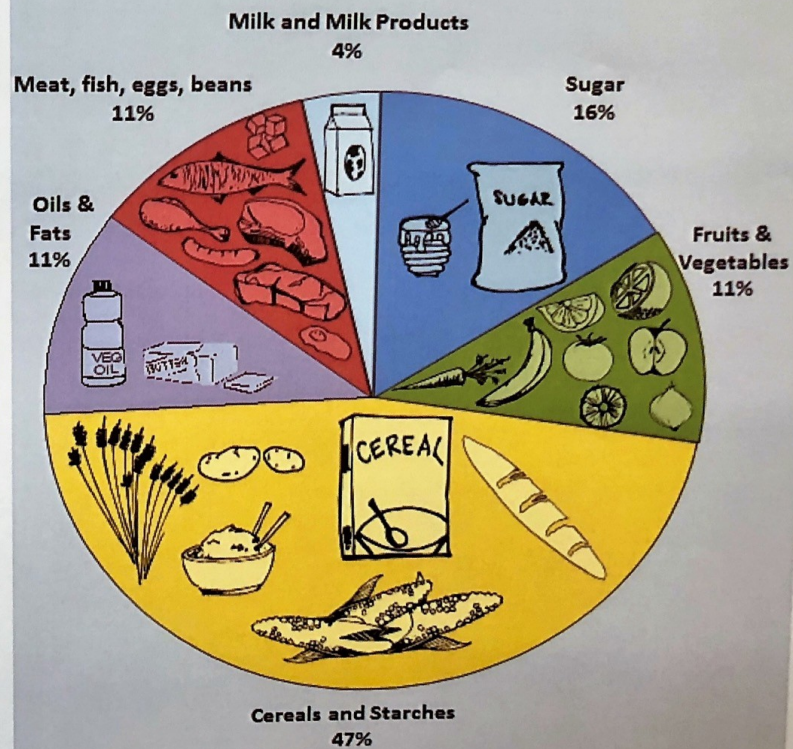
Australia's role – agriculture trends to 2030

- Australia's fastest growing sector!
- Highest productivity of all Australian sectors
- Second largest export industry
- \$63 billion at farm gate – tracking for \$100b?
- Education – agriculture enrolments at UM record 220 in 2018; 'Food for a Healthy Planet' +/- largest subject (400+)
- Each Australian farmer feeds 600 people 150/450
- Each Australian scientist can feed even more...

What we should be eating (Harvard's Healthy Eating Plate Model)



What we are actually producing (According to 2011 FAO)



Evan Fraser, Guelph, FBS analysis, 2015

Shifting diets reduces environmental pressure

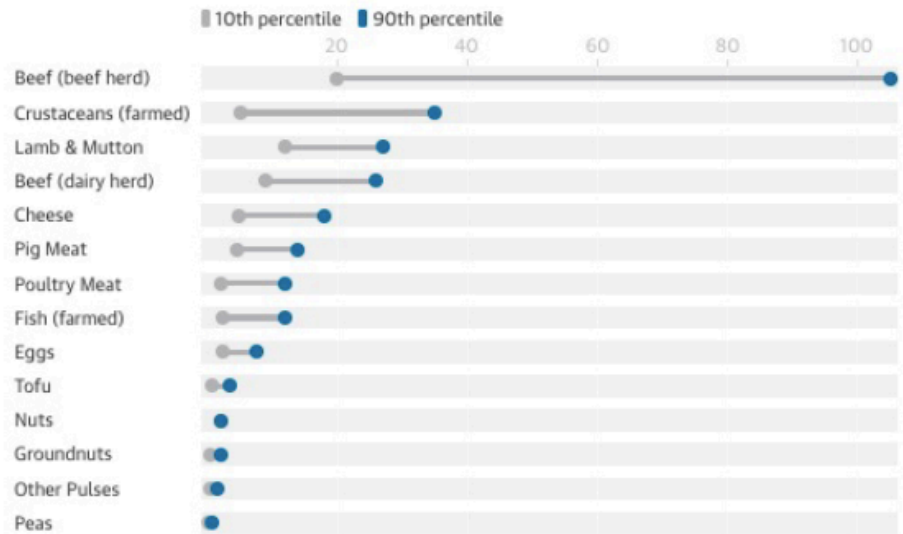
Avoiding meat and dairy is 'single biggest way' to reduce your impact on Earth

Biggest analysis to date reveals huge footprint of livestock - it provides just 18% of calories but takes up 83% of farmland



Poore, J., and Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. *Science*, 360, pp. 987-992. Graphics: The Guardian

Beef results in up to 105kg of greenhouse gases per 100g of meat, while tofu produces less than 3.5kg



Guardian Graphic | Source: Poore and Nemecek, Science



Food you've never heard of could end hunger

OCT 6, 2018 11:18 AM EDT

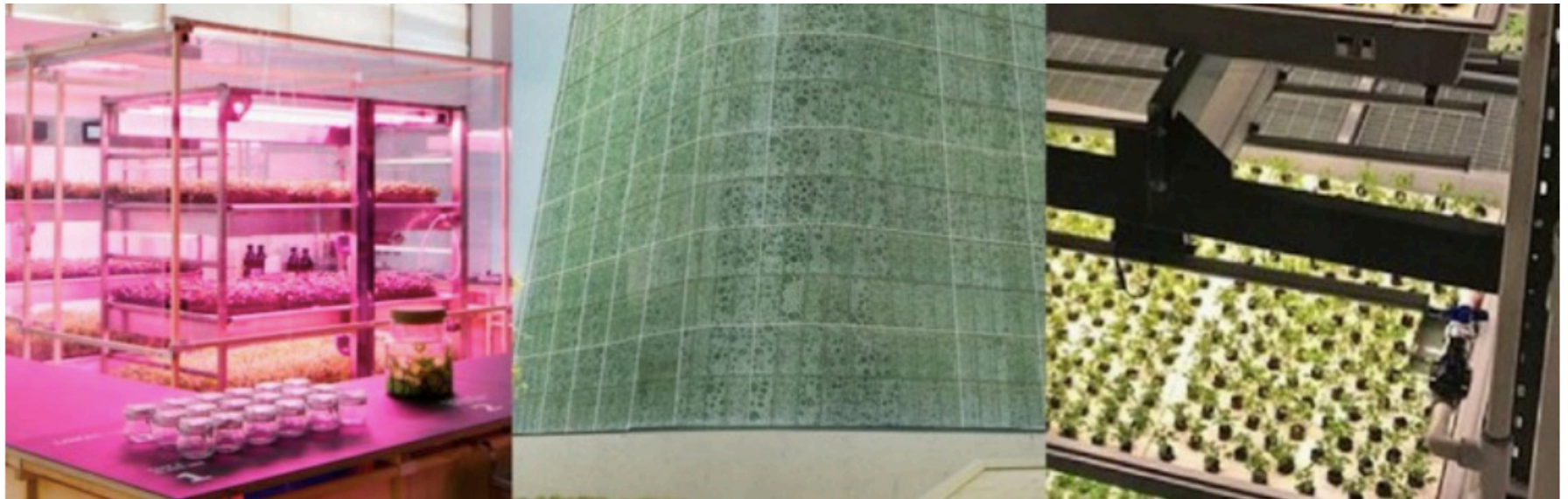
BY DEMARCO MORGAN, VIDYA SINGH / CBS NEWS



13 Vertical Farming Innovations That Could Revolutionize Agriculture



These innovations are bound to rise in popularity and revolutionize the face of vertical farming in the future!





Let them eat bugs: US startup sees future of sustainable food in creepy crawlies

Grubbly Farms is raising black soldier flies as a substitute for wild-caught fish in food for livestock and farmed seafood

The Future

- Food and nutritional security in a carbon, water, energy and **climate** constrained world
- Land and water – greater scarcity and value
- Global connectivity essential
- **We can do it, but...**
- **NOT** with 'business as usual'!





Thank you!