

Global strategies for animal protein for humans

Washington DC, April 10th 2019

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This talk

- The food system challenge
- Modelling the food system
- Challenges around meat
 - Health
 - Environment
 - Equity
 - Substitutes



The three waves of Malthusian pessimism

- Thomas Malthus (1766-1834)
 - 1798 Essay on the Principle of Population
 - The power of population is indefinitely greater than the power in the earth to produce subsistence for man
- The Industrial Revolution



The second wave

- The second wave: Limits to Growth and the Population Bomb
- Green Revolution





Data from Burney, Davis & Lobell, PNAS, 2010



Baldos & Hertel 2014 (GTAP)

Future population growth

(medium fecundity assumption)



UN Population Division, World Population Prospects, 2015 Revision

Current regional and projected global meat consumption



Alexandratos, N. & Bruinsma, J. World Agriculture Towards 2030/2050. FAO, 2012.

Water scarcity



Mekonnen & Hoekstra Science Advances 2016

Soil Degradation



UN Food and Agriculture Organisation 2014

Coming challenge

- Continuing demand growth
- Urbanisation & mega-cities
- Hunger & under-nutrition
- Obesity & over-nutrition
- Pressures on agriculture
 - Water scarcity
 - Competition for land and soil degradation
- Resilience to shocks
 - Climate change
 - Human



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What if we eat healthily?

- Assume by 2050 we adopt diets recommended by the World Health Organisation
- Calculate diet-related disease deaths
- ... and greenhouse gas emissions
- ... and begin to explore economics

PNAS (2016) 113, 4146.

Compared to FAO diet predictions, adoption of a diet meeting nutritional guidelines would in 2050 result in 5.1M avoided deaths per year

С

Avoided deaths per million people (HGD vs REF) 9 - 169 170 - 302 303 - 662 663 - 1,422 1,423 - 3,089 No data

Cartography: © Boris Johnson

Adoption of a diet meeting nutritional guidelines would in 2050 reduce the increase in food-system associated GHG emissions from 51% to 7%



There are substantial economic benefits of switching to better diets



GWP (Σ GDP) \approx \$US 80T yr⁻¹

Food and Planetary Boundaries

Planetary boundaries



Johan Rockström



Environmental pressure (percentage of present impact)

Nature (2018) **562,** 519



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Meat & health

Processed meat and risk of colorectal cancer



Bradbury et al. (2019, in press)

Number of deaths at the global level attributable to diet



Number of deaths (in thousands)

Meat & the environment

Complexities of multiple emissions

GWP GTP kg GWP CO_2e kg⁻¹ beef cattle liveweight kg GTP CO $_2$ e kg $^{-1}$ beef cattle liveweight 30 12.5 25 10.0 ٠ ٠ 20 7.5 \times 15 5.0 10 2.5 Grass fed Not grass fed Grass fed Not grass fed

Contested evidence base



Grazed and confused?

Ruminating on cattle, grazing systems, methane, nitrous oxide, the soil carbon sequestration question – and what it all means for greenhouse gas emissions



Led by Tara Garnett



What if we taxed climate unfriendly food?

- Use life cycle analysis to assess GHG emissions
- Introduce a proportionate tax
- Look for perverse effects; redesign tax intervention
- (Recognise a rather simplistic first step)

Nature Climate Change 2016 e3155





Net ~100K avoided deaths and 1 Gt CO_2 emission reduction yr⁻¹ ~10% of reduction required for $\Delta T < 2^{\circ}$



Net ~100K avoided deaths and 1 Gt CO_2 emission reduction yr⁻¹ ~10% of reduction required for $\Delta T < 2^{\circ}$



Net ~500K avoided deaths and 0.9 Gt CO₂ emission reduction yr⁻¹

Meat & political equity

Cattle distribution



Robinson et al. PLoS One 2014



Health and Harmony: the future for food, farming and the environment in a Green Brexit

February 2018

"Public money for public goods"

Alternative income streams for livestock farmers in high-income countries.



The Best I the M

The Sharper Image is one of my favorite stores – with fantastic products of all kinds. That's why I'm thrilled that they agree with me: Trump Steaks are "The World's Greatest Steaks" – and I mean that in every sense of the word. These steaks are, by far, the best tasting, most flavorful beef you've ever had – truly in a league of their own. The Sharper Image is the only place where you can buy Trump Steaks.

Trump Steaks are five-star gourmet quality that belong in a very, very select category – Certified Angus Beef® Brand USDA Prime. There's nothing better than that. Of all the beef produced in America, less than one percent qualifies for this elite category. It's "The Best of the Best." Trump Steaks are aged to perfection to provide the ultimate in tenderness and flavor.

Treat yourself to the very, very best life has to offer. One bite and you'll know exactly what I'm talking about. Believe me: I understand steaks. It's my favorite food. And Trump Steaks are the best.



Meat alternatives















WEF 2019



Lynch & Pierrehumbert Front. Sustain. Food Syst. 2019

Supportive narratives

Foods containing alternative proteins help you live a healthier life

Alternative proteins are free of the risk of food poisoning or contamination

Products based on alternative proteins taste excellent

Alternative-protein products are better for the environment

Alternative-protein products do not harm animals



Alternative proteins promote food security by releasing land currently used to grow animal feed for the production of human food.

Cautionary narratives

Alternative-protein products will always play just a minor role in the global food system

Alternative-protein products are not real food



Alternative-protein products are not as good as the real thing

Livestock is more than food

Conclusions

- Food system entering uncharted waters
- Action needed on all fronts; no silver bullets
- We need to have difficult conversations about the sustainability of livestock
- The industry has to be part of the solution
- We fail on food we fail on everything



Food The O on the

The Oxford Martin Programme on the Future of Food