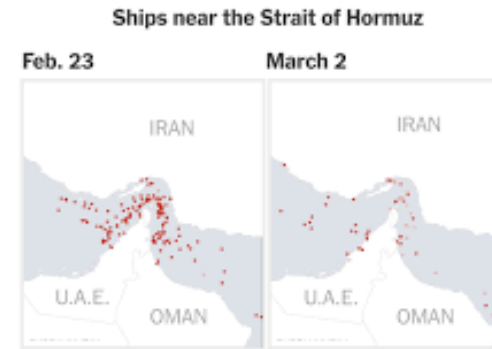


Implications of a volatile world for UK food systems and security

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The cheaper food paradigm

Consumption drives economic growth

Cheaper food is good for growth

Markets provide the solution

Changing diets is not the role of governments

Social safety nets are not needed

Ill-health from poor diets not accounted for

Waste is economically rational

Ultra-processed foods are cheap to produce and buy, and increasingly available

Business models are based on growth in output and consumption

Farming focuses on a few commodities grown intensively and at scale

Market concentration

Markets are dominated by few, big players, with vested interest in the *status quo*

Competitors and disruptors face significant barriers to entry

Policy stimulates market via:

- deregulating
- liberalizing
- driving efficiency through scale
- targeting state support at globally important commodities

Environmental impacts not costed

Unsustainable path dependencies

So much money has been spent by business interests, it is difficult to change tack

Near-monopolies exert big price pressures

Transformative change is perceived as prohibitively challenging, politically and economically

Innovation is driven by incumbents and focused on efficiency improvements to BAU

OUR FOOD SYSTEM RELIES ON TRADE

For food, feed, inputs, packaging

Food security is about trade at a global and local level

Flour (39%) (**Wheat** Flour, Calcium, Iron, Niacin, Thiamin), **Milk** Chocolate (30%) [Sugar, Cocoa Butter, Cocoa Mass, Dried Skimmed **Milk**, Dried Whey (**Milk**), Butter Oil (**Milk**), Vegetable Fats (Palm, Shea), Emulsifiers (**Soya** Lecithin, E476), Natural Flavouring], Vegetable Oil (Palm), Wholemeal **Wheat** Flour (9%), Sugar, Glucose-Fructose Syrup, Raising Agents (Sodium Bicarbonate, Malic Acid, Ammonium Bicarbonate), Salt

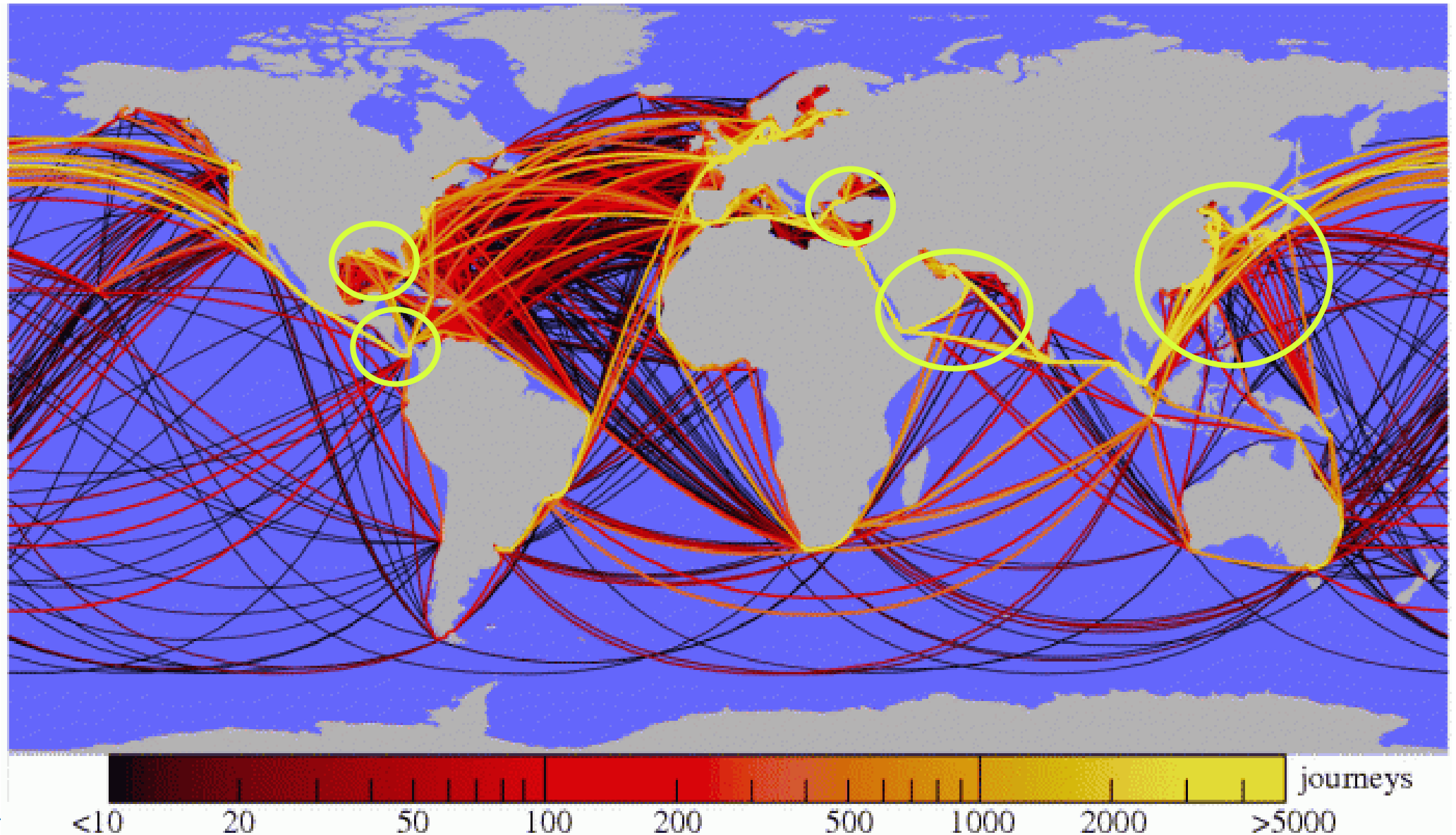
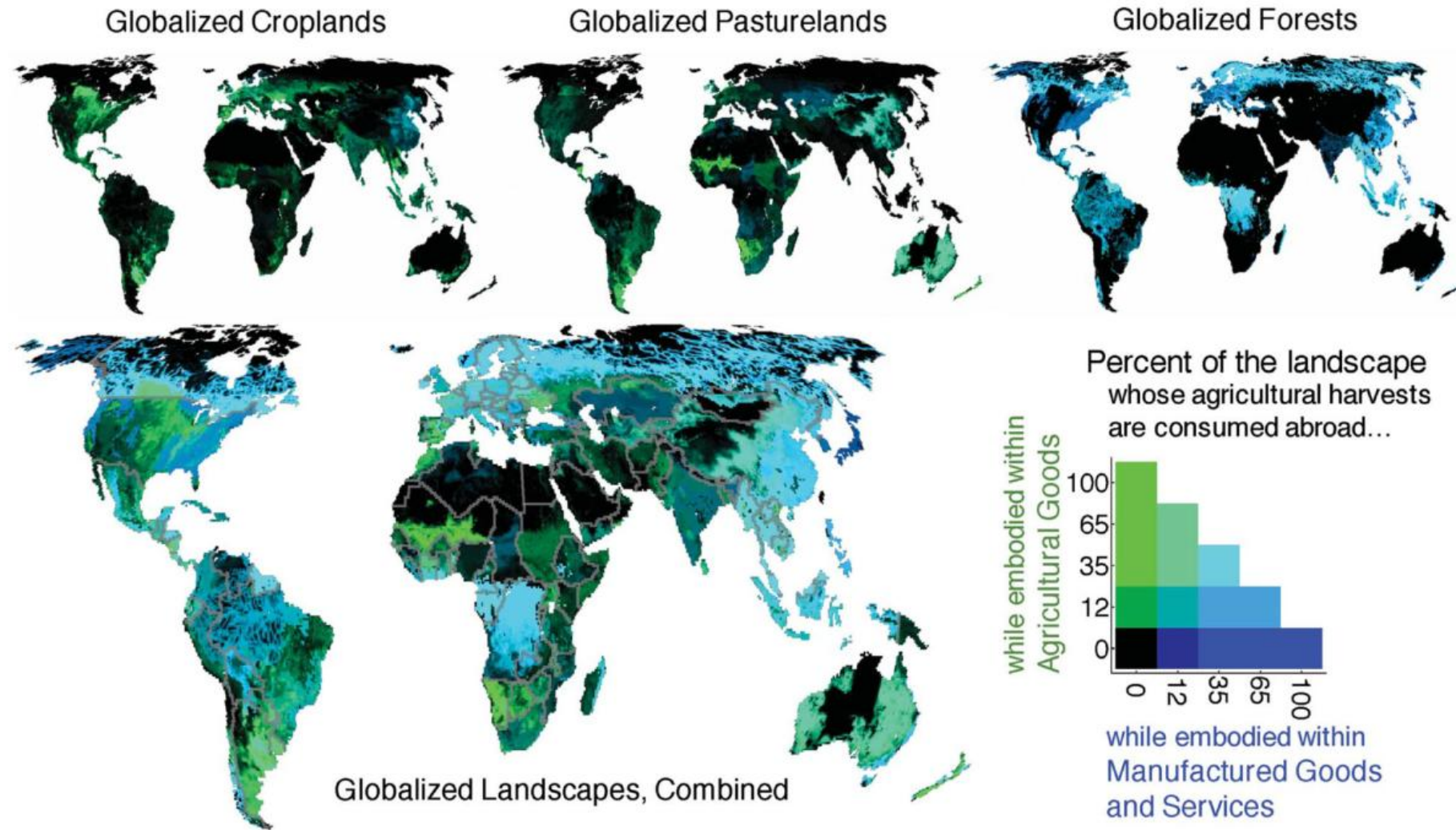


Figure 14. Relative roles played by agricultural commodities versus manufacture and services in globalizing lands



Trade is a very significant driver of global land use

Brighter greens and darker blues indicated production for trade in agricultural commodities:

Source: Bergmann, L. and Holmberg, M. (2016), 'Land in Motion', *Annals of the American Association of Geographers*, 106(4), pp. 932–56, <https://doi.org/10.1080/24694452.2016.1145537>.

‘BUSINESS AS USUAL’ AND IMPLICATIONS OF THE ACTION GAP

The action gap is the gap between what is needed (adaptation and mitigation) and what can be done.

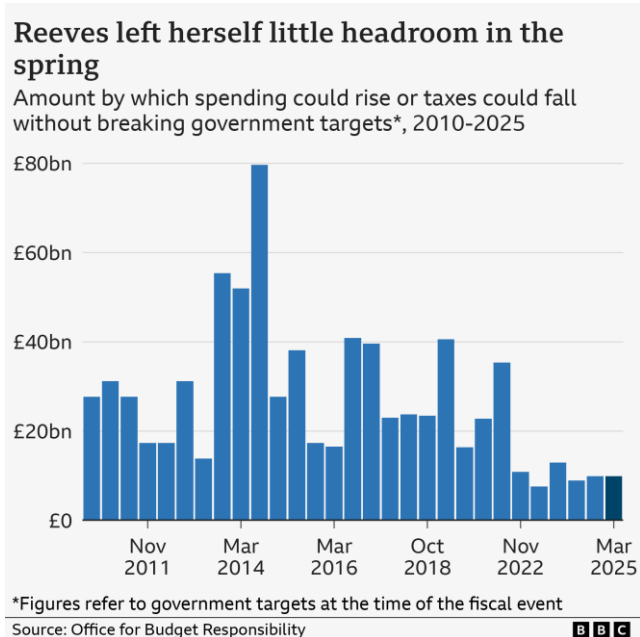
Governments face a “5-D” challenge in today’s world

- The need to invest in **Defence** and wider national security throughout and adaptation of key systems to build resilience;
- **Demographics** and aging populations provide a challenge where there is a need for more social security yet with a lower proportion in the workforce;
- **Development**: recognition that climate change is a collective problem, and that it is not possible to focus on domestic action and ignore the needs of lower income and more vulnerable countries;
- **Decarbonisation** for mitigation and the need for sustainability transitions;
- **Debt**. Sovereign debt is at record levels across much of the world. More spend implies more debt &/or more taxes



Implications:

1. **Economic growth** is important to raise tax revenue when raising taxes is politically toxic
2. **Trade-offs are accentuated**. Options that are deemed less urgent are de-prioritised (esp. ODA and decarb)

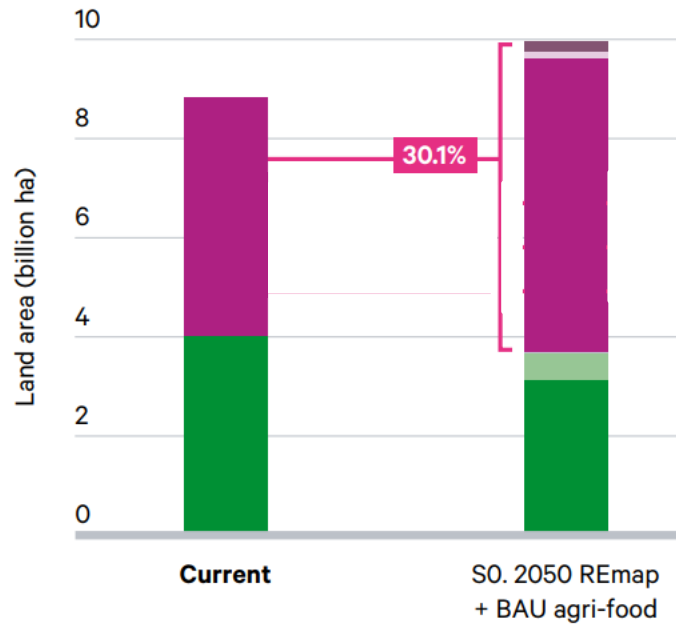


BBC

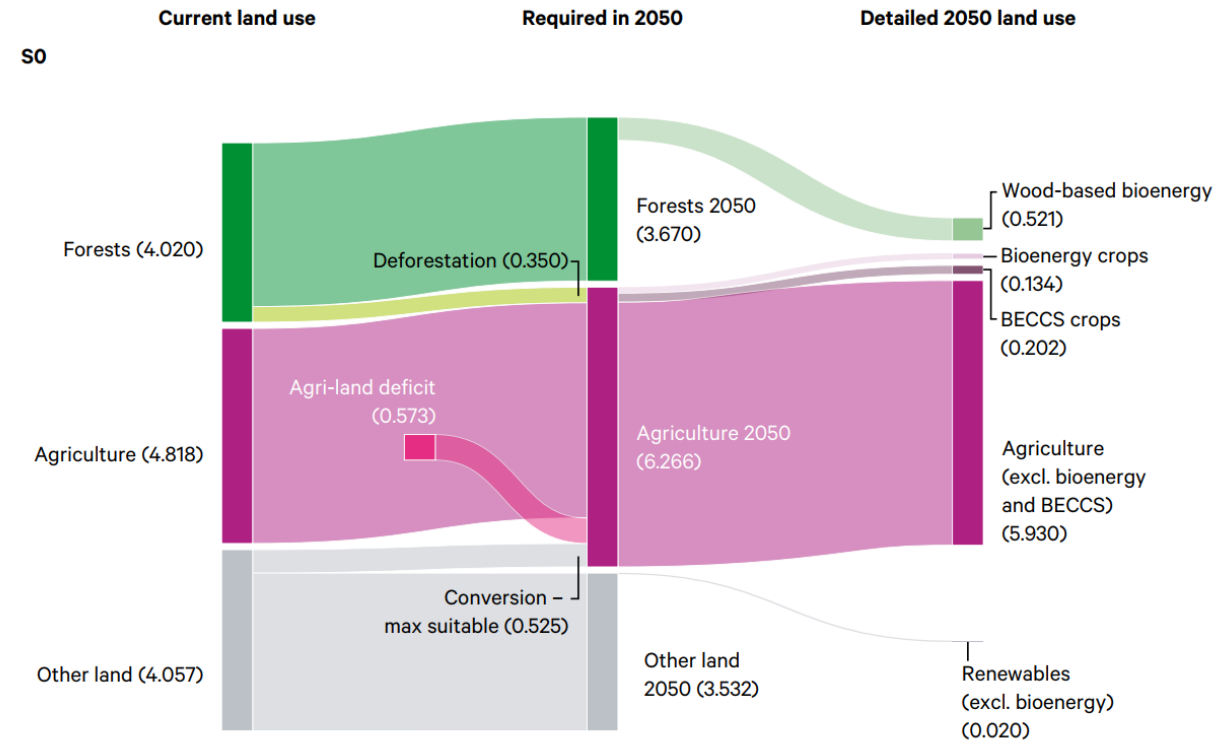
The emerging crisis of global land use (King et al 2023)

Figure 33. Change in global land use to 2050 modelled under the REmap energy scenario, combined with a BAU agri-food scenario (S0)

■ Forests (excl. bioenergy) ■ Wood-based bioenergy ■ Afforestation ■ Other land for renewable energy
■ Agriculture (excl. bioenergy and BECCS) ■ Bioenergy crops ■ BECCS crops



Demand for the goods and services from land are likely to grow globally



Sources: Chatham House modelling calculations; Smith, P. et al. (2016), 'Biophysical and economic limits to negative CO₂ emissions', *Nature Climate Change*, 6(1), pp. 42–50, <https://doi.org/10.1038/nclimate2870>; Bajželj, B. et al. (2014), 'Importance of food-demand management for climate mitigation', *Nature Climate Change*, 4(10), pp. 924–29, <https://doi.org/10.1038/nclimate2353>; FAO (2022), 'FAOSTAT > Land Use', <https://www.fao.org/faostat/en/#data/RL> (accessed 1 Jun. 2022); IRENA and IEA (2017), *Perspectives For The Energy Transition: Investment Needs for a Low-Carbon Energy System*, https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Mar/Perspectives_for_the_Energy_Transition_2017.pdf.

The emerging global crisis of land use

How rising competition for land threatens international and environmental stability, and how the risks can be mitigated

How will increasing demand for land play out?

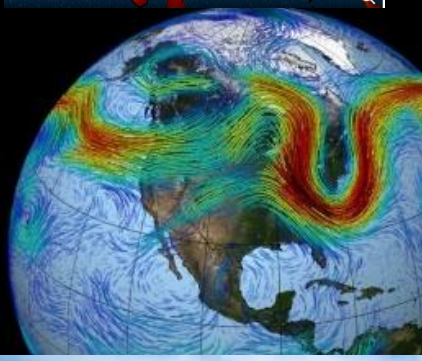
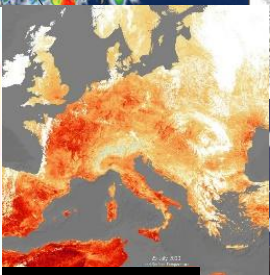
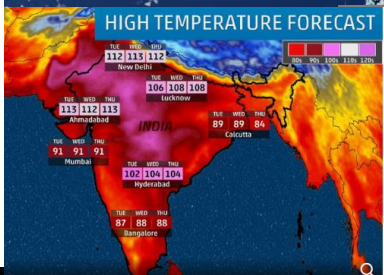
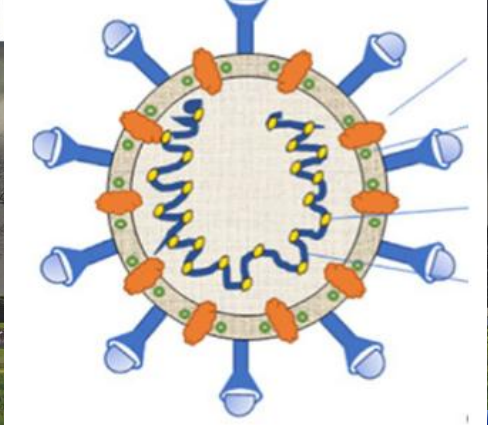
Figure 37. Countries' land wealth by each of the five featured PCA components



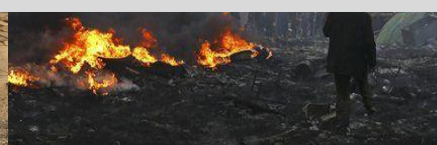
Note: PCA = principal component analysis.
Source: Authors' analysis.

'Land wealth' typology

- **“Land Superpowers”**: good land holdings, well governed, powerful for trade (e.g. US, Germany, China)
- **“Potential Land Elites”**: good land resources but currently less exploited (e.g. Zambia, Peru)
- **“Threatened Land Wealthy States”**: well-endowed with land but it is degrading and climate vulnerable (e.g. India, Kenya, Chile)
- **“Land poor elites”**: rich and powerful nations without productive land endowment (e.g. Singapore, Gulf States)
- **“Land poor developing countries”**: lower levels of development and without large endowment of high-quality land (e.g. Bangladesh, Sri Lanka, Niger)



Events happen that reshape markets, politics and attitudes



SCENARIOS FOR ROBUST STRATEGIC PLANNING

Scenarios “sample” plausible futures in order to plan actions that mitigate future problems and enhance opportunities

Scenario framework

A1: Geopolitics and stability: Will the world be increasingly volatile, conflicted and contested or return to cooperative, rules-based international relations and thus be calmer? How will climate change (extreme weather) and biodiversity issues (e.g. soil fertility, pests and diseases) interact with geopolitical and political drivers to create volatility, supply chain risks, people displacement and or conflict? How will geopolitical and geostrategic issues interact with e.g. energy transitions to accelerate or start to reduce the speed of climate change and the need for critical minerals? In short, will the world be more or less volatile?

A2: Economics and markets: Will global markets be the norm, or do economies - driven by contestation and conflict - become more regionalised, managed and securitized (more regionalised markets are likely to have to be more regulated to account for changes in availability and price; and “securitized” means trading preferentially with allies and perhaps more on-shoring)? In short, is the domestic economy more reliant on domestic production and trading preferentially with allies, and how might this effect prices and availability of goods (and thus impact on natural resources)?

A3: Attitudes to consumption and environment. Will economic growth – based on underlying material consumption – continue as the prime driver of economic development, with environmental considerations becoming subsidiary? Or will attitudes to the environment constrain consumption growth on the demand side (such as through developing a circular economy, through technology, or through adopting sustainable lifestyles)?

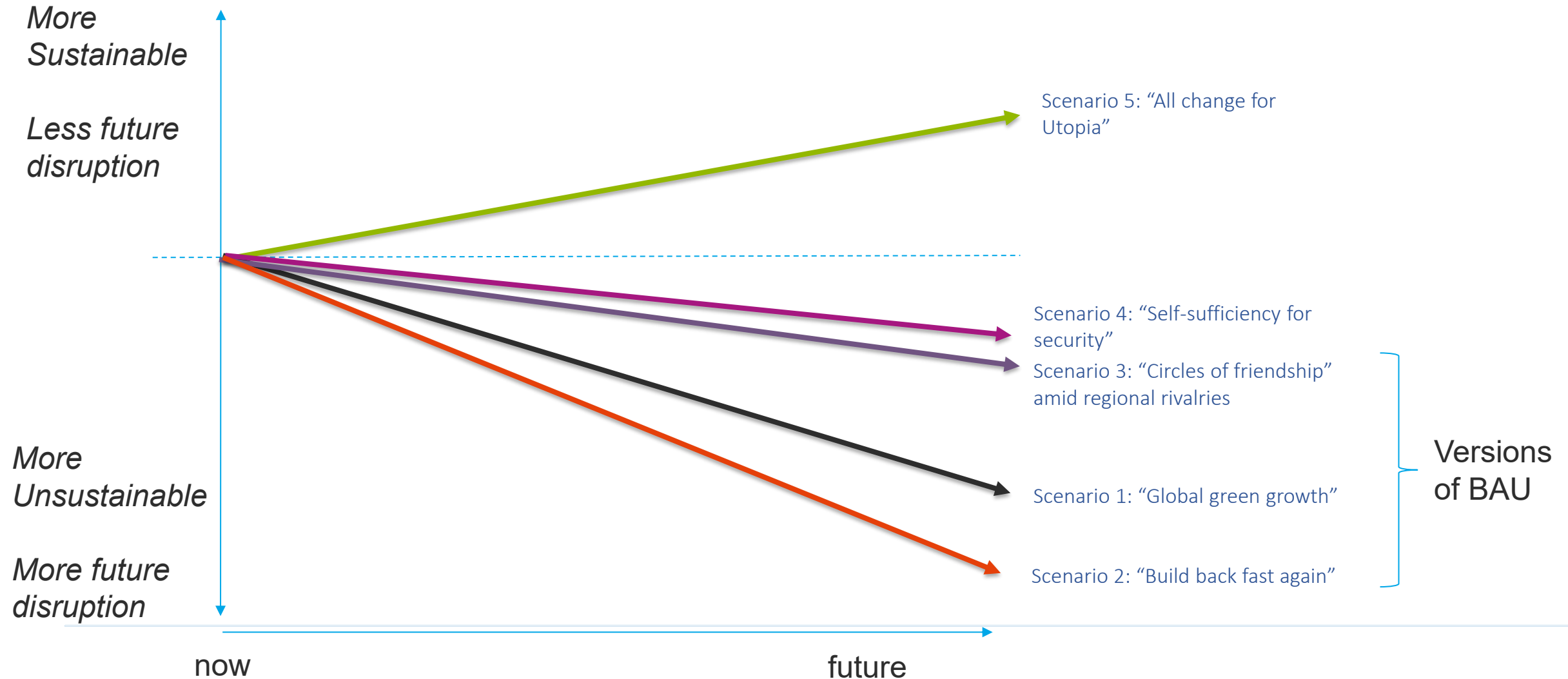
	Axis 1	Axis 2	Axis 3	
Scenario 1: “Global green growth”	Stable, cooperative world, with some climate disruption	Global markets and trade	Growth-focussed, but green growth (through tech efficiency)	Notes: BAU as might have been imagined 20 years ago
Scenario 2: “Build back fast again”	Unstable world with geopolitical tension/conflict coupled with climate disruption	Global markets and trade, but highly volatile	Economic growth fixated	Notes: BAU as per today
Scenario 3: “Circles of friendship” amid regional rivalries	Fragmented multipolar/ regionalised world, with increasing climate instability	Trade primarily with regional allies in blocs	Security driven need to consume within constraints on resource availability	Notes: Less extreme version of self-sufficiency scenario below
Scenario 4: “Self-sufficiency for security”	Unstable world, full of conflict, contests and supply chain disruptions	Little globalized trade, mainly domestic and regionalised markets	Security driven world of austerity	Notes: Plausible “world in conflict” scenario
Scenario 5: “All change for Utopia”	Stable, cooperative world, with some climate disruption	Global markets and trade	Well-being orientated, sustainable living with low consumption	Notes: What would a sustainable lifestyle-driven world really be like?

<https://www.agrifood4netzero.net/agri-food-system-2050.html>

Univ Leics “Future environmental agenda” (Benton et al, in prep)



Plausible futures will likely drive more disruptive outcomes



Scenario exercises conclusions

- **Environmental pressures will get more intense** if the global system volatility (climate x geopolitical/security tensions) increases, as maintaining the current system – through increasing defense spending and business as usual approaches - will soak up more fiscal headroom.
- Two routes from volatility to sustainability most likely:
 - **A world of global conflict and serious interdiction of international supply chains**, would see an impoverished, de-globalised and localized, future, where excessive consumption is constrained. Such futures (*Circles* and *Self-sufficiency*) reflect worlds of austerity.
 - Pain and environmental anxiety can increase to **cause a soft-revolution, creating the political space for economic restructuring based on more sustainable lifestyles** and changing consumption for the better. This world (*Utopia*) would be unstable as it requires global cooperation.
- In all scenarios, **adaptation to climate change is required**, and mitigation is typically deprioritised. In most futures, **nature will remain exploitable** if economically beneficial.
- Many scenarios have more volatile trade, leading to a changing balance in favour of “**on-shoring**” **more domestic production for domestic consumption**. This may tackle elements of security but will lead to price increases. Price and availability changes may increase pressure on natural resources, as well as **fueling a degree of populist push-back on the cost of environmentalism**.
- In most futures, **political polarization and misinformation increases**, particularly from incumbents want to reserve the status quo.

IMPLICATIONS OF SCENARIOS FOR THE UK FOOD SYSTEM

The risks to food supply are often underestimated through ignoring cascading and compound effects

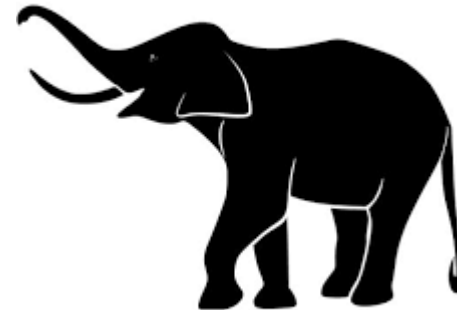
The metaphorical zoo of future disruption

Potential disruptors of food system: drought, flood, heatwave affecting one or more production areas; pests and diseases; disruption on port or transport infrastructure; disruption on centralised processing facilities; problems with labour caused by climate hazards (diseases, movement, instability); contestation and conflict etc etc etc

Turbulent
Uncertain
Novel
Ambiguous



Black swan:
perceived rare,
high-impact events



Black-elephant-in-the-room: If there are 1000 potential black swan events, each at 1/1000 probability, then something is **very** likely to happen



If we can't predict the exact risks, only that "something will happen" we need to focus on resilience:

Properties of resilience to reduce exposure and vulnerability (broadly applicable at state or farm enterprise level):

Ally shoring and/or diversification of supplies of critical goods.

Increasing self sufficiency/on-shoring.

Increasing redundancy/storage.

Securitising food supply – increasing self-sufficiency, ally-shoring - for national security may make the world more unstable by reducing market capacity....

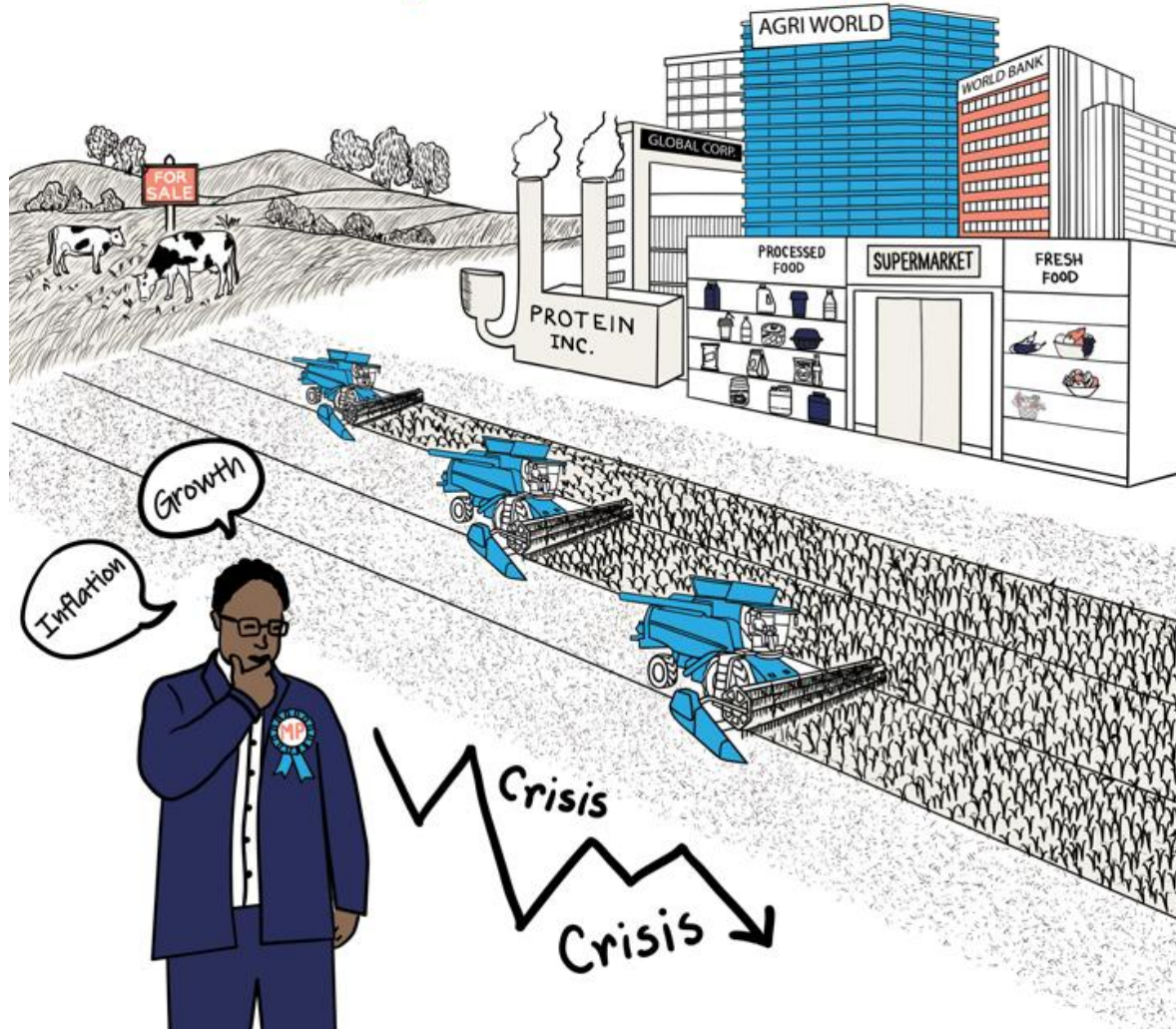
Avoiding single points of failure.

Development of increased flexibility/agility/substitutability/or reducing demand and doing-without.

Early identification of and intervention in hotspots of risk.

A Business-as-usual scenario: keep on doing what we're doing and adapt to more disruptions

'BUILD BACK FAST (AGAIN)'



An unstable, globalized world which most values economic growth and sustainability “too difficult”

- **Farmscape:** (Un)sustainable intensification, land sparing, tech-driven. A world of ultra-processed foods. Much volatility – resilience is important. Adaptation of farm businesses to volatility is key (e.g. soil management, diversification).

What would be needed?

- **Resilience building**, and how to maximise mitigation when building adaptation? **Tech for RUE, yield maximisation**
- Need for land-use strategy/incentives to ensure the right land is used in the right way
- Food insecurity and inequality growing: how to mitigate by producing more food, more cheaply in a crisis?

CONCLUSIONS

Food x climate x politics = an uncertain future



Turbulent; Uncertain; Novel; Ambiguous (TUNA)

“Business as usual” is perhaps the least likely form of the future in the medium term

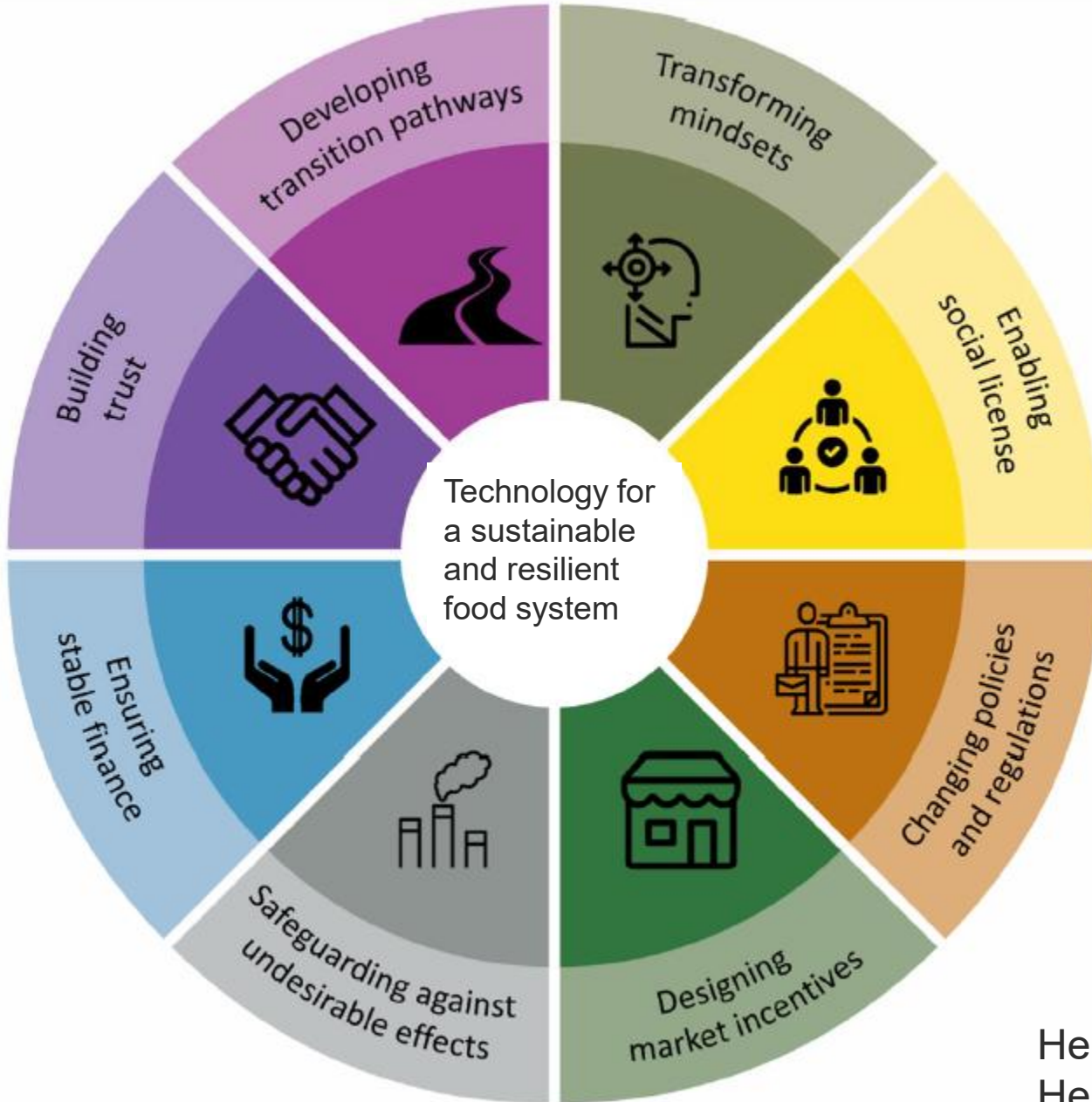
- **Our current system is locked-in to its current configuration (ideologically via economic growth and CFP; practically through consolidation of major players and path-dependency). Trade reliance and unsustainability are features.**
- **The action gap will grow faster than the ability to mitigate the risks as political and geopolitical change interacts with supply chain disruptions to drive more “nation first nationalism” in a contested world, where there is little international law and what is possible is defined by how countries wish to project power**
- **BAU approaches are likely to continue until they fail. Volatility/disruption (markets, trade, weather) likely to increase over time.**
- **Food is part of national security. Taking a ‘security lens’ (instead of a ‘maximise productivity’ lens) creates more space for realistic food system transformation that delivers in this volatile world**

Implications for agriculture and food

- **“Resilience” – adapting to volatility – will become ever more important for farms, food business and citizens.**
- **Ensuring food security (which is not the same as maximising farming productivity) will become a stronger systemic goal: affecting who we trade with, for what, and how; and what we grow, for whom, how and where**
- **In many futures, agro-ecological, circular, diverse farming approaches are more desirable, if not central to them (for ecological, economic and security reasons)**
- **Changes to the supply side (agriculture) go hand-in-hand with changes in the demand side (from dietary change and waste reduction and changes to market incentives/disincentives).**



Innovation for change: beyond tech



- **“silver bullets” from technology alone will not solve the systemic problems**
- **innovation across multiple social, economic and governance arenas is needed**
- **The “innovation pull” – what solutions are needed - will crucially depend on the state of the world ahead and how they determine political, social and market drivers**

Herrero, M, et al. 2020. *Nature Food* 1: 266–272.

Herrero, M, et al. 2020. *Lancet Planetary Health*

Barrett, C, et al. 2020 *Nature Sustainability* 3: 974-976

Thank you!

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