



The Age of Renewable Food

Feeding the world in the era of 'peak people'

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A 'wicked' problem...



DEMAND:

- 108,000 more people/day
- More babies + longer lives
- Rich eat 35,000 more meals
- Population >11 bn by 2100
- Meat demand soaring in NICs
- Food demand doubles by 2060s

CONSTRAINTS:

- 'Peak water'
- 'Peak land'
- 'Peak oil'
- 'Peak Phosphorus'
- 'Peak fish'
- 'R&D drought'
- 'Capital drought'
- 'Climate extinction'

Peak water

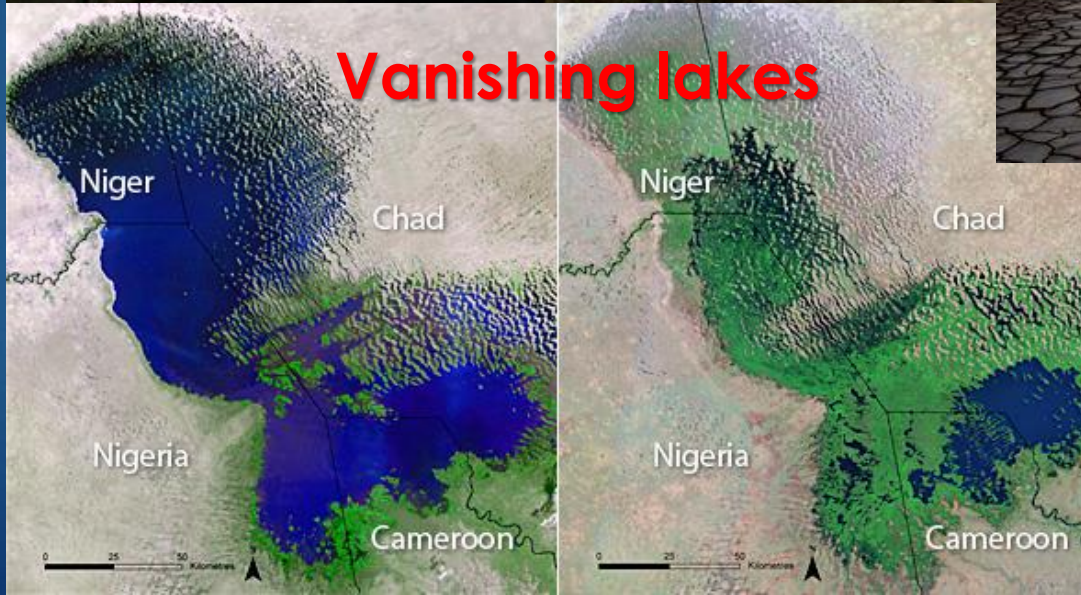
“By 2030, demand for water could be 40% greater than supply available” – UN Report



Groundwater mining



Disappearing rivers



Vanishing lakes



Shrinking glaciers

Vanishing land

33% of world's topsoil lost since 1975

80% of minerals lost from heavily cropped soils

Global soil loss is currently 43 billion tonnes a year and, with climate change, could reach 72 billion tonnes a year by 2070

– Borelli P et al, PNAS, Sep 2020.

Killer diet

- ▶ 2 people in 3 now die of a diet-related disease (The Lancet)
- ▶ 75% of healthcare costs linked to chronic diet-related diseases
- ▶ 1.9 bn overweight/obese – 0.8bn malnourished.
- ▶ Diabetes: world's 7th largest killer by 2030 (WHO)
- ▶ **Food deaths are preventable deaths**



Food: driving the 6th Extinction:

- ▶ 70% of large wild animals lost since 1970; insects vanishing
- ▶ 66% of fish gone since 1970
- ▶ 55% of land area cleared.
- ▶ 5mt of pesticides/yr
- ▶ Food demand is collapsing Earth's life support systems and is the main driver of extinction.



"We are tearing down the biosphere. I don't think the world can sustain this."

- E.O. Wilson, author of 'Half Earth'

Megacities: mega-risks



By 2050s 6-7 billion (68%) will inhabit cities.

Total urban area = Australia

Urban water use 2800 cu kms

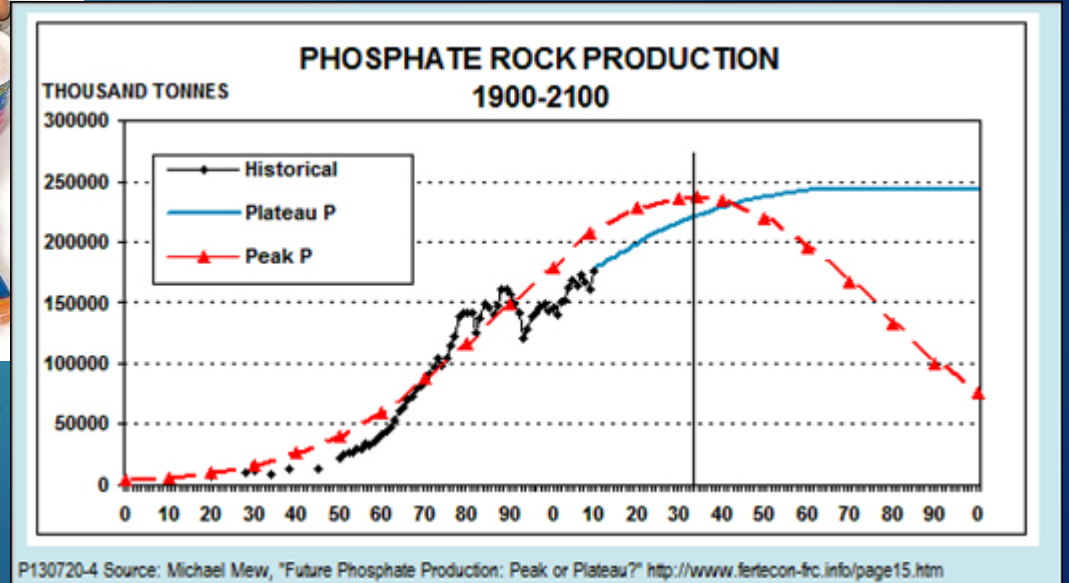
Cities cannot feed themselves

- ▶ Mumbai – 42 million
- ▶ Delhi – 36 million
- ▶ Dhaka – 35 million
- ▶ Kinshasa – 35 million
- ▶ Lagos – 32 million

Why we must recycle nutrients



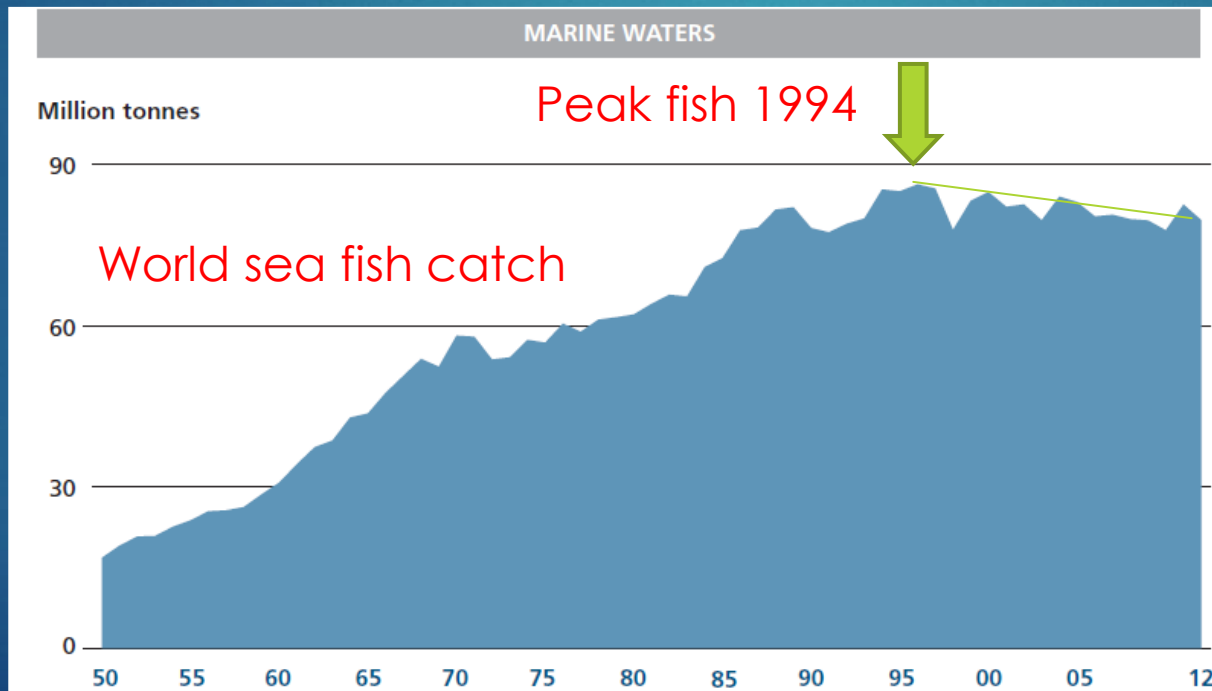
- 30-50% of world's food currently wasted or lost
- Farming is now mining



Sources of artificial fertilisers will be scarce and costly by 2050 >

Peak fish

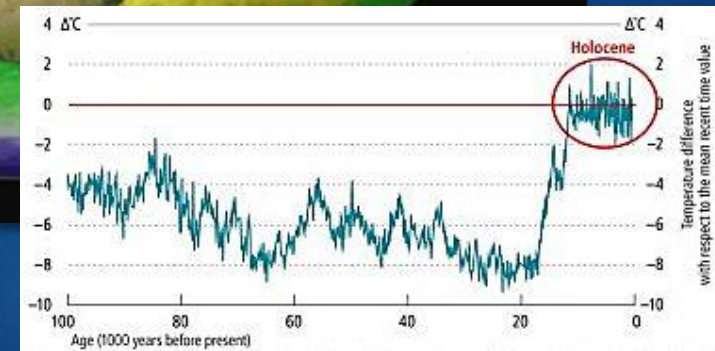
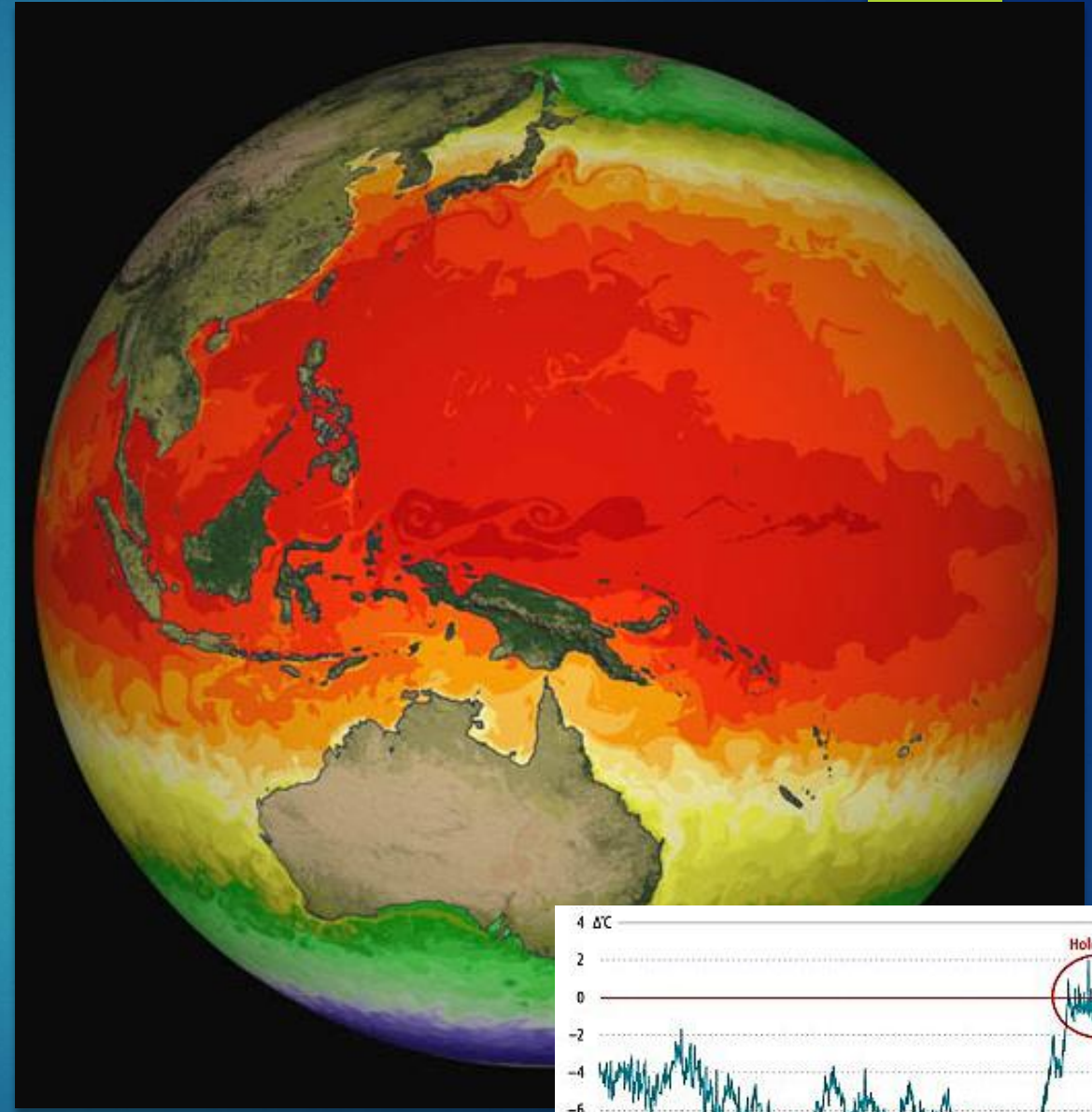
“The maximum wild capture fishery potential from the world's oceans has probably been reached .” - FAO



- 90% of fisheries 'fully-fished or overfished'
- Most fish now contain toxic plastic
- 760+ Ocean Dead Zones

Food and Climate Impact

- ▶ Ideal climate for farming (Holocene) extinct
- ▶ Food production adds >30% of global warming
- ▶ Farming 'highly vulnerable' above +2°
- ▶ World **on track** for +4-5 degrees by 2100
- ▶ **High risk** of regional famines, refugee tsunamis and **wars**



Our deadly jawbone...

Every meal you eat costs the Planet:

- 5-10 kilos of topsoil
- 1.3 litres of diesel
- 800 litres of fresh water
- 0.3g of pesticide
- 3.5 kg of CO₂



Our present food system is no longer sustainable...





When food fails...

- ▶ Gwion Gwion, Kimberley, Australia, c17,000 year BP
- ▶ Sea level rise (due to global warming) flooded 2.4 million sq kms, a quarter of the continent
- ▶ Extinction of megafauna
- ▶ Extinction of Gwion culture
- ▶ Use of hunting tools, rather than weapons
- ▶ Clearly a fight over food/hunting rights.

Food and Empires

- ▶ **ROME:** grain trade built the Empire. Food failure in 3rd Century caused its collapse.
- ▶ **CHINA:** growth founded on wheat/rice. Ming dynasty, and others, fell due to famine.
- ▶ **VIKINGS:** invaded Europe when displaced by climate cold snap.





Food wars

- ▶ 30 Years War (Germany) killed 7 million
- ▶ French Revolution 1789, > arose from famine. 3m die as result.
- ▶ Russian Revolutions, 1906, 1918, arose from famines
- ▶ World War 1, a million Germans died of hunger; all of Europe suffered.
- ▶ Stalin's War on Kulaks (farmers) 1926-32, killed 11 million.
- ▶ China 'Years of Difficulty', 1960s, killed 15-30 million.
- ▶ Pol Pot (1975) killed 2 million.

WWII: 'lebensraum'

- ▶ Primary Nazi war aim was the conquest of Soviet farm lands for German 'living space'.
- ▶ Driven by German starvation in WW1, racism and politics.
- ▶ Weaponization of hunger.
- ▶ Primary Japanese war aim was the conquest of Manchuria and China for food and resources.





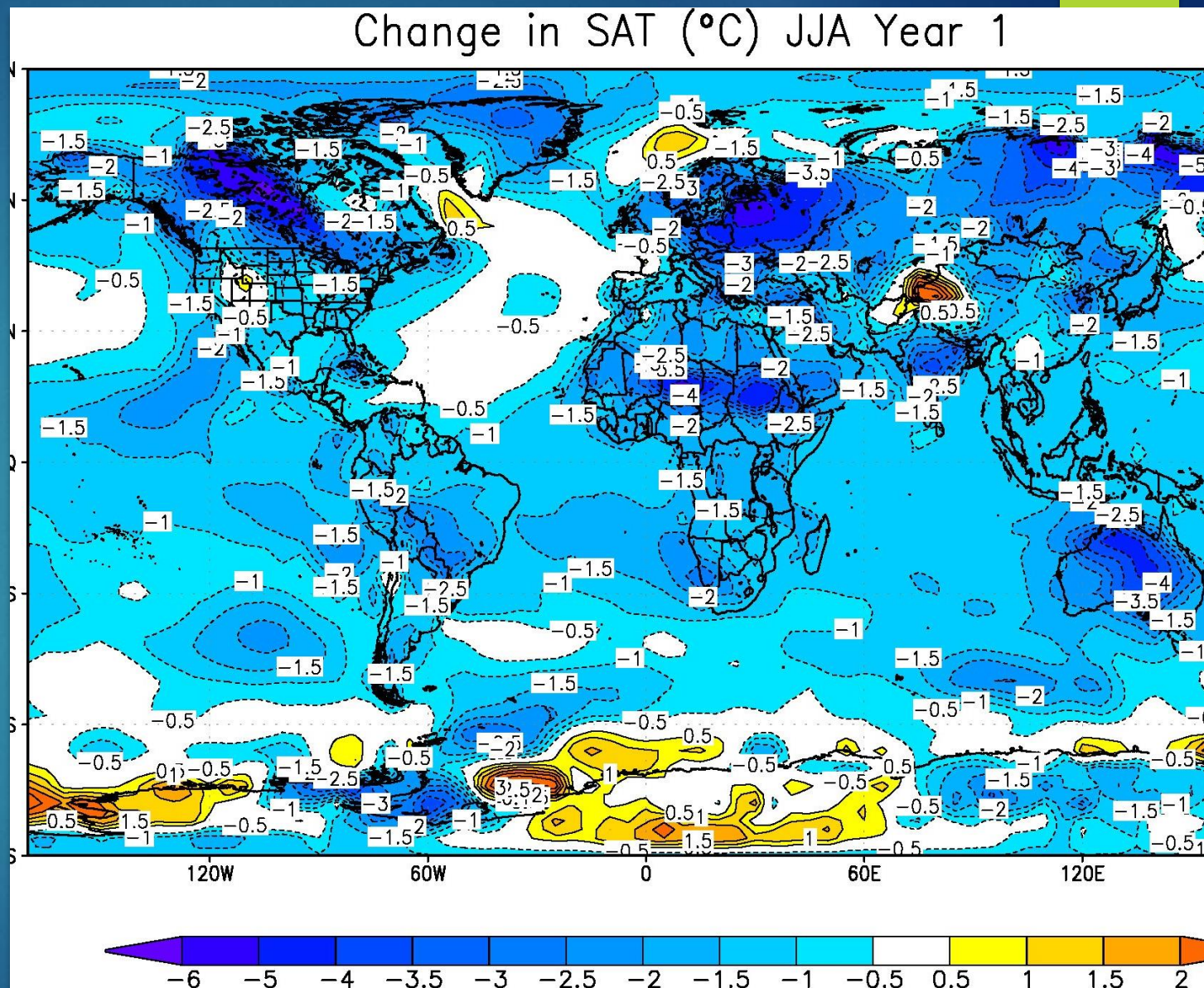
Current food wars

- ▶ **SYRIA**: climate change, drought & famine displace millions of farmers leading to urban unrest.
- ▶ **YEMEN** direct targeting of agriculture, 24 million starve.
- ▶ **DARFUR**: climate, farming and food collapse fuel war, 3m starve.
- ▶ **Other food conflicts**: 53 countries including Nigeria, Afghanistan, Congo, Egypt, Tunisia, Libya, Mali, Chad, Central African Republic, Maghreb region, Mozambique, Cote d'Ivoire, Zimbabwe

Future food wars

Emerging food, land & water crises in:

- SOUTH ASIA – risk of nuclear war
- NORTH CHINA – risk of refugee tsunamis
- SUB-SAHARAN AFRICA
- MIDDLE EAST/NORTH AFRICA
- CENTRAL ASIA
- CENTRAL & S.AMERICA



Impact of nuclear war on global food supply

Death wish?

- ▶ Global weapons budget \$1.8 trillion/year
- ▶ Global food research budget: \$70 billion/year
- ▶ Humans spend 25X more on better ways to kill ourselves than feed ourselves
- ▶ We must invest 20% of global weapons budget into food.



PEACE THROUGH FOOD

▶ If 20% of the world arms budget were invested in novel food systems it would:

- ▶ Feed everybody
- ▶ Recycle waste
- ▶ Re-use water
- ▶ Help prevent most wars
- ▶ Curb refugee floods
- ▶ Sustain humanity
- ▶ Reduce disease
- ▶ End the 6TH Extinction.





Joel Salatin, Polyface Farms

Solutions 1: Regenerative farming:

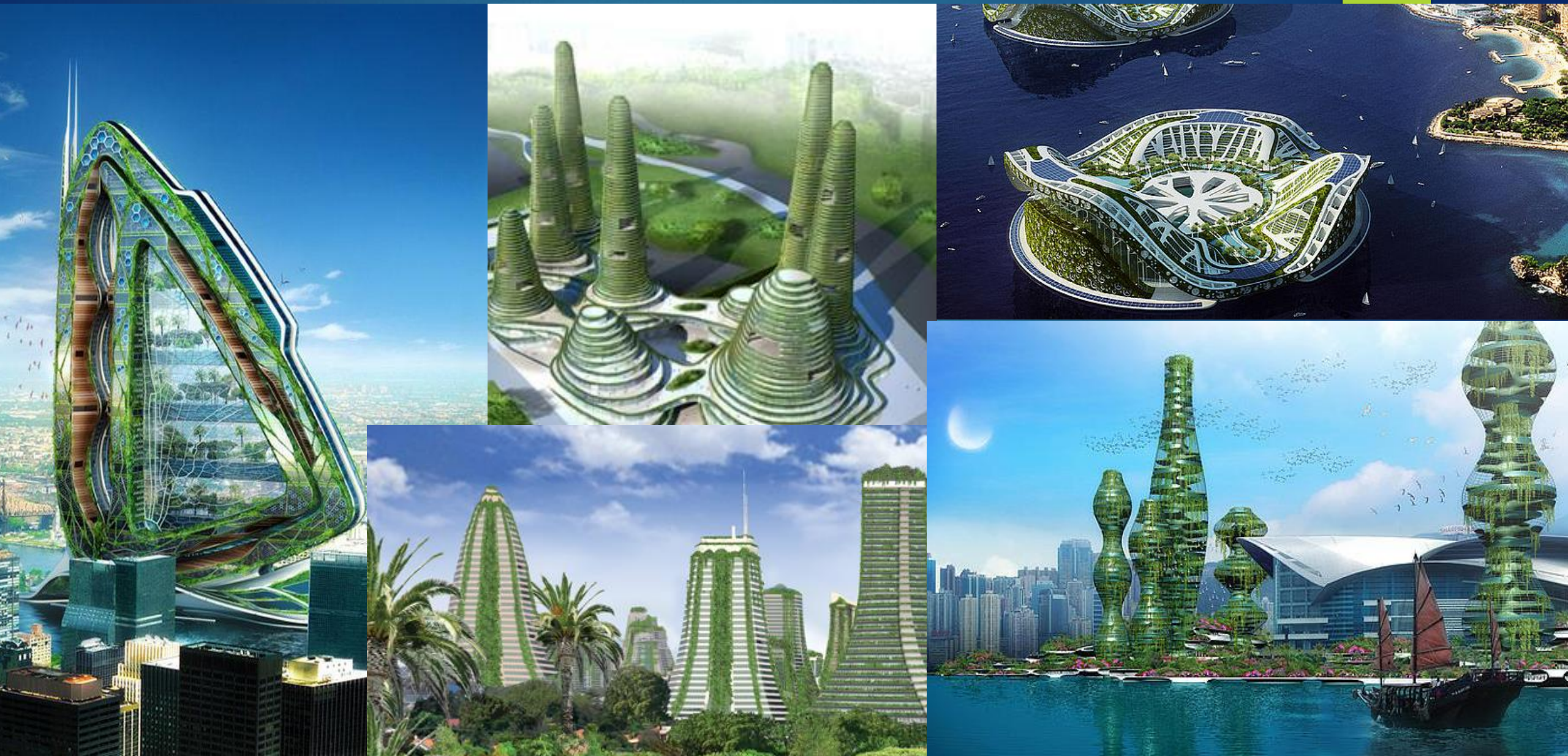
- * Restores soil fertility
- * Locks up carbon
- * Saves water
- * Avoids chemicals
- * Kinder to animals
- * Healthier food
- * Protects environment

Robot eco-farms



Agriculture does not have to be low-tech to be regenerative.

Solutions 2: green cities



'Sky farms'

800m 'urban farmers: FAO



Singapore



Swedish Tax Dept.



New York



Linköping



Milan & Shanghai

'Agritecture' and renewable food



Food without soil

Blue Farms, Sydney



- Recycled nutrients
- Recycled water
- No pesticides
- No soil
- Biological control
- Automated
- Specialty crops



Aquaponics and aeroponics

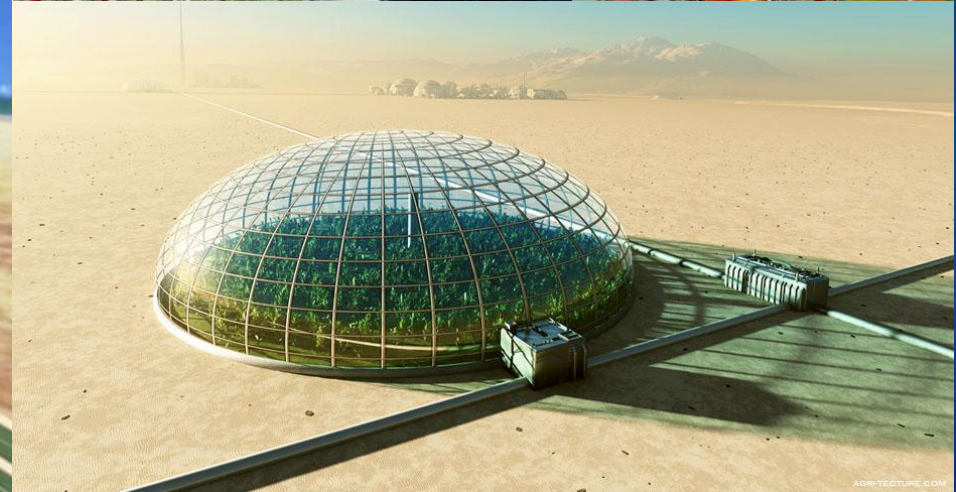
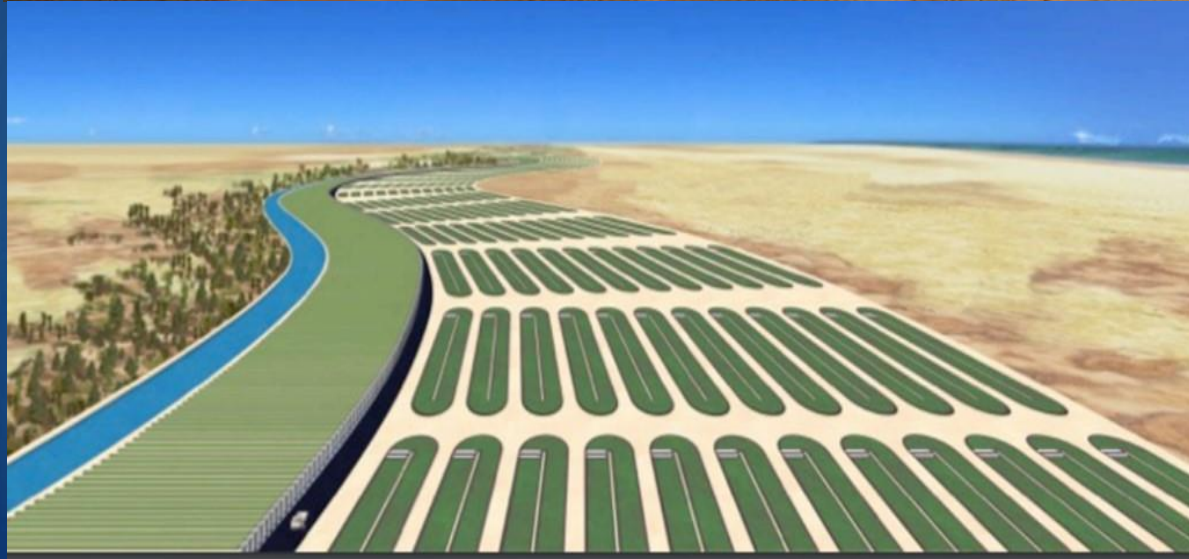


Floating farms



Desert farms

Sundrop Farms, SA



Microfarms



Ikea farm



Entomoculture...



Cowless meat etc.

- 2011: first cultured sausage
- 2013: first cultured burger
- 2016: first cowless milk >
- 2018: chickenless eggs
- 2020: health profiled 'meat'



Biocultures & food printers



Of 30,500 edible plants we eat just 200

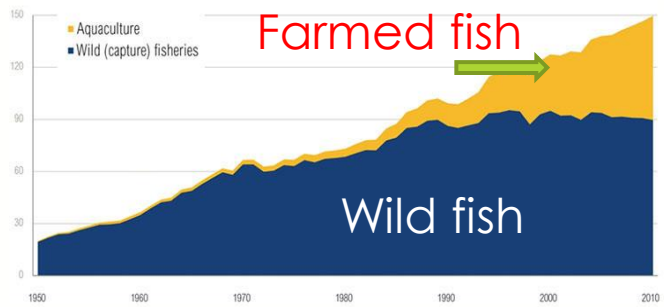
<http://foodplantsinternational.com> / new scientist



Solutions 3. Deepsea farming

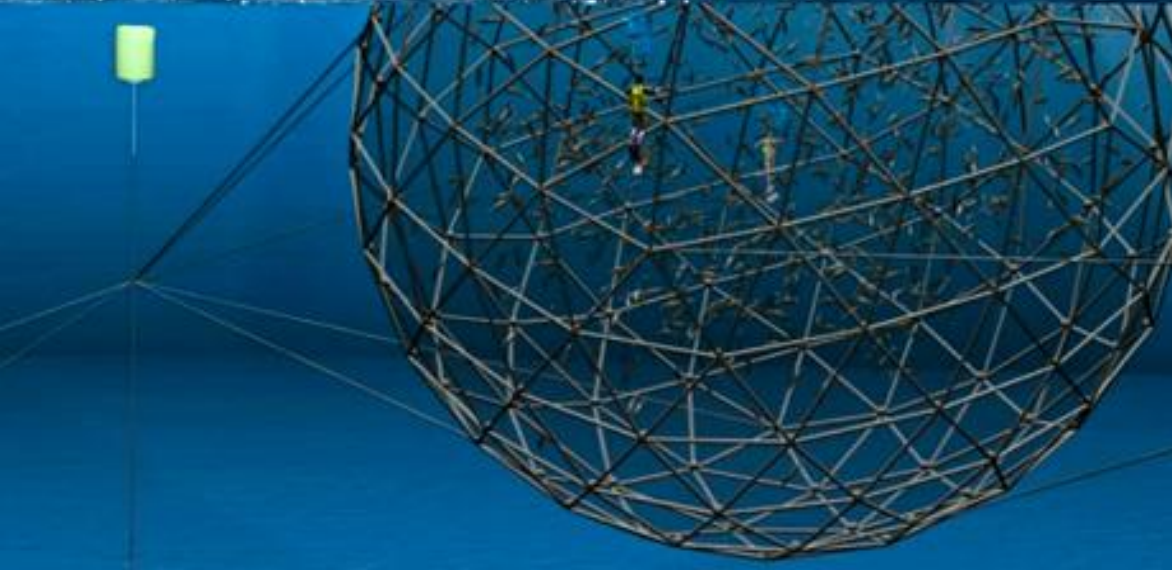


World Fish Production (in million tons)



WORLD RESOURCES INSTITUTE

Sources: <http://ow.ly/rp1fMN>



Algaepreneurs

By 2060 water plants (algae) will be the world's top crop:

health food, **stockfeed**, **transport fuel**,
plastic, **textiles**, **chemicals**, **paper**,
clean-up, **biomining** etc



Re-wilding half the planet



A new **respect** for food...

- **Food Year** in every junior school on Earth
- Teach respect for food: how to eat for **health** & to **sustain our food supply**



OR?



The 'Age of Renewable Food'



- Vast new range and choice of renewable foods
- Climate-proof food systems
- Secure food for megacities
- Diets that heal
- Driving the 'ideas economy'
- Preventing wars
- Restoring the Earth

Julian Cribb

FOOD OR WAR



'Anyone with an interest in either the human future or in food should read this clear, authoritative, scary book.'

Paul R. Ehrlich

Food or War *By Julian Cribb*

- ▶ Explains the links between food and conflict, past, present and future
- ▶ Explains why today's food system cannot be sustained
- ▶ Describes new food systems that will:
 - ▶ Protect the planet
 - ▶ Create healthier humans
 - ▶ Save our wildlife, soils and water
 - ▶ Create new jobs and investment
 - ▶ Prevent war.

<https://www.cambridge.org/us/academic/food-or-war>