How shocks related to the war in Ukraine impact the global food system

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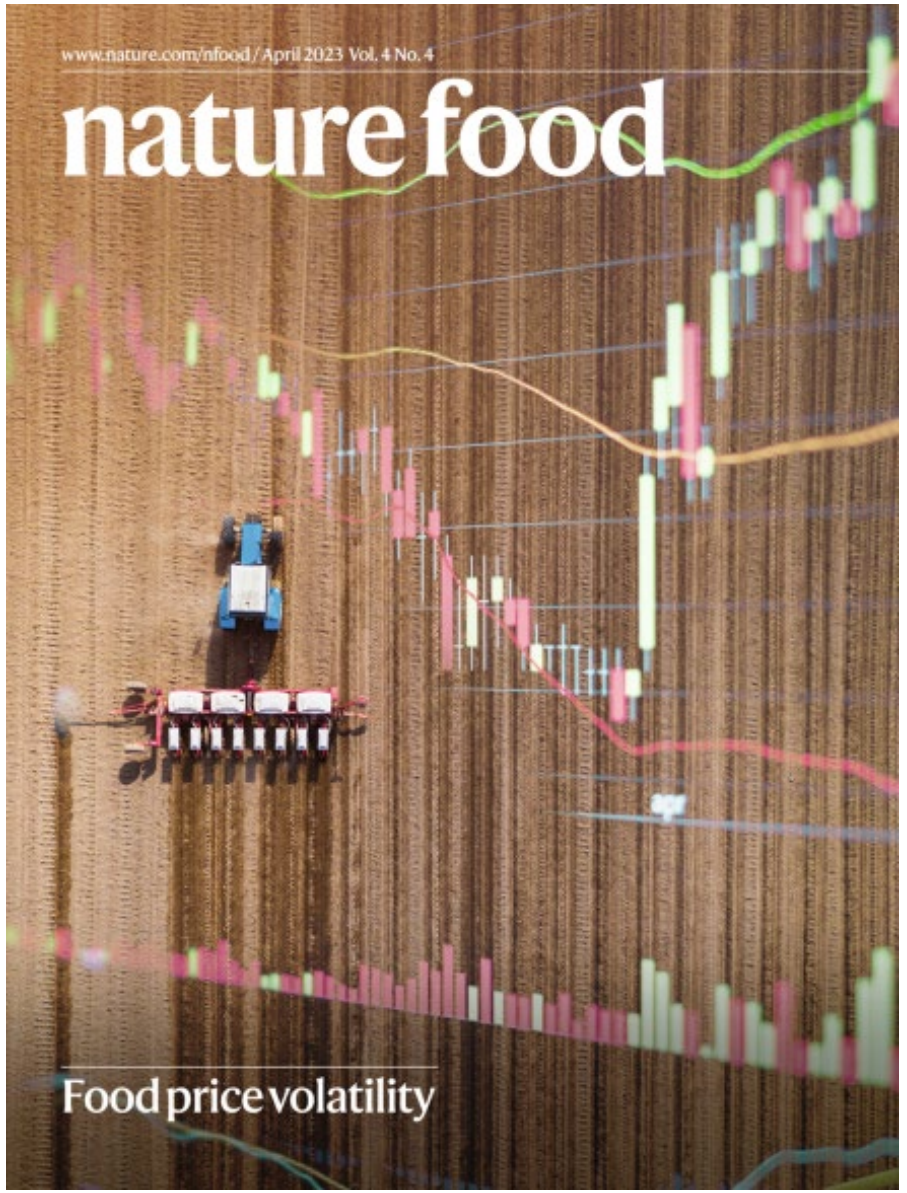
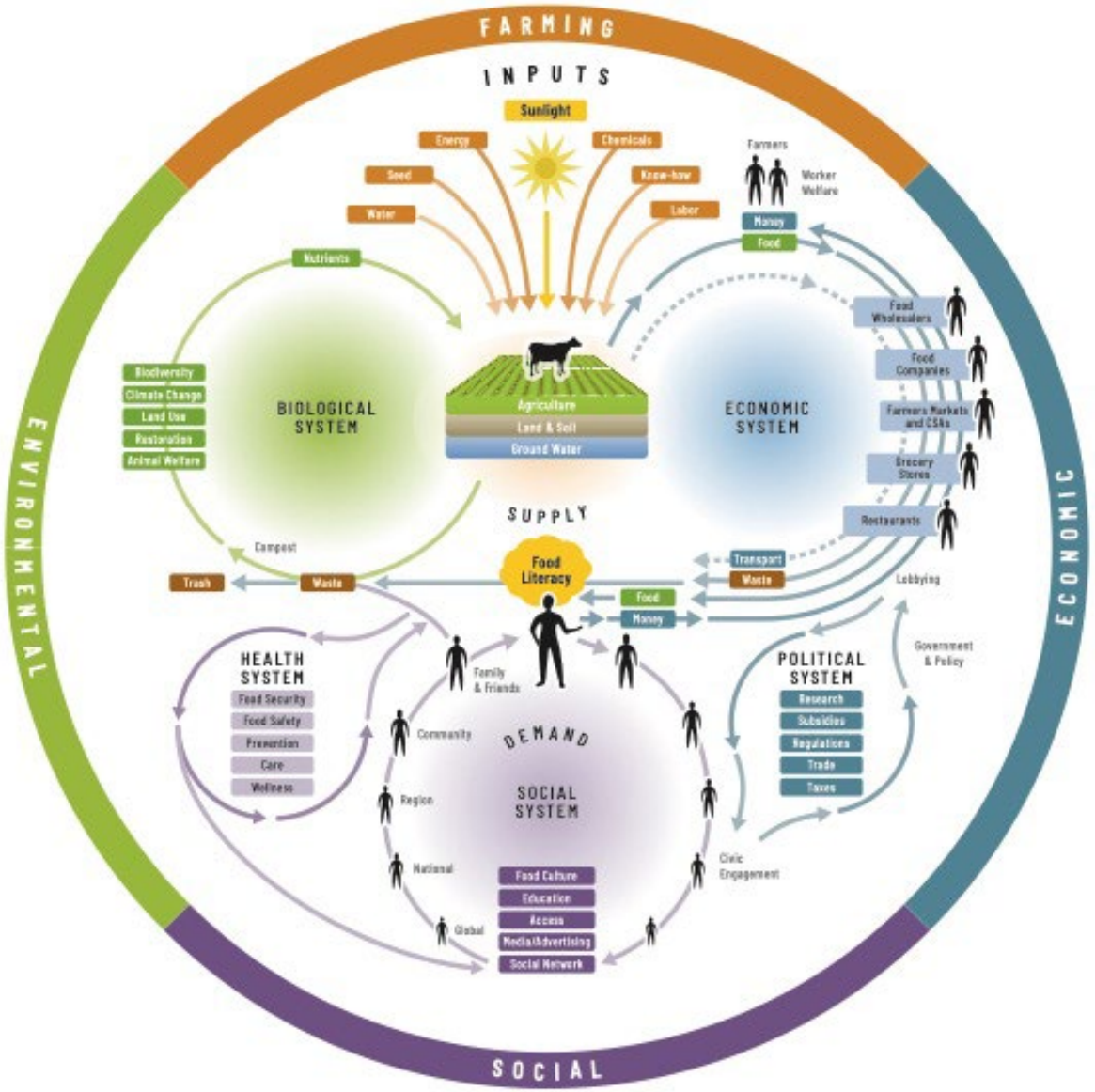


Contents

- War in Ukraine as an example of trigger for cascading risks for the food system
- Portrayal of food system implications of war in Ukraine
- Scenarios and modelling conducted
- Nutrition and environmental outcomes
- Reflection on impacts from this type of shock

Shocks can affect different parts of the food system

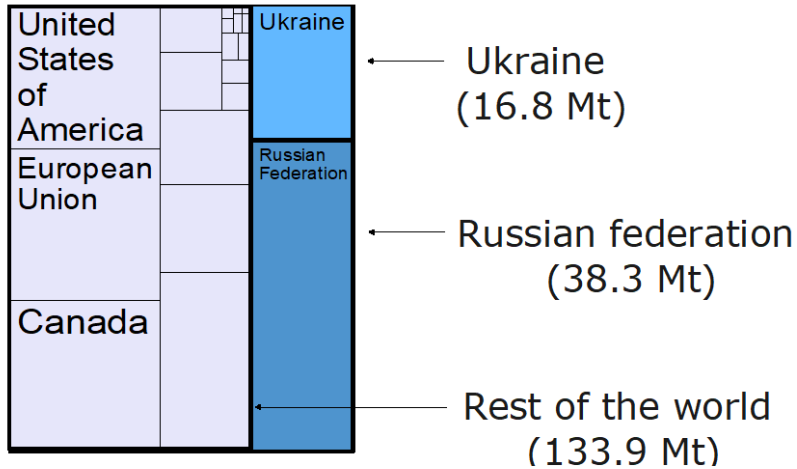


Source: Nourish Life

War in Ukraine: a shock to global food trade

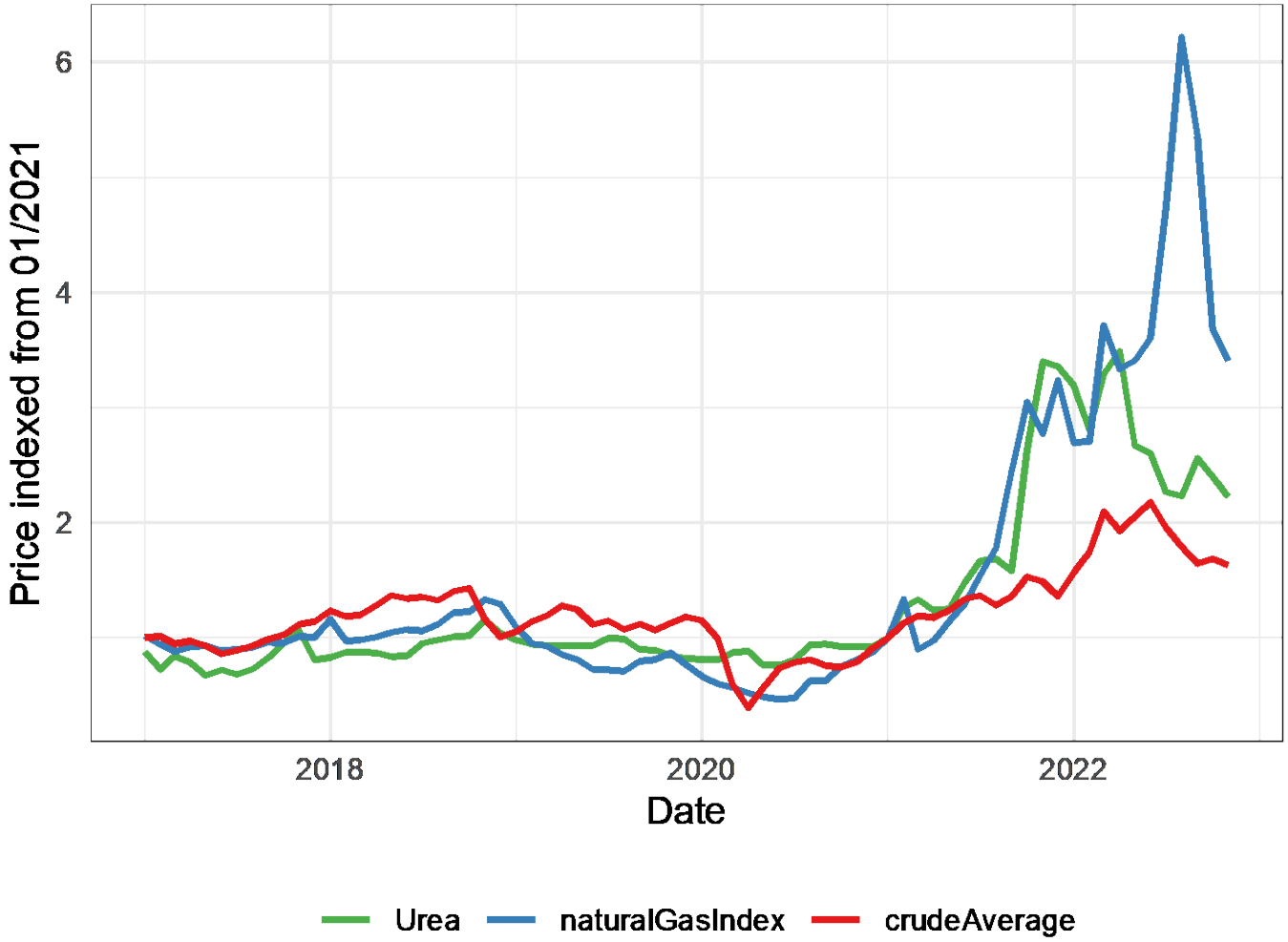
- Russia invaded Ukraine on 24 February 2022, but tensions had been building for some time.
- "*As a leading exporter of grain, Ukraine has seen a dramatic drop in its exports, resulting in major food security concerns for millions of people around the world*", European Council of the EU
- "*Russia and Ukraine produce 30% of the world's wheat supply and - prior to the war - Ukraine was seen as the world's bread basket*", BBC, May 2022
- 29% of global exports of wheat from Russia (20%) or Ukraine (9%), in 2021, Some countries highly exposed
  - Egypt imported 84% of wheat imports from Russia and Ukraine
  - WFP bought half of its grain from Ukraine
- Black sea route critical for exports from Ukraine
  - initially blockaded by Russia
- Russia under sanctions (e.g. by EU and US)
  - although not on food and fertilisers.

Global wheat exports in 2021



War in Ukraine: trigger for higher agricultural input costs

- Fertiliser prices
  - Inorganic N produced using natural gas
  - Disruption to fertiliser exports
  - Price tripled, in 12 months to May 2022
- Higher fuel prices
  - Increased costs of machinery use
  - Higher transport costs
- How much is caused by the war in Ukraine is unclear



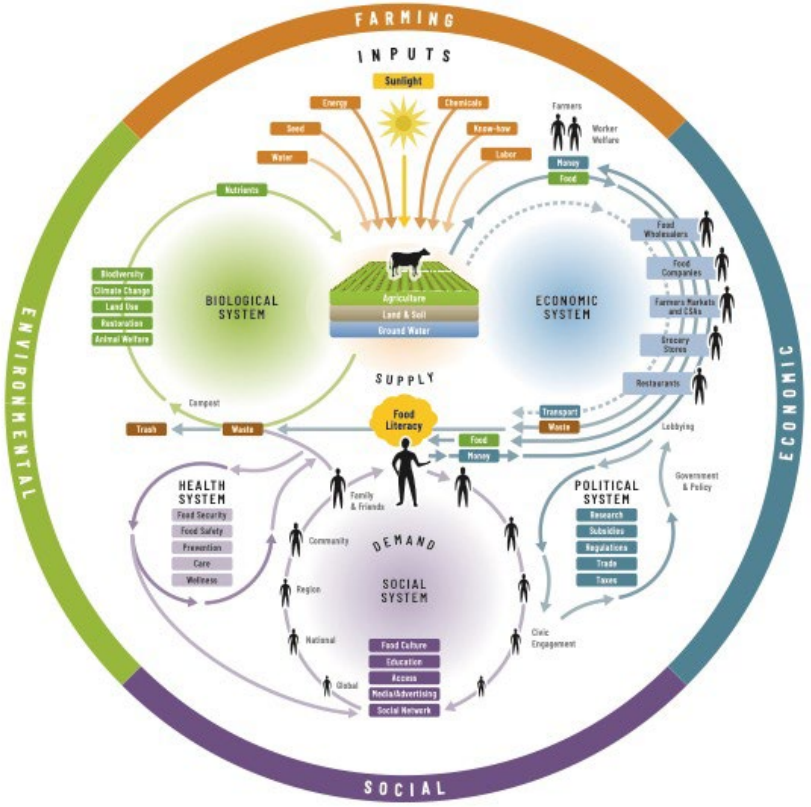
Data from https://www.worldbank.org/en/research/commodity-markets

How is global food systems impacted and which are the main drivers?

Types of shocks

- international trade disruption
- Fertiliser prices ↑
- Energy prices ↑
- Transport costs ↑

But, how are the different outcomes impacted by difference aspects of the shock? With implications for focus of responses



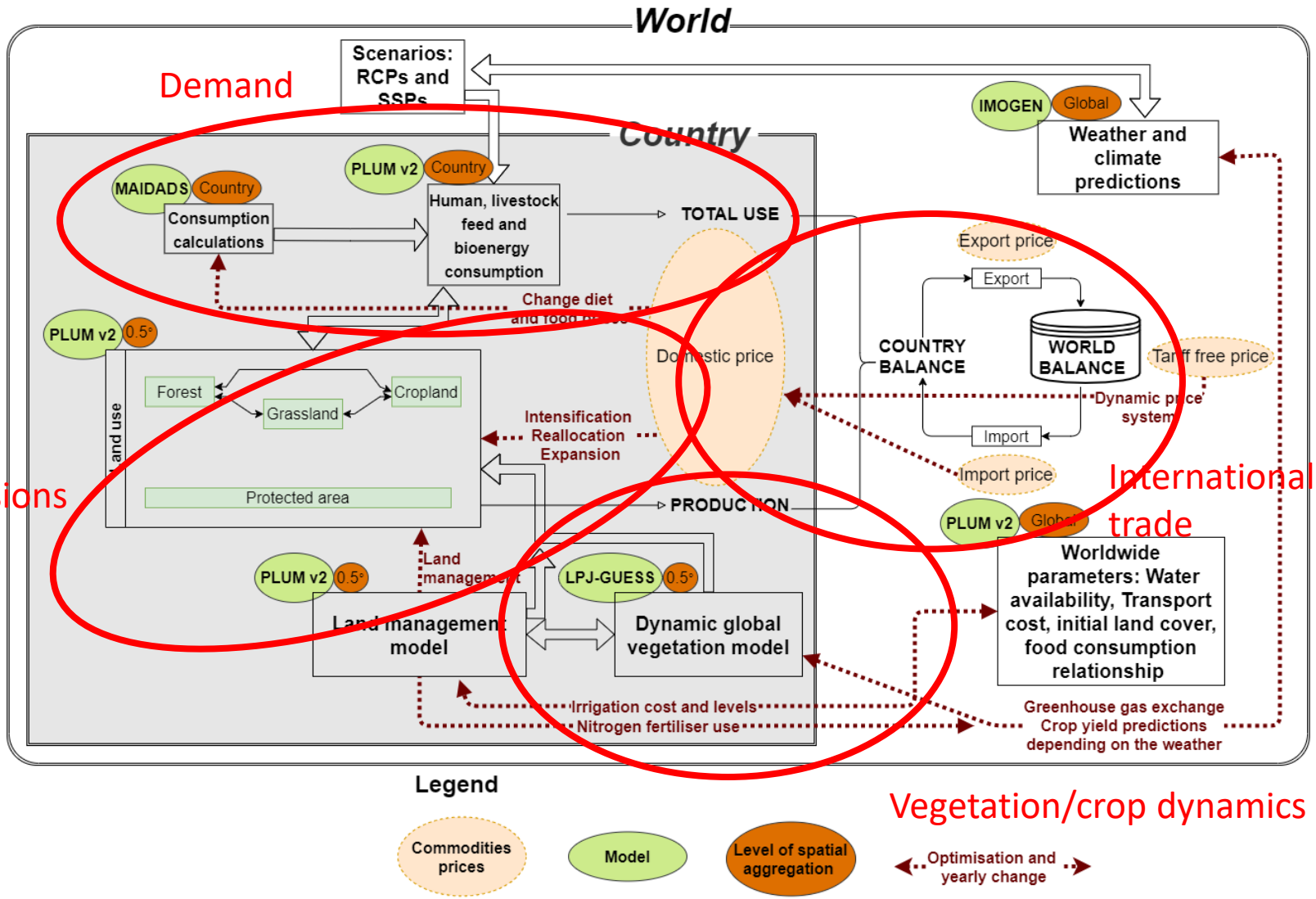
Example outcomes

- Agricultural other land cover areas
- Fertiliser use and ag intensity
- Food prices
- Diets
- Human nutrition and health

Need to use modelling to try to answer this question.

Land System Modular Model (LandSyMM)

- Model of the global food and land system
  - couples land use decision making, food demand, global trade, ecosystem processes, biodiversity, and the climate system.
- For further details see https://landsymm.earth



Scenarios exploring two routes for impacts

Scenarios designed May 2022

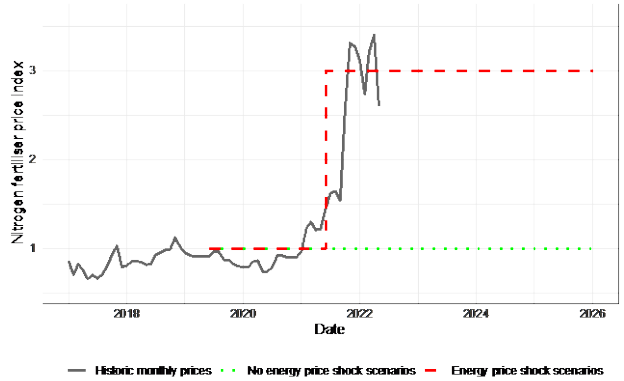
Impact types

A. Impact on food export market

- Restrict exports from Ukraine and Russia to between 50 and 100%

B. Energy prices

- Tripling of fertiliser cost
- Increase management intensity cost by 50% (for fuel)
- Increase transport costs by 50% (for fuel)



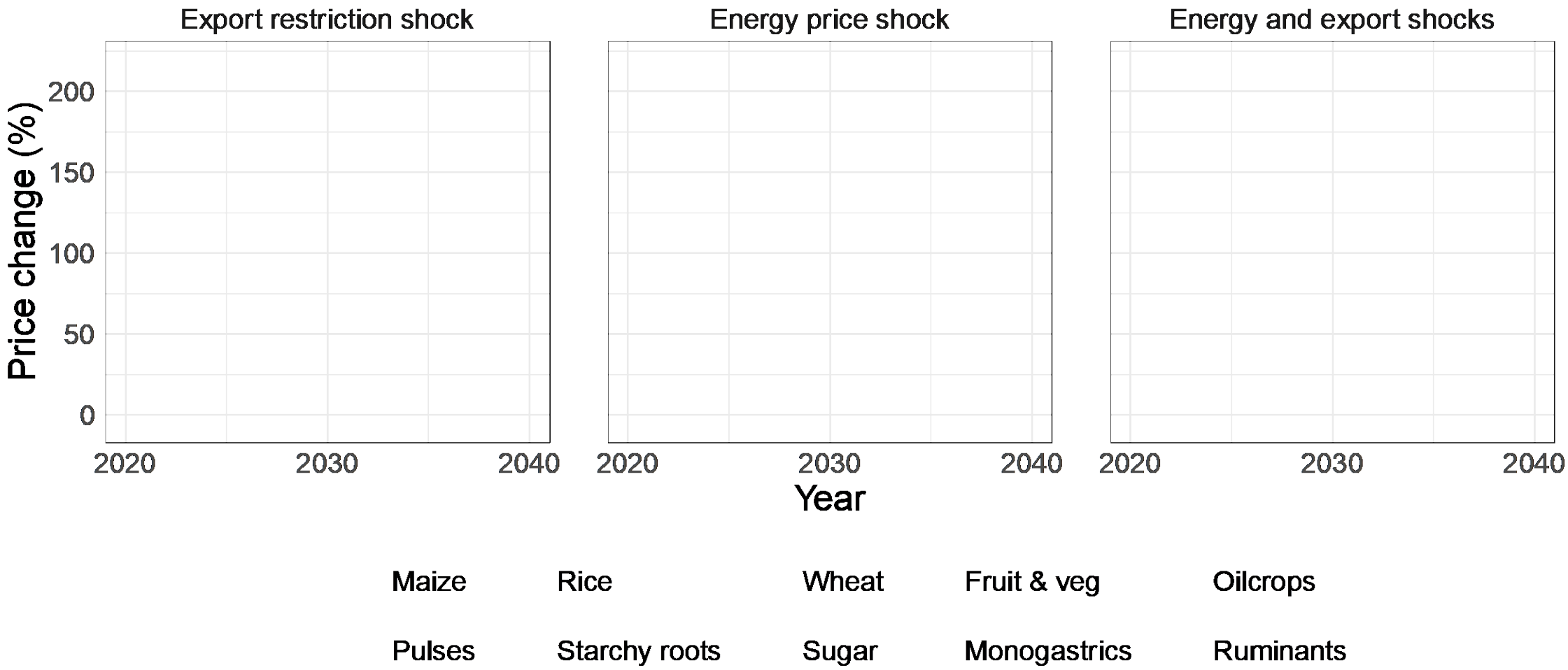
Scenarios

International food commodity trade conditions

Energy and fertiliser price change

Higher energy and fertiliser prices	Energy price shock (B)	Energy and export shocks (A & B)
No energy or fertiliser price increases from 2021	No shocks	Export restriction shock (A)
	Business-as-usual for food exports	Food exports from Russia & Ukraine restricted

Food commodity prices increased by shocks



Impact on total food price inflation

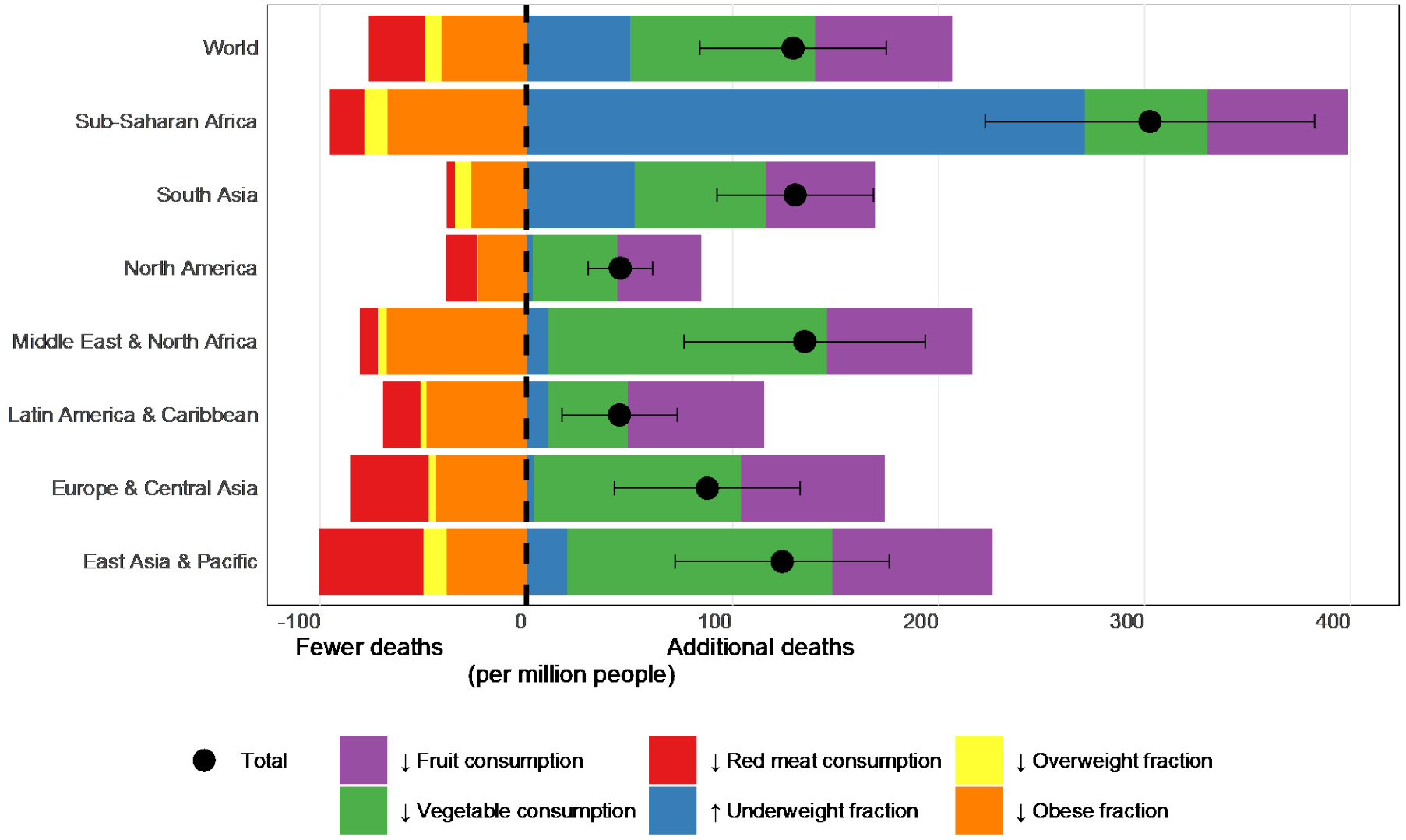
Percentage change 2021-2023 in food commodities consumed in each region with constant 2021 consumption quantities (i.e. a Laspeyres index). Median ensemble values, and 90% quantile range in bracket shown.

Region	Scenario		
	Export restriction shock	Energy price shock	Energy and export shocks
East Asia & Pacific	2.4 (1.1-5.4)	77.5 (62.6-97.7)	83.8 (62.5-108.2)
Europe & Central Asia	2.5 (1.4-5.5)	69.4 (57.9-87.7)	77.3 (58.1-100.5)
Latin America & Caribbean	1.8 (0.8-4.3)	66.8 (53.8-83.8)	71.6 (52.4-92.0)
Middle East & North Africa	3.2 (0.9-7.1)	72.6 (58.7-87.4)	82.1 (63.2-101.3)
North America	2.8 (1.4-6.1)	72.4 (60.2-87.9)	81.0 (61.6-100.9)
South Asia	3.3 (0.5-6.7)	75.4 (61.2-91.0)	84.7 (65.4-101.4)
Sub-Saharan Africa	2.6 (0.5-5.0)	72.2 (57.1-85.0)	79.1 (60.6-96.3)
World	2.6 (0.8-5.9)	74.1 (59.2-89.8)	81.2 (61.5-100.4)

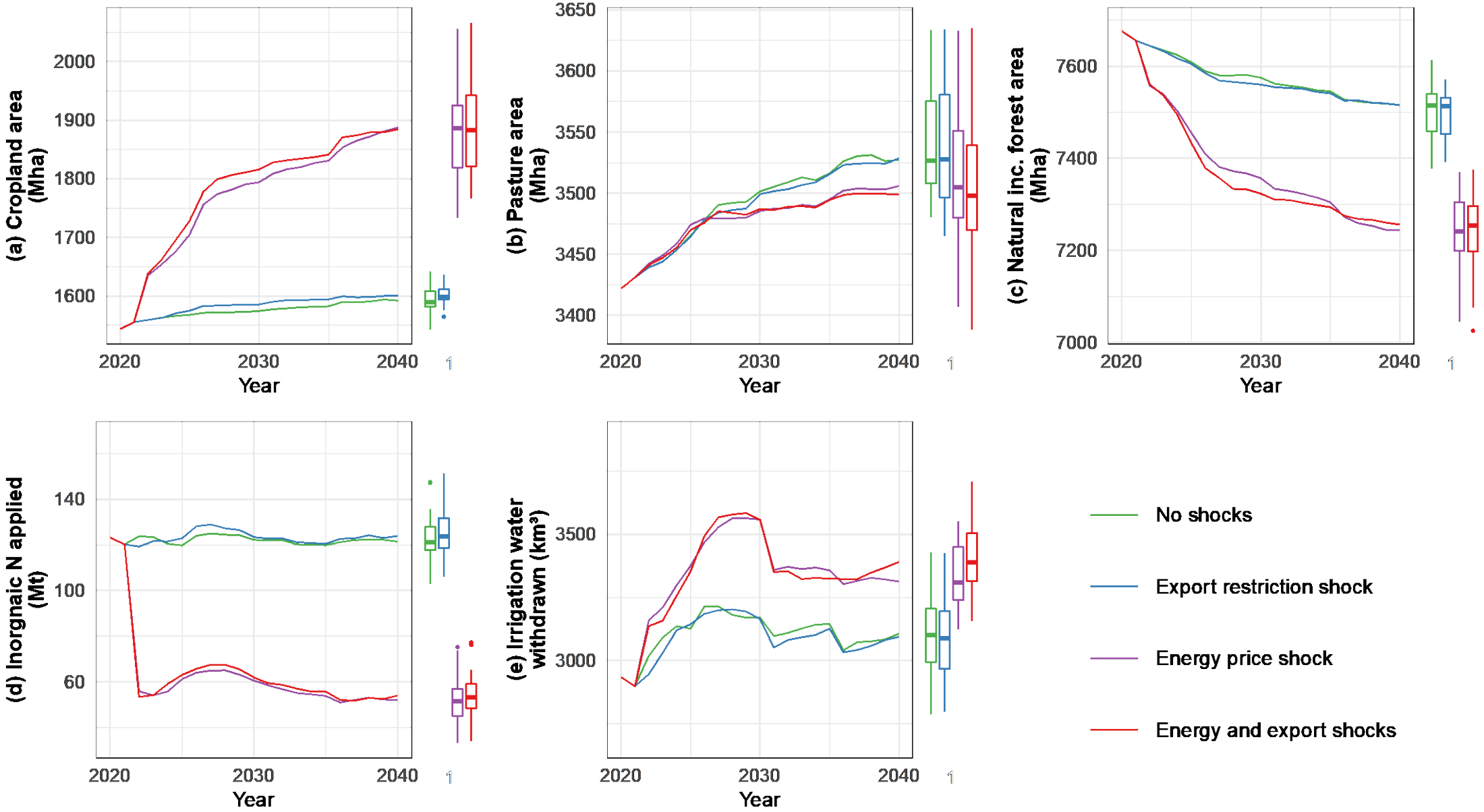
Implies an annual food price inflation of 34.6%

Large price increases create human health and nutritional consequences

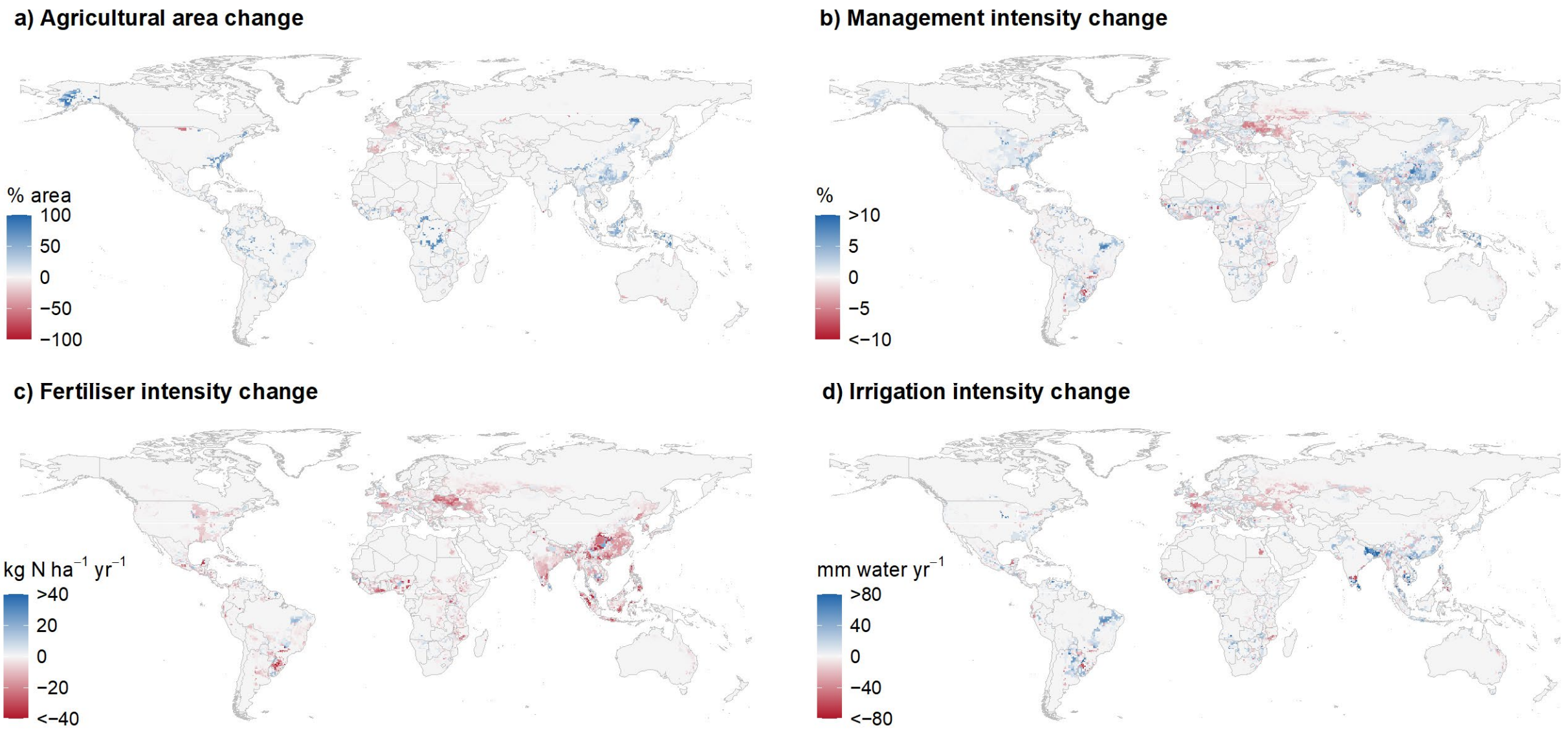
- Rising malnourishment and related deaths.
- Undernourishment of 60-110 million additional people
- 0.4 – 1.0 million net annual additional deaths globally, despite some reduction in obesity related deaths.



Global environmental impacts: deforestation



Environmental impacts: production input substitution

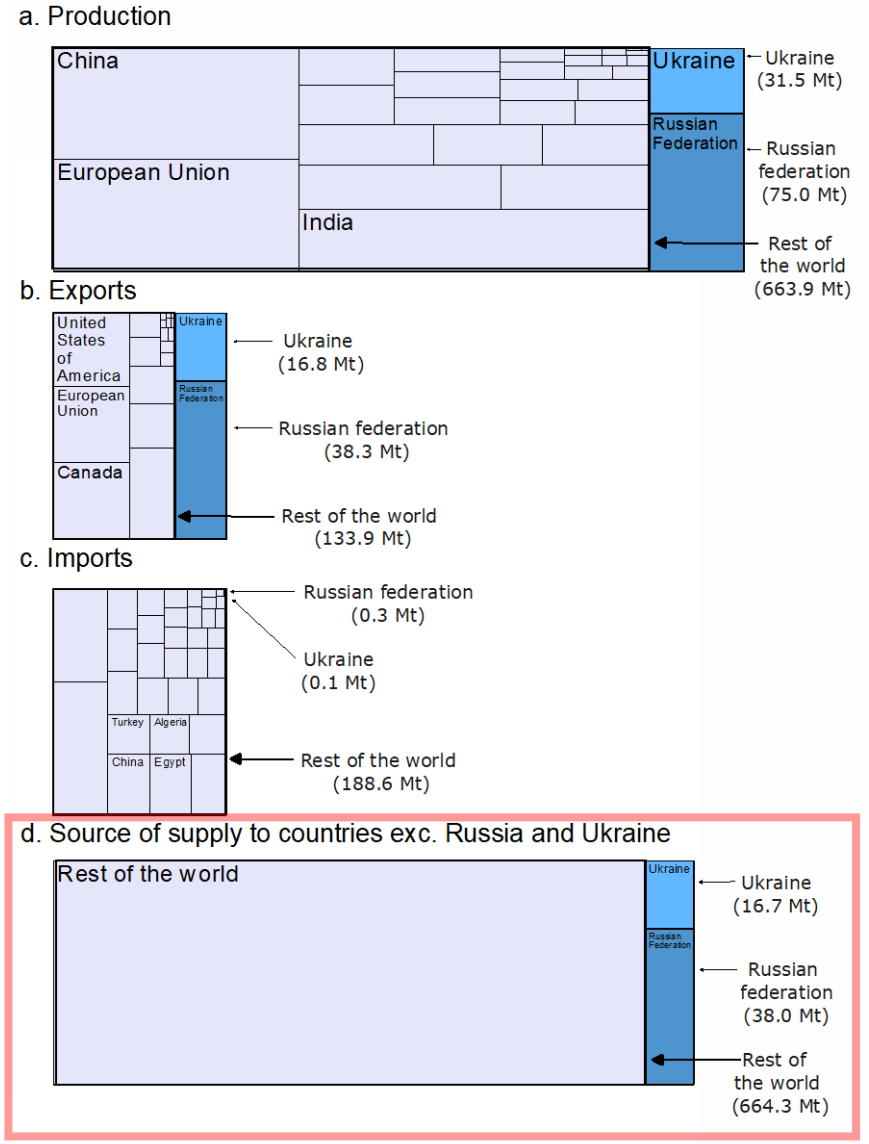


Land use changes at 2030 for energy and export shocks

Telling the story another way: **Domestic production**, stocks and substitution

- Reporting, e.g. “Russia and Ukraine produce 30% of the world's wheat supply” (BBC), is wrong
  - Even when correctly stated as global exports emphasis is quite misleading

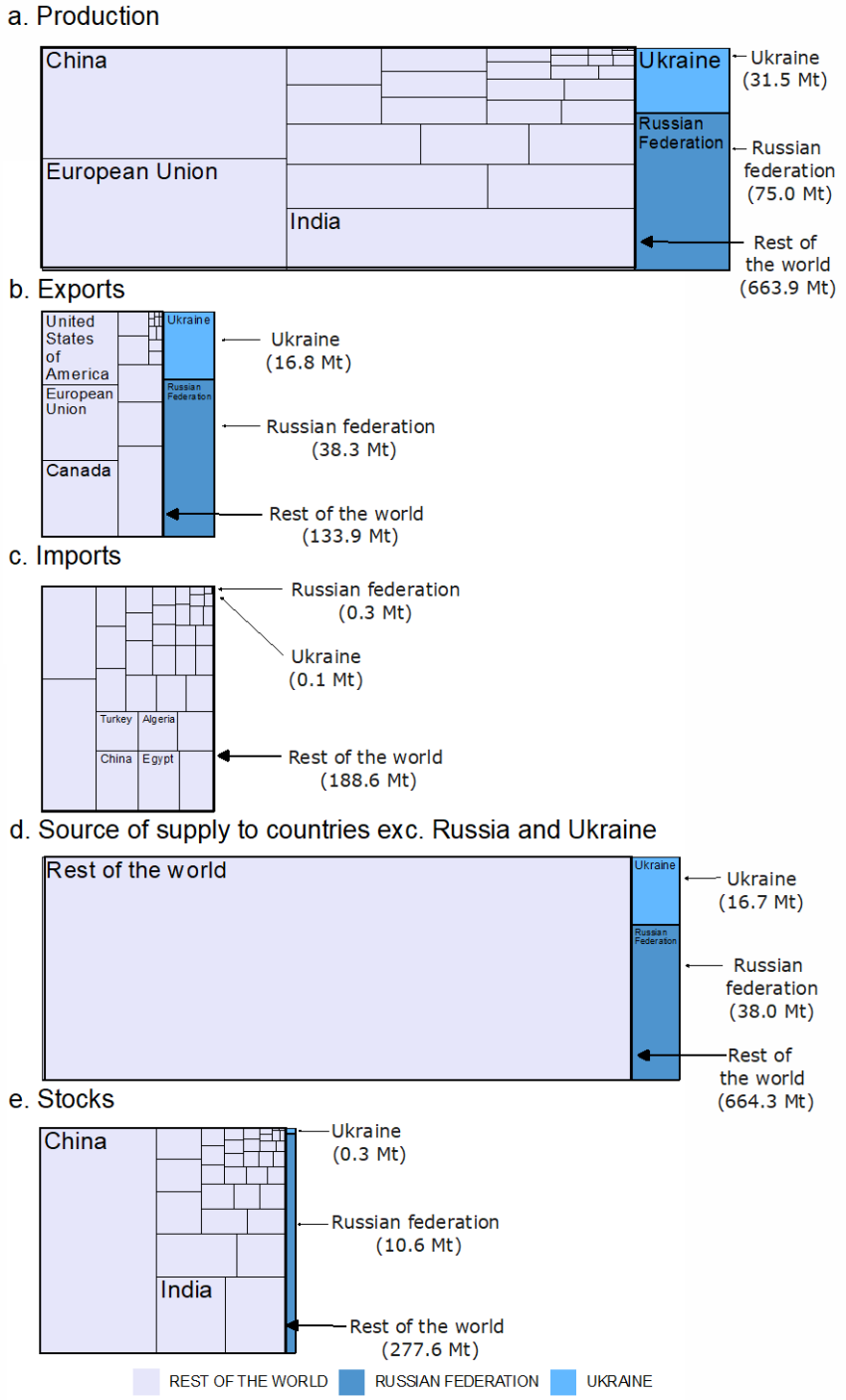
- International trade only part of food supply
  - 76% of wheat produced and consumed domestically (83% for cereals)
  - Exports from Russia and Ukraine provided **7.6% of rest of the world supply** for wheat (3.5% for cereals)



Telling the story another way: Domestic production, stocks and substitution

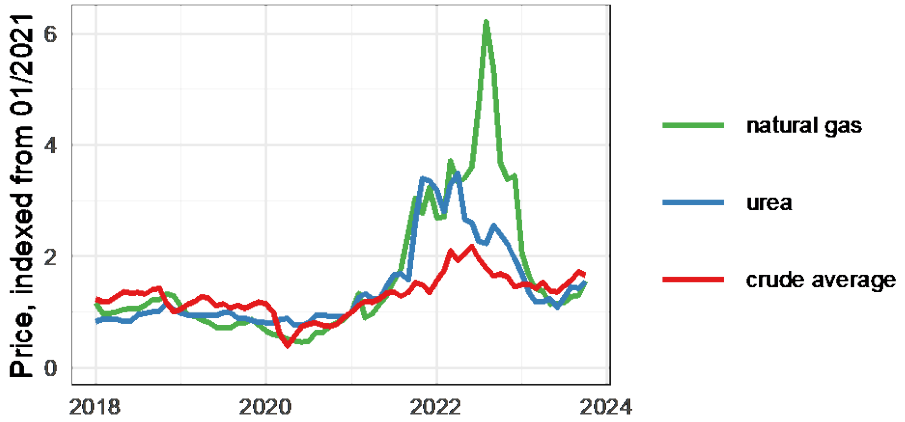
- Stocks - Buffer losses
  - Wheat: 278 Mt stock in rest of world - equiv. 5 years RUS+UKR export
  - Cereals: 803 Mt stock in rest of world - equiv. 8 years RUS+UKR export

- Substitution - Cereals not just used for food
  - Wheat: 148 Mt feed and 92 Mt other uses (total 31%)
  - Cereals: 1020 Mt feed and 481 Mt other uses (total 53%)

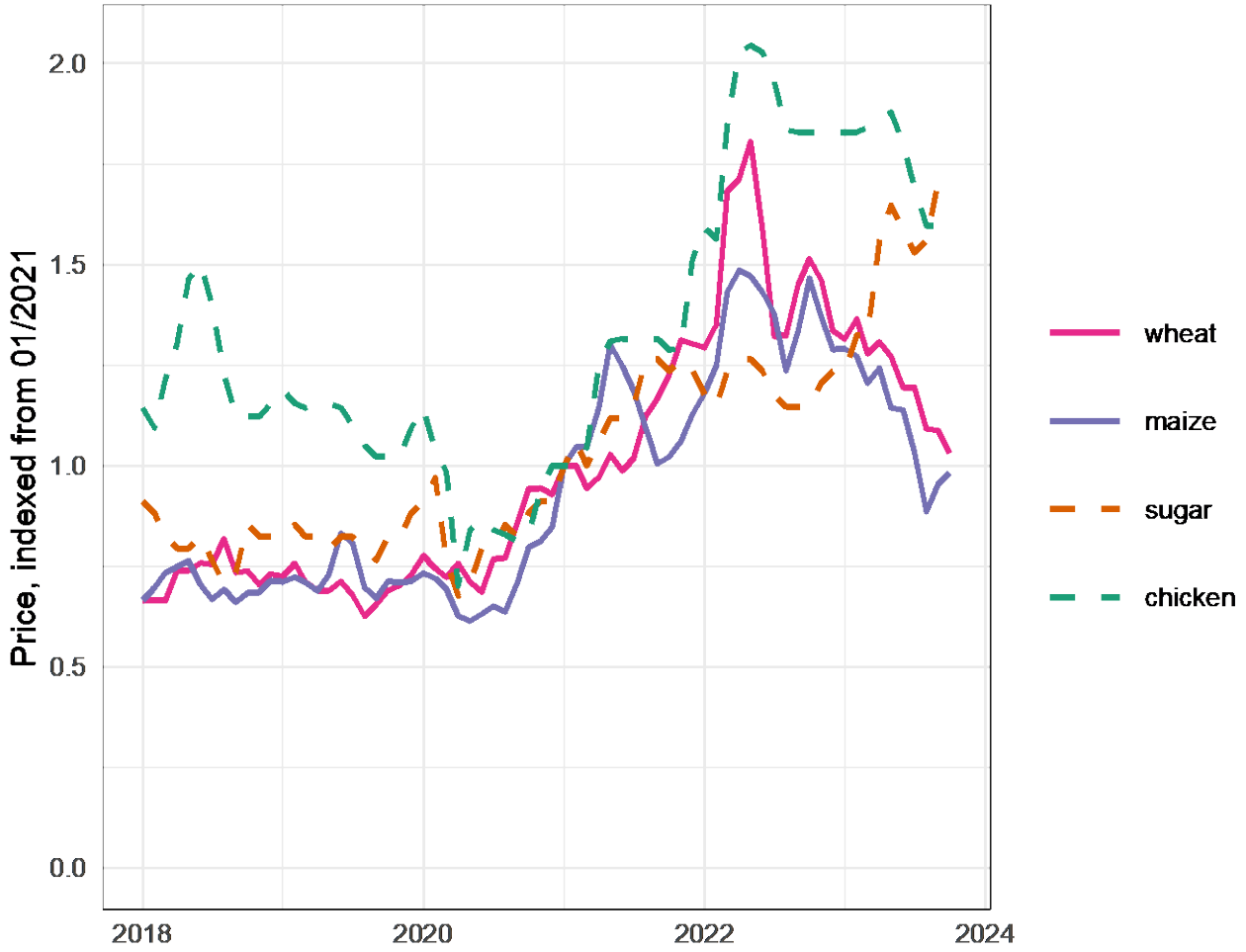


More recently

- Inputs prices shock largely gone



- Food commodity prices have also returned closer to historical levels
- Evidence of reductions in fertiliser demand and crop planting, which may having contributed to price spikes
- Model work did not simulate removal (or moderation) of energy price shock



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Final remarks

- War in Ukraine is an example of shock triggering cascading impacts to the food system
- Need to consider not just climate/weather events, but geopolitical, economic, technological, etc. shocks/stresses
- In the case of war in Ukraine, energy price rises a much greater impact on global food supply, health & environment than Ukraine/Russia export restrictions
- Potential for health of millions to be impacted, as well as environmental harms
- Academic publication cycle not good at responding to real-world events

Thank you

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