University of Nottingham
Food Systems Institute

Farming Futures for UK Agriculture

Professor Paul Wilson

Director, Centre for Food Policy and Foresight

Sowing ideas, cultivating solutions

Sustainability Community Nutrition

Food System Institute: World-leading Interdisciplinary Research

Our focus

Our ambitious research endeavours address challenges across three pillars:

Sustainable and resilient food systems

Making our food systems less fragile

Food, Community and Society

Shaping our food system along side communities and society for health and sustainability

Food, Nutrition and Health

Improving population dietary health for a reduced death toll

Centre for Food Policy and Foresight

Deliver Impact – translate research to policy and practical recommendations

Nottingham Together – 50 colleagues from across range of Schools within CFPF; **largest UK HEI Food Policy Centre**

Foster Collaboration – policy demands interdisciplinary approaches and systems thinking

Identify Research Gaps – guiding research possibilities

Setting Research and Policy Agendas – priority setting, urgent and emergent challenges, funding focus

Reputation and Representation – getting UoN on the food policy map and in driving debate, nationally and internationally.

Farming and food are …. complex

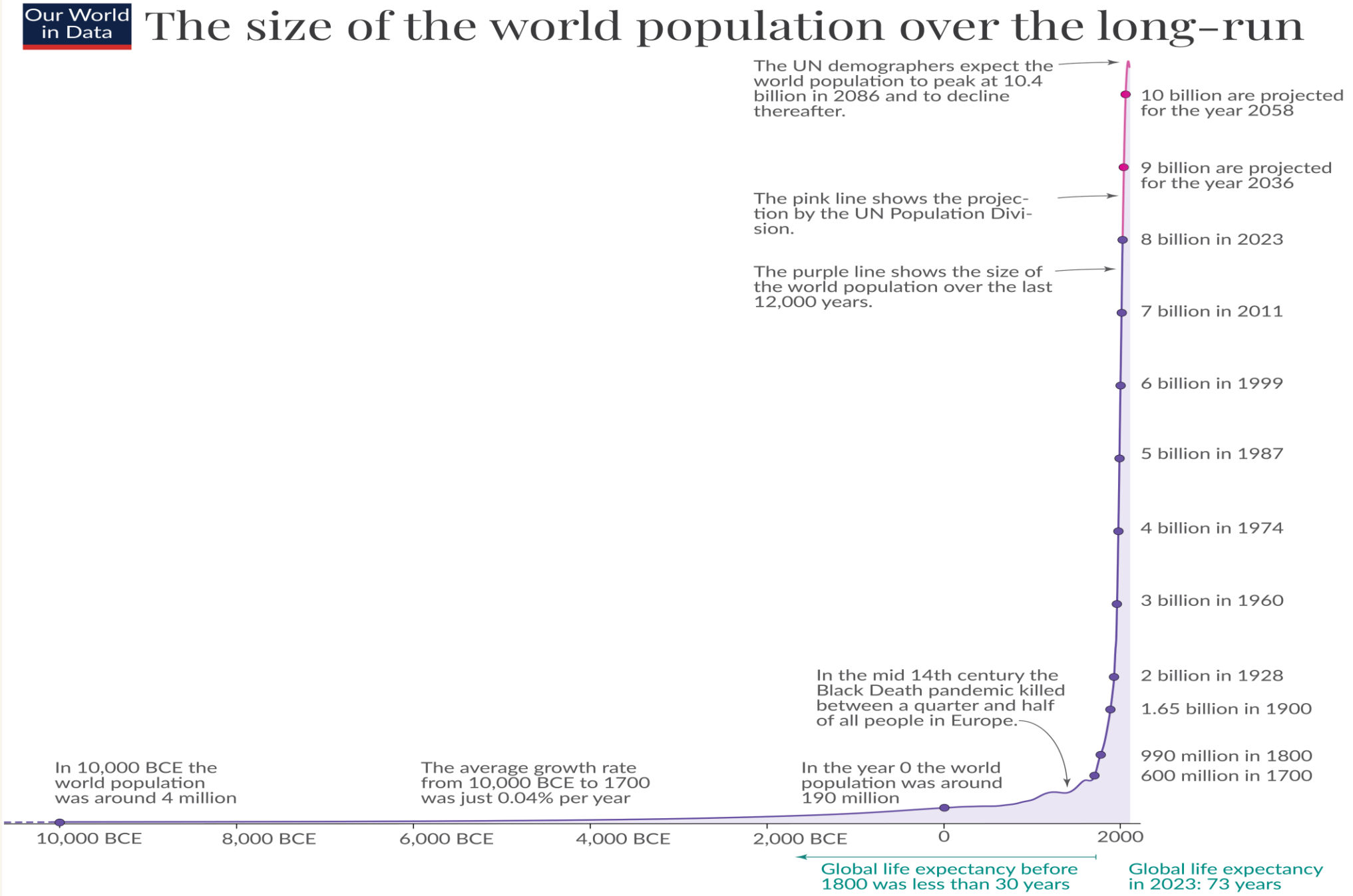
Farming and food is …. important

37% of global land use
26% of global workforce
9% of world undernourished
25% of total GHGs

70% of global water use
4% of global GDP
8.2bn people rely on for food
8% of all trade is for food

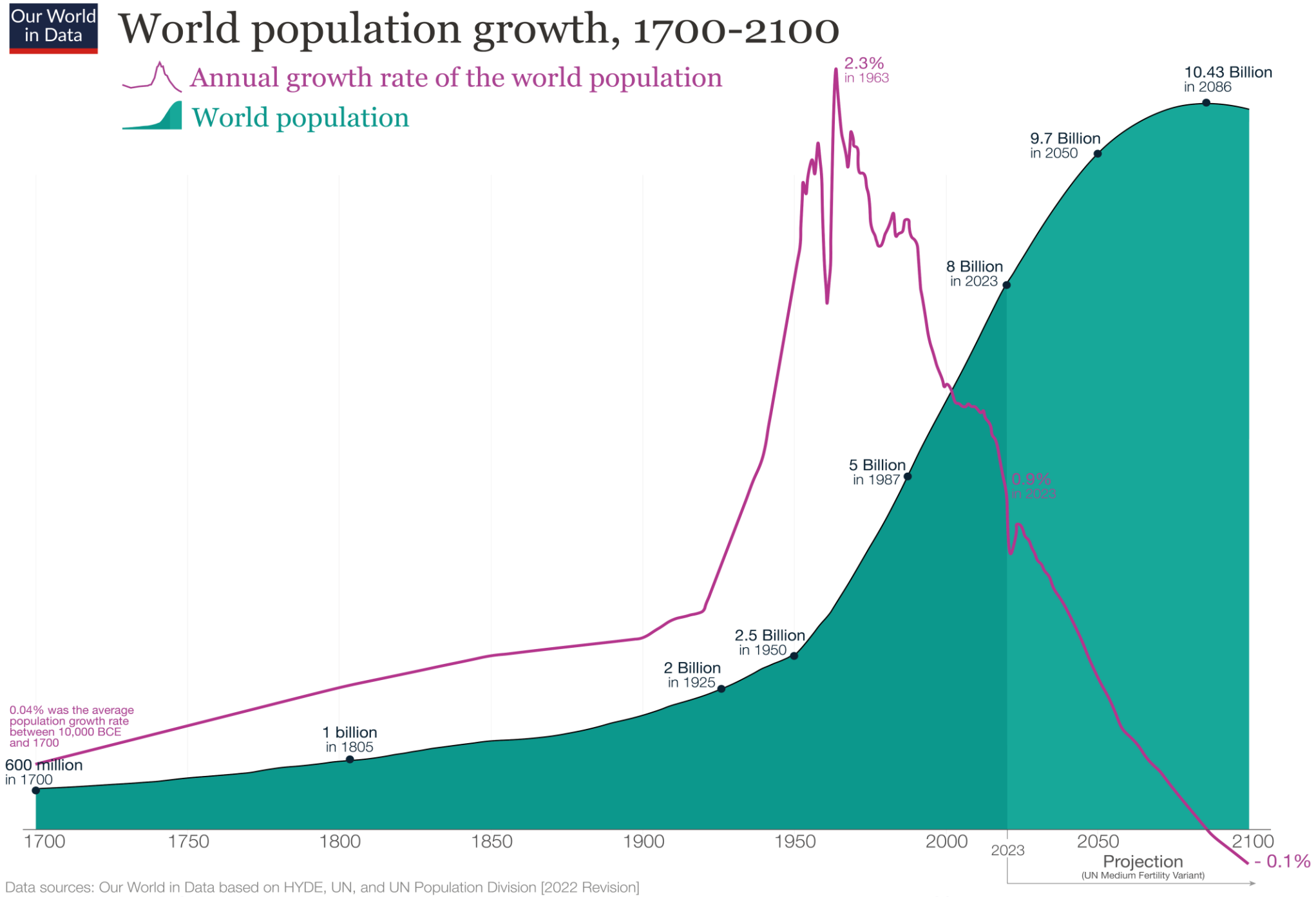
Rapid growth in world population

Source: our world in data



Population growth increase is slowing

Source: our world in data



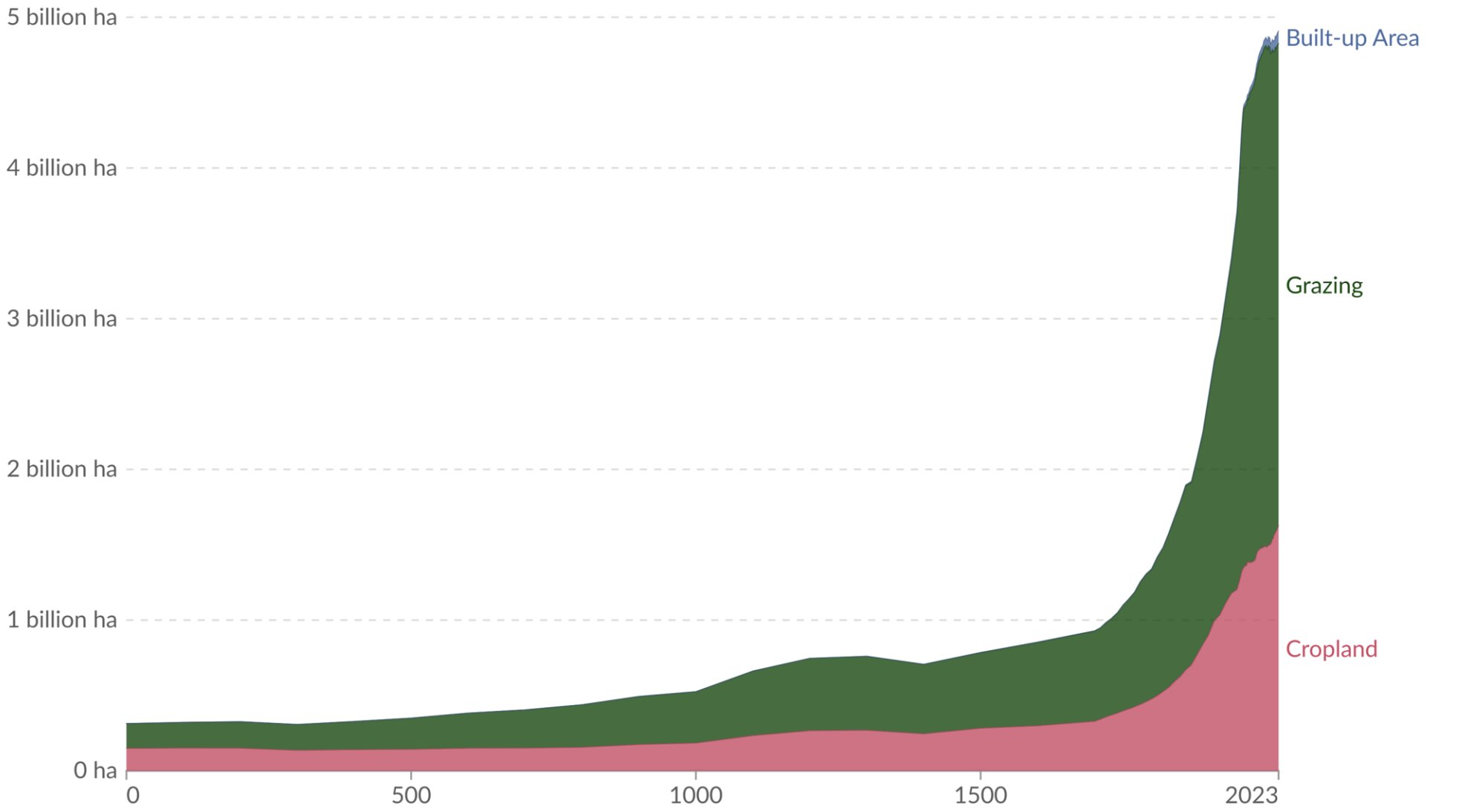
Data sources: Our World in Data based on HYDE, UN, and UN Population Division [2022 Revision]
This is a visualization from OurWorldinData.org, where you find data and research on how the world is changing.

We use more land for agriculture than we have ever done

Land use over the long-term, World

Total land area used for cropland, grazing land and built-up areas (villages, cities, towns and human infrastructure).

Our World in Data



Source: HYDE (2023) – with minor processing by Our World in Data

Data source: HYDE (2023)

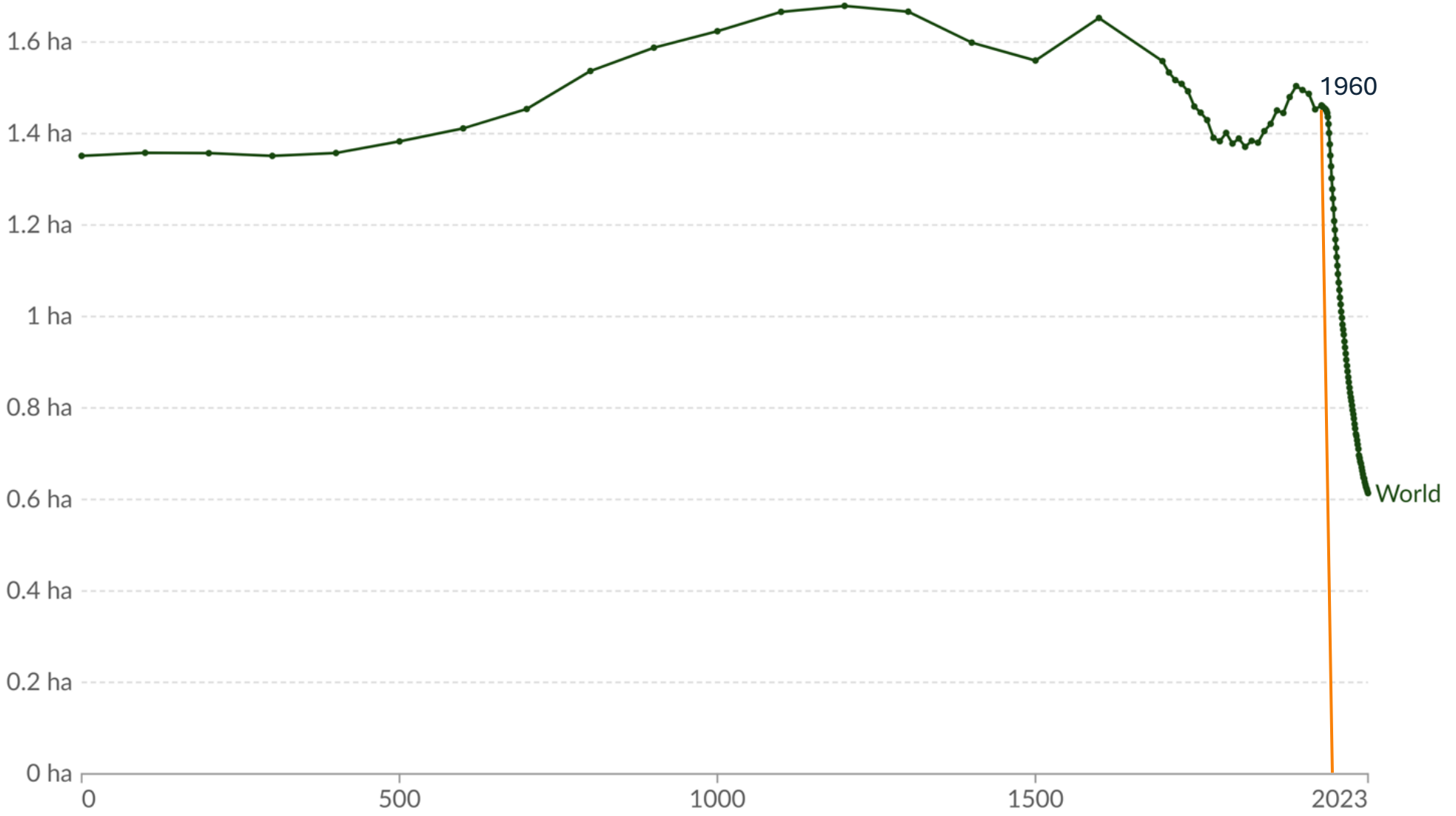
OurWorldinData.org/land-use | CC BY

We use less land per person than we have ever done

Agricultural land use per person

This dataset is showing estimates of the total agricultural land area – which is the combination of cropland and grazing land – per person. It is measured in hectares per person.

Our World in Data



Source: HYDE (2023) – with minor processing by Our World in Data

Data source: HYDE (2023)

OurWorldinData.org/land-use | CC BY

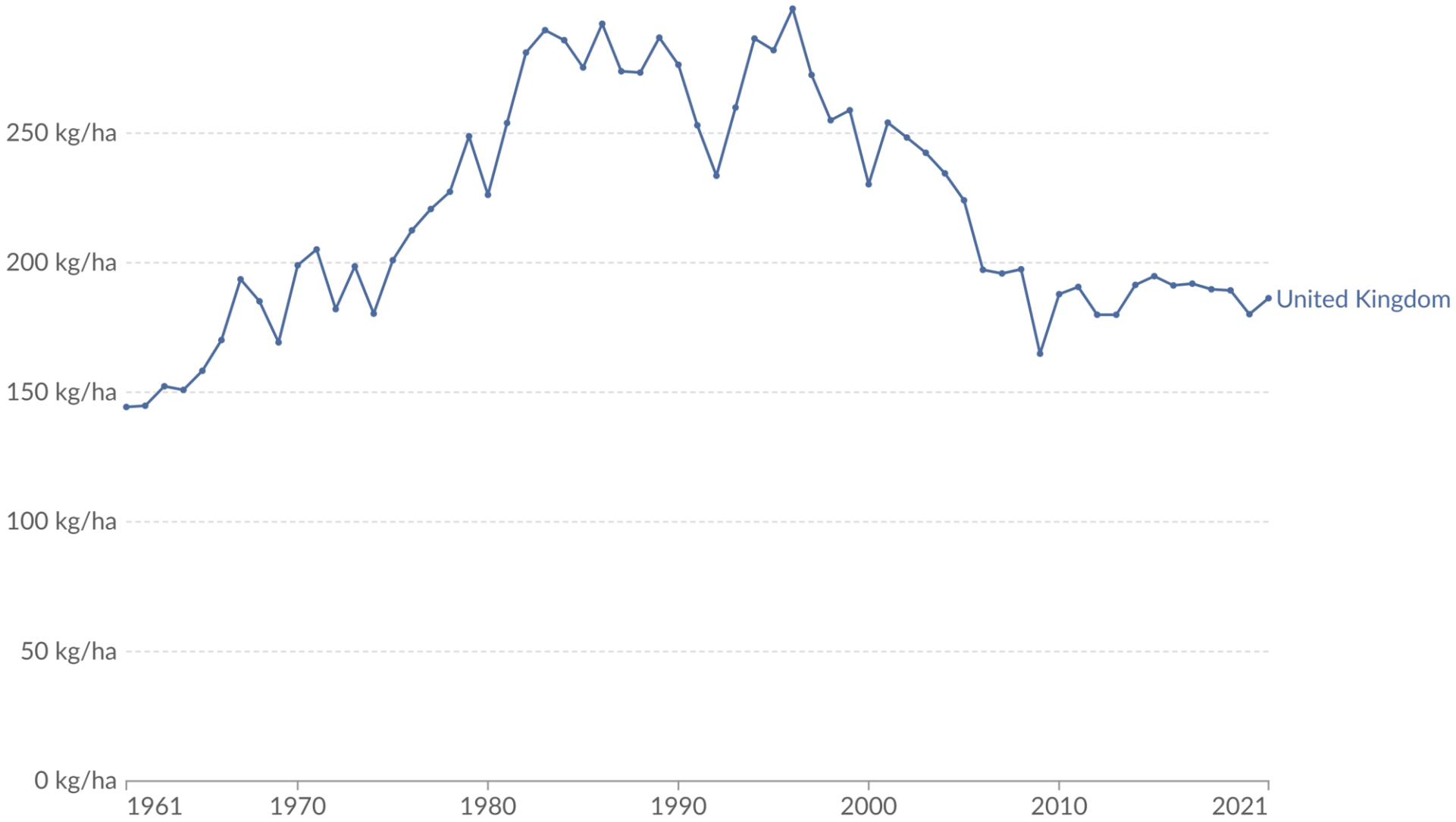
Locally we are applying much less fertiliser per ha than 30 year ago

Source: Food and Agriculture Organization of the United Nations (2023) – with major processing by Our World in Data

Fertilizer use per hectare of cropland, 1961 to 2021

Application of all fertilizer products (including nitrogenous, potash, and phosphate fertilizers), measured in kilograms of total nutrient per hectare of cropland.

Our World in Data



Data source: Food and Agriculture Organization of the United Nations (2023)

OurWorldinData.org/fertilizers | CC BY

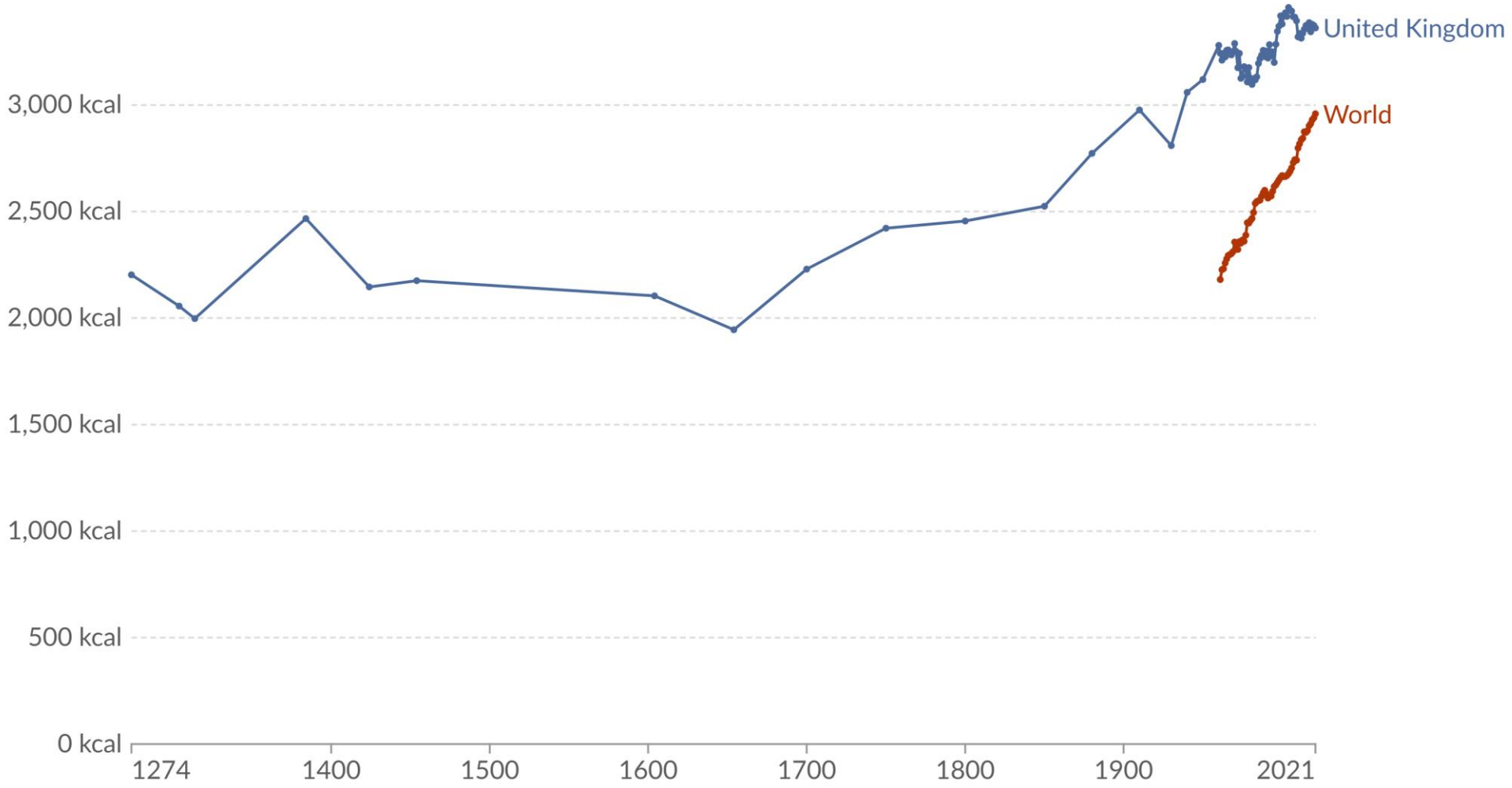
Globally we are supplying the most calories per day ever

Source: Food and Agriculture Organization of the United Nations (2023) and other sources with major processing by Our World in Data

Daily supply of calories per person, 1274 to 2021

Our World in Data

Measured in kilocalories per person per day. This indicates the calories that are available for consumption, but does not necessarily measure the number of calories actually consumed, since it doesn't factor in consumer waste.



Data source: Food and Agriculture Organization of the United Nations (2023) and other sources
OurWorldinData.org/food-supply | CC BY

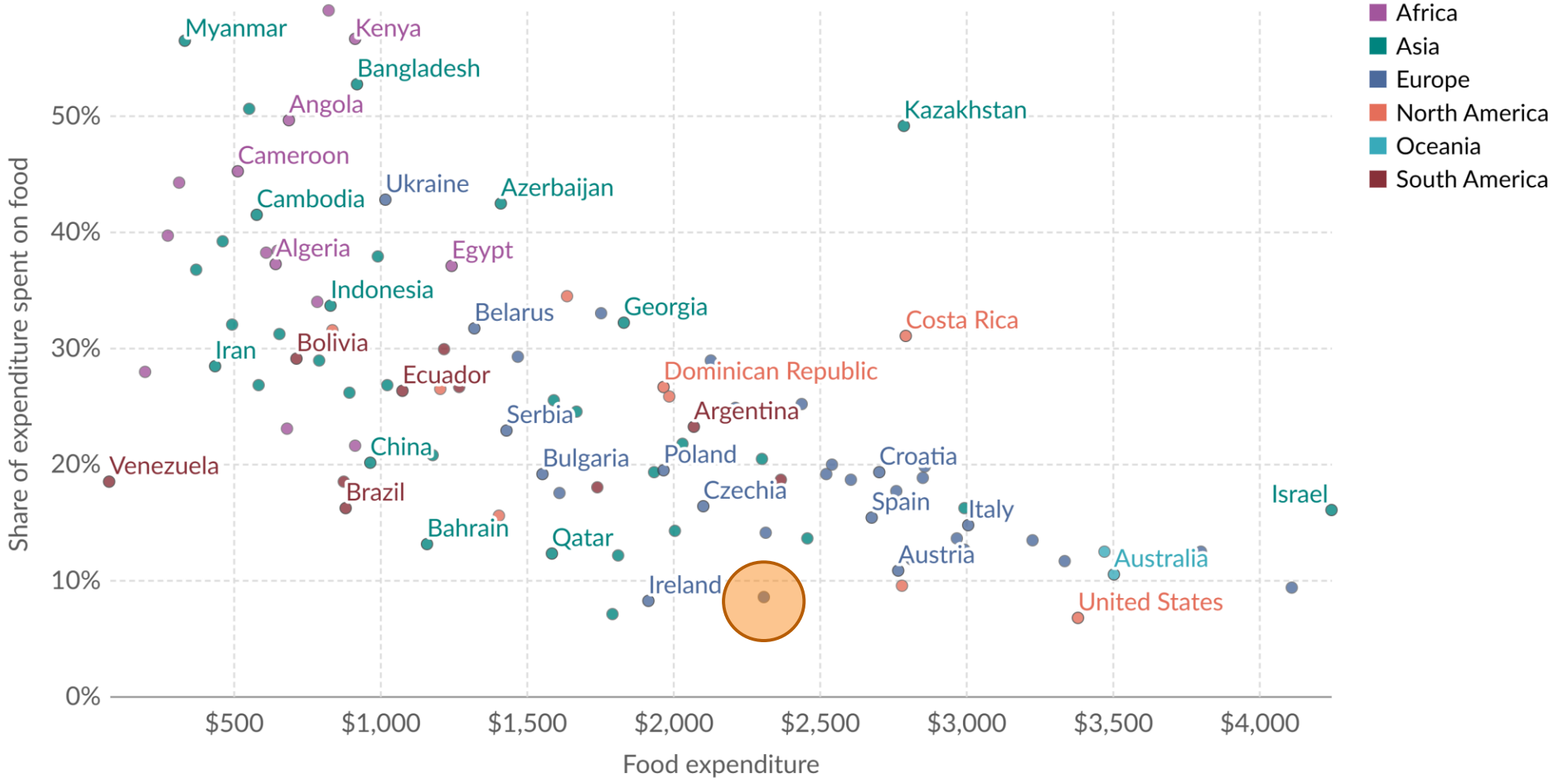
Developed country expenditure on food is low – driven by agricultural advances that have allowed economic development

Source: USDA Economic Research Service (ERS) (2023)

Share of expenditure spent on food vs. food expenditure per person, 2022

Our World in Data

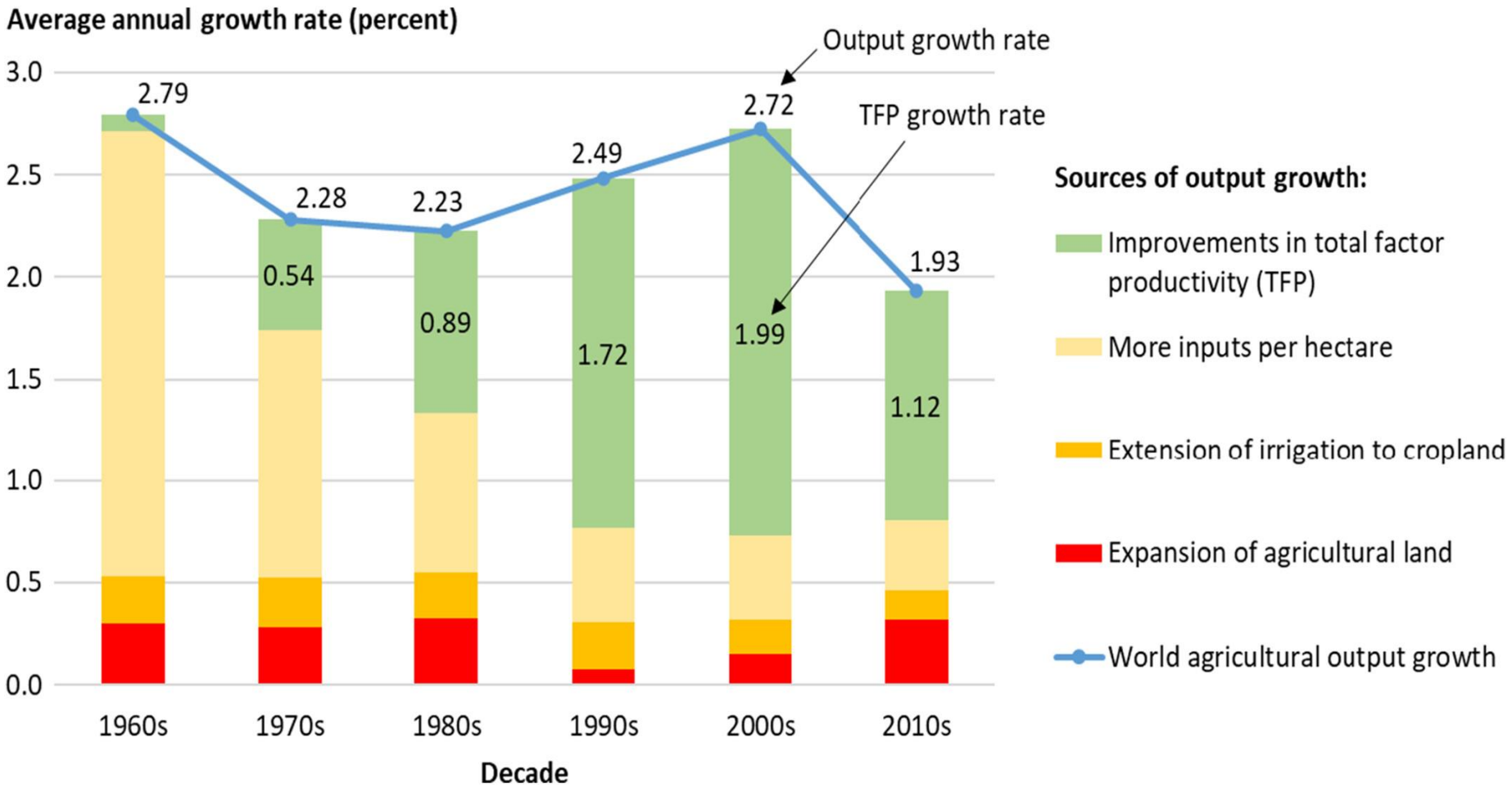
Food expenditure only includes food bought for consumption at home. Out-of-home food purchases, alcohol, and tobacco are not included. Food expenditure is expressed in US dollars per person. It is not adjusted for inflation or differences in the cost of living between countries.



Data source: USDA Economic Research Service (ERS) (2023)

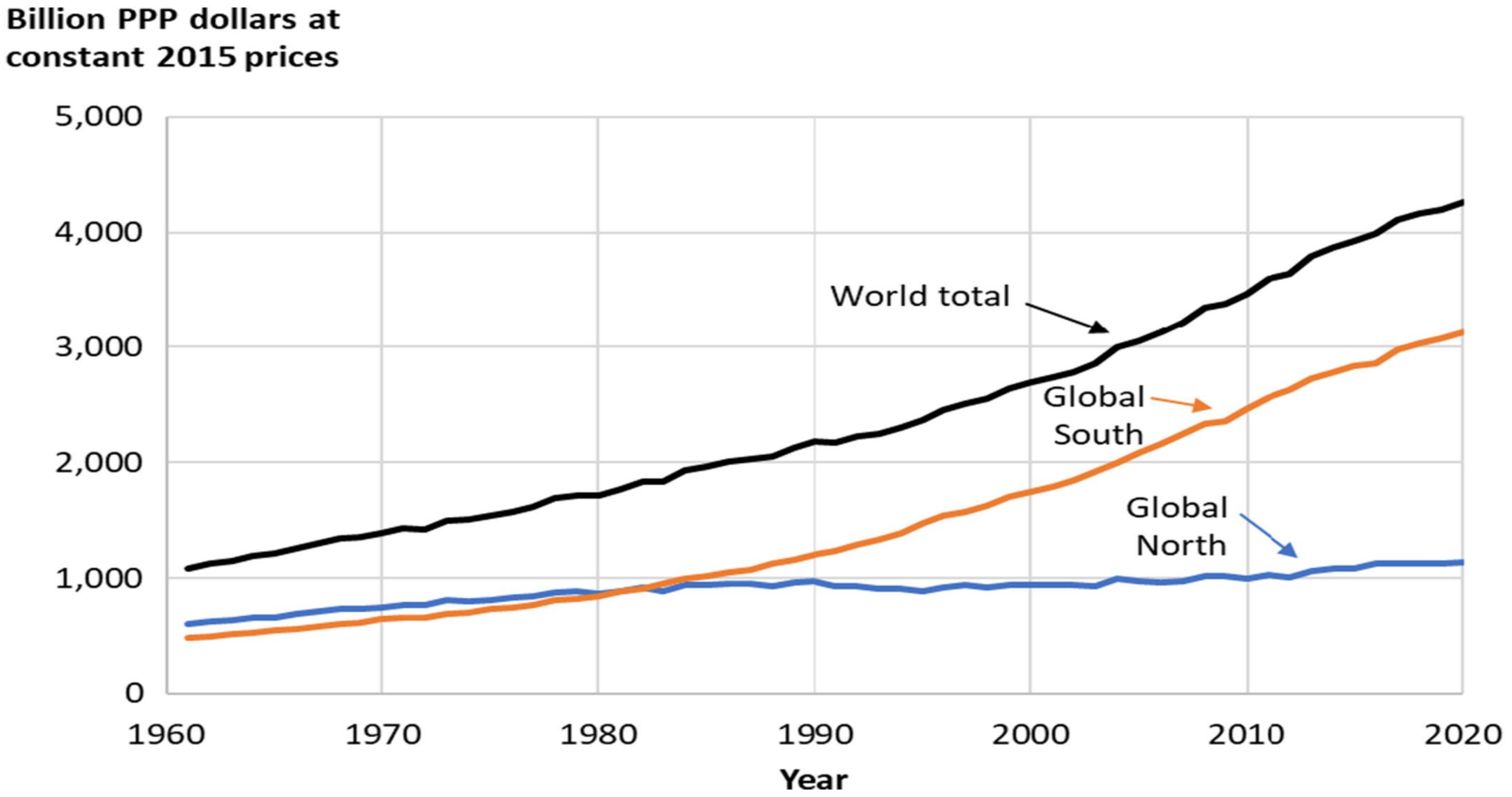
OurWorldinData.org/food-prices | CC BY

Source of World Agricultural Output Growth over Time



EuroChoices, Volume: 23, Issue: 3, Pages: 4-13, First published: 24 July 2024, DOI: (10.1111/1746-692X.12434) - Productivity-led Pathways to Sustainable Agricultural Growth: Six Decades of Progress

Agricultural Output Growth Shifts from Global North to Global South



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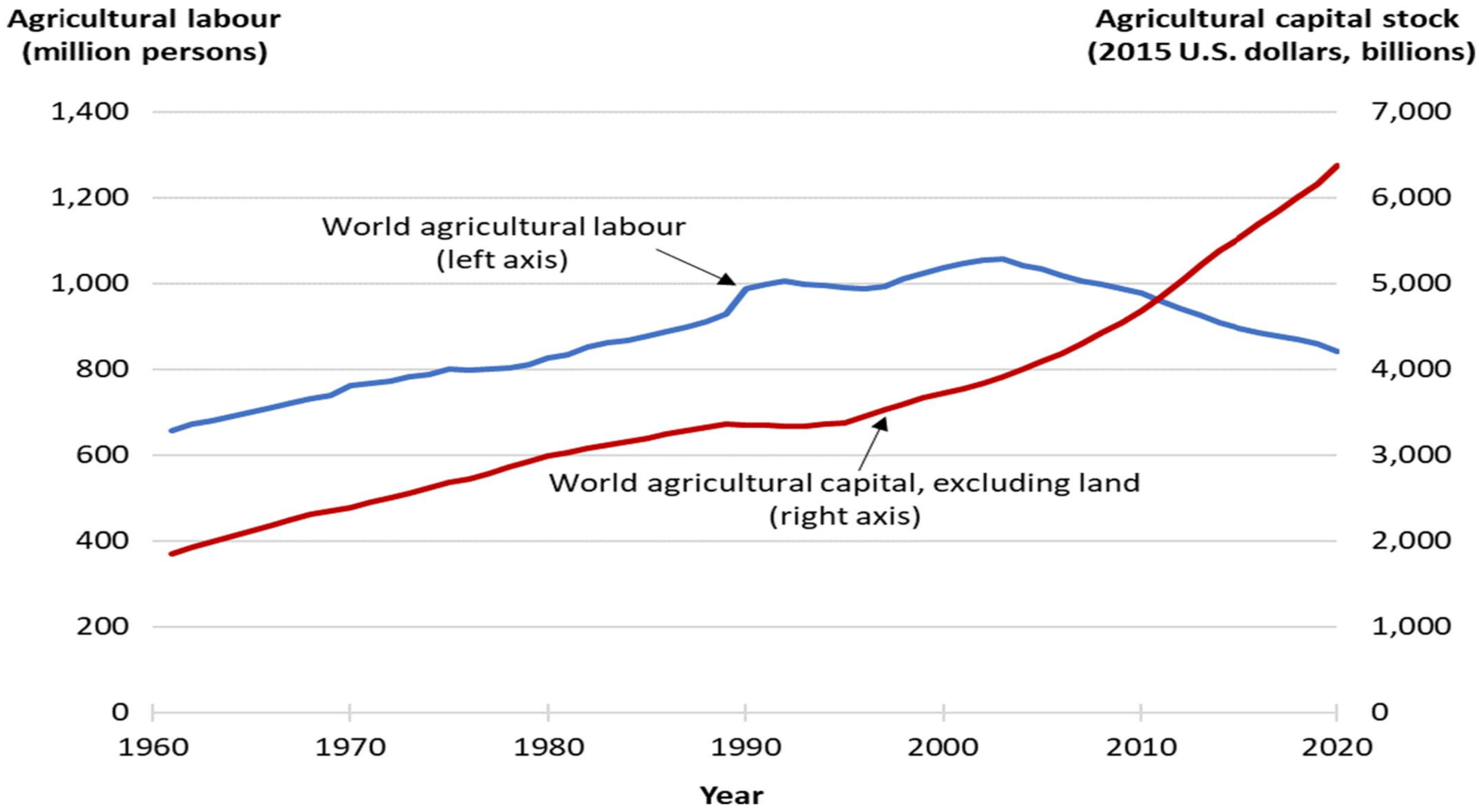
Labour is Replaced by Capital at a Global Level



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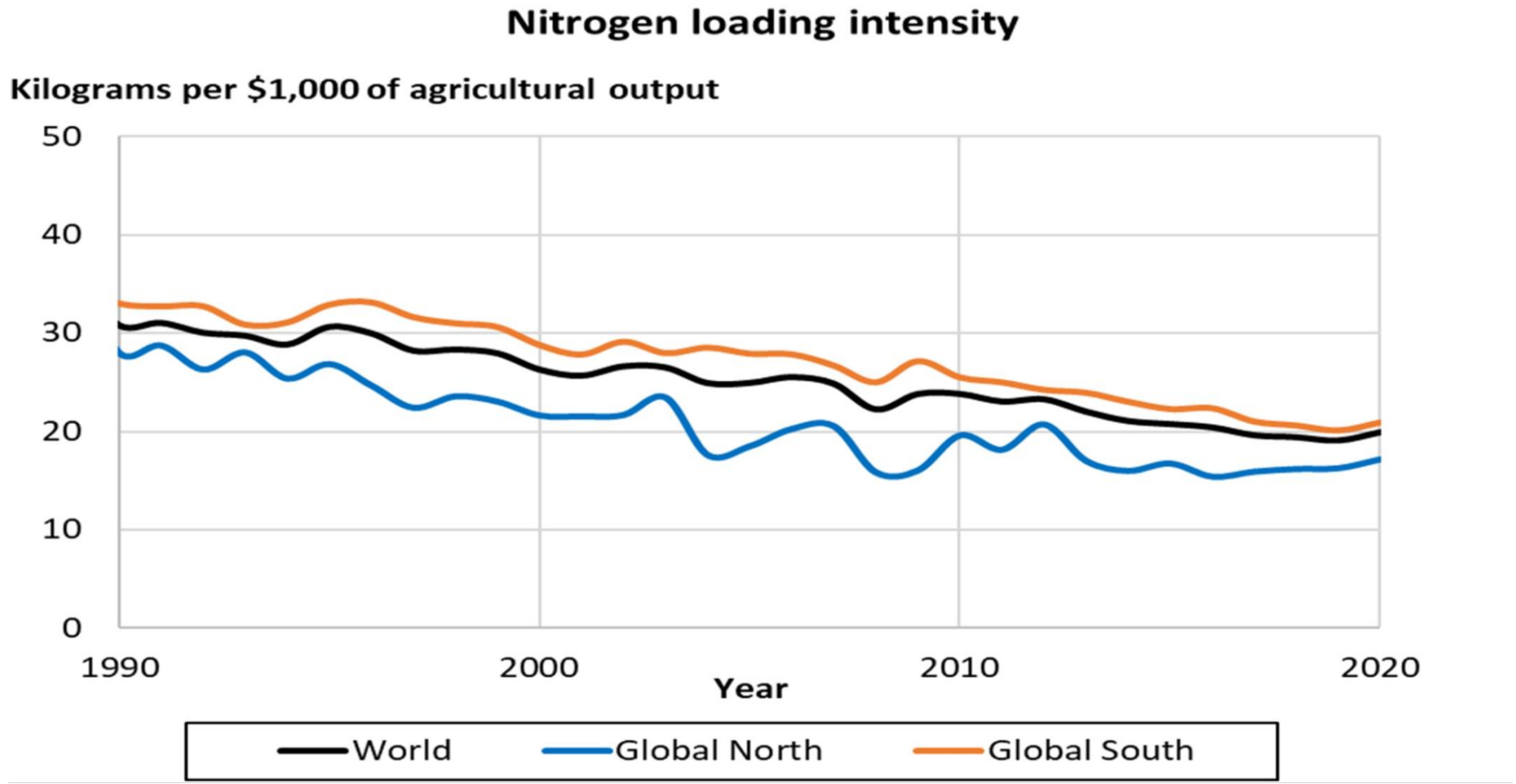
Higher Productivity leads to fewer natural and environmental resources per unit of Agricultural Output



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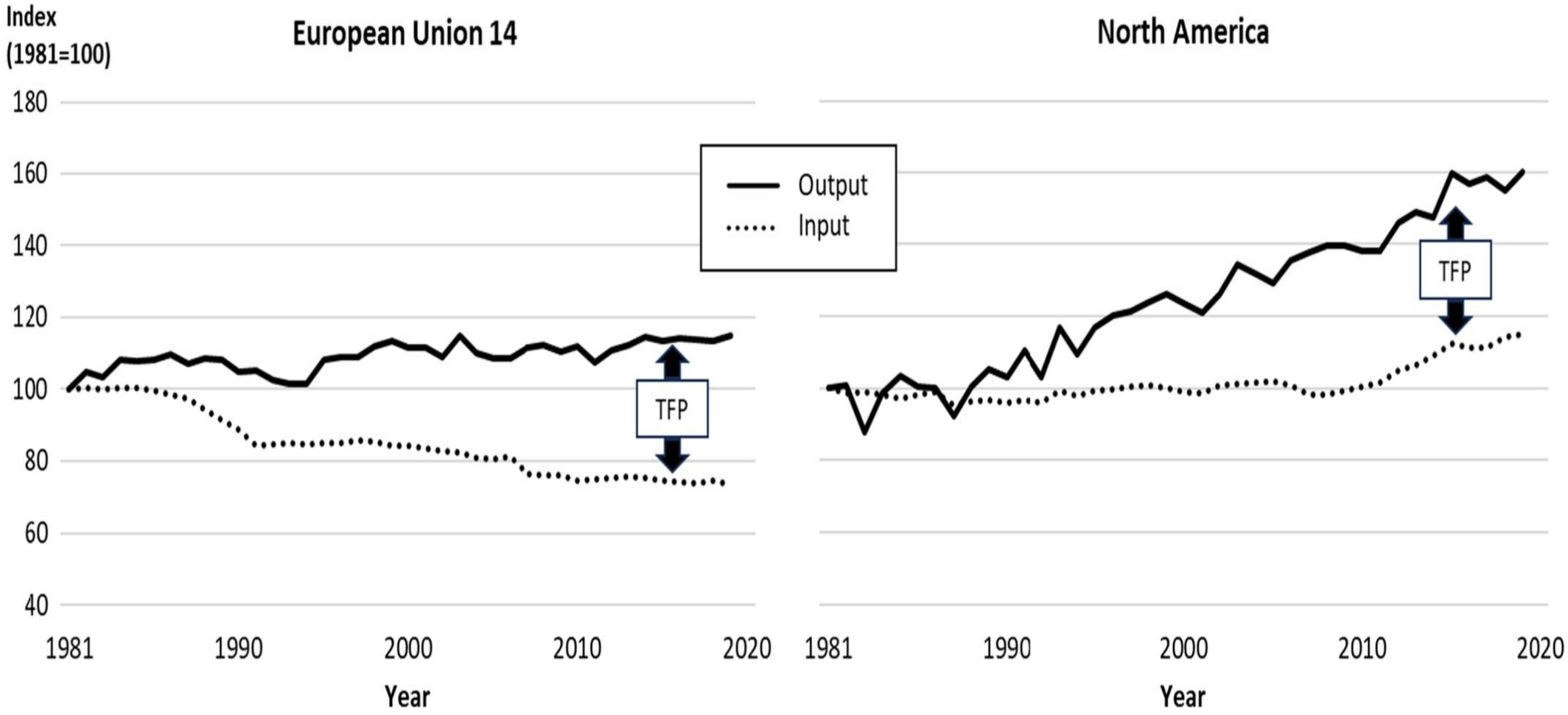
EU and North America Ag Productivity – similar gains, different drivers



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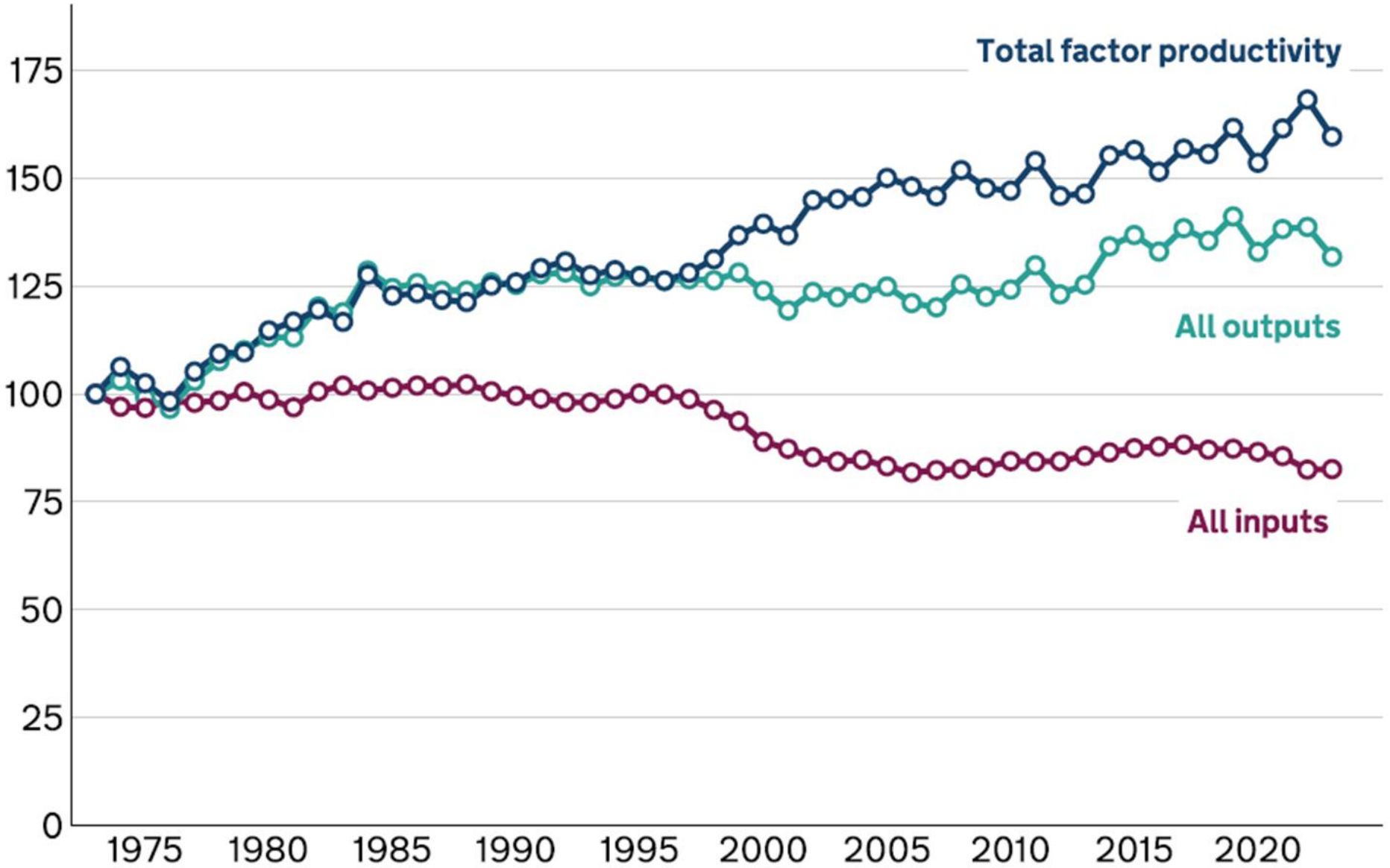
Farm Performance Metric?

TFP growth driven by lower inputs

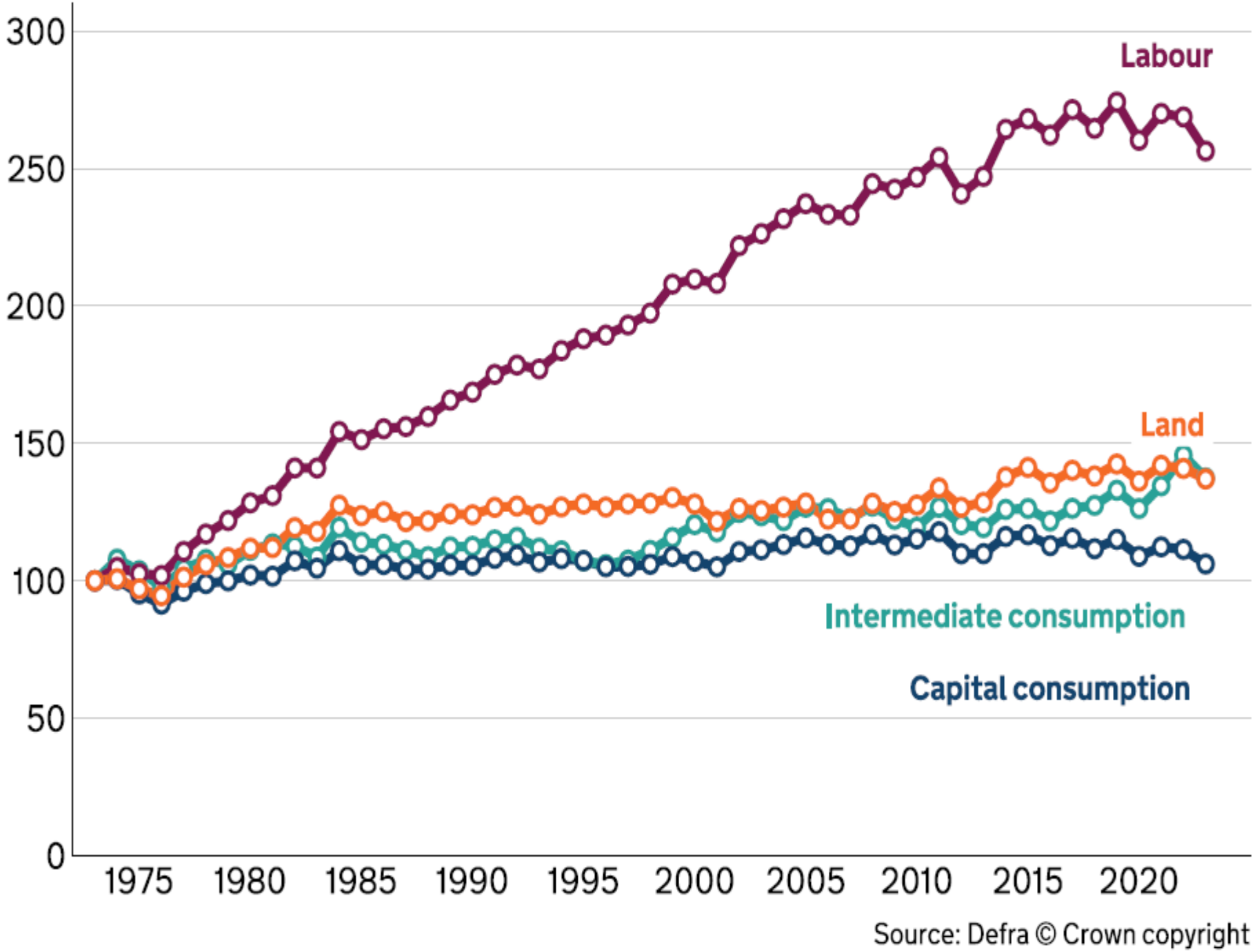
Source: Defra
https://www.gov.uk/government/statistics/total-factor-productivity-of-the-agricultural-industry/total-factor-productivity-of-the-united-kingdom-agricultural-industry-in-2023

Figure 2: Long term trends in TFP of the UK agricultural industry (1973 = 100)



Source: Defra © Crown copyright

TFP growth driven by lower labour use

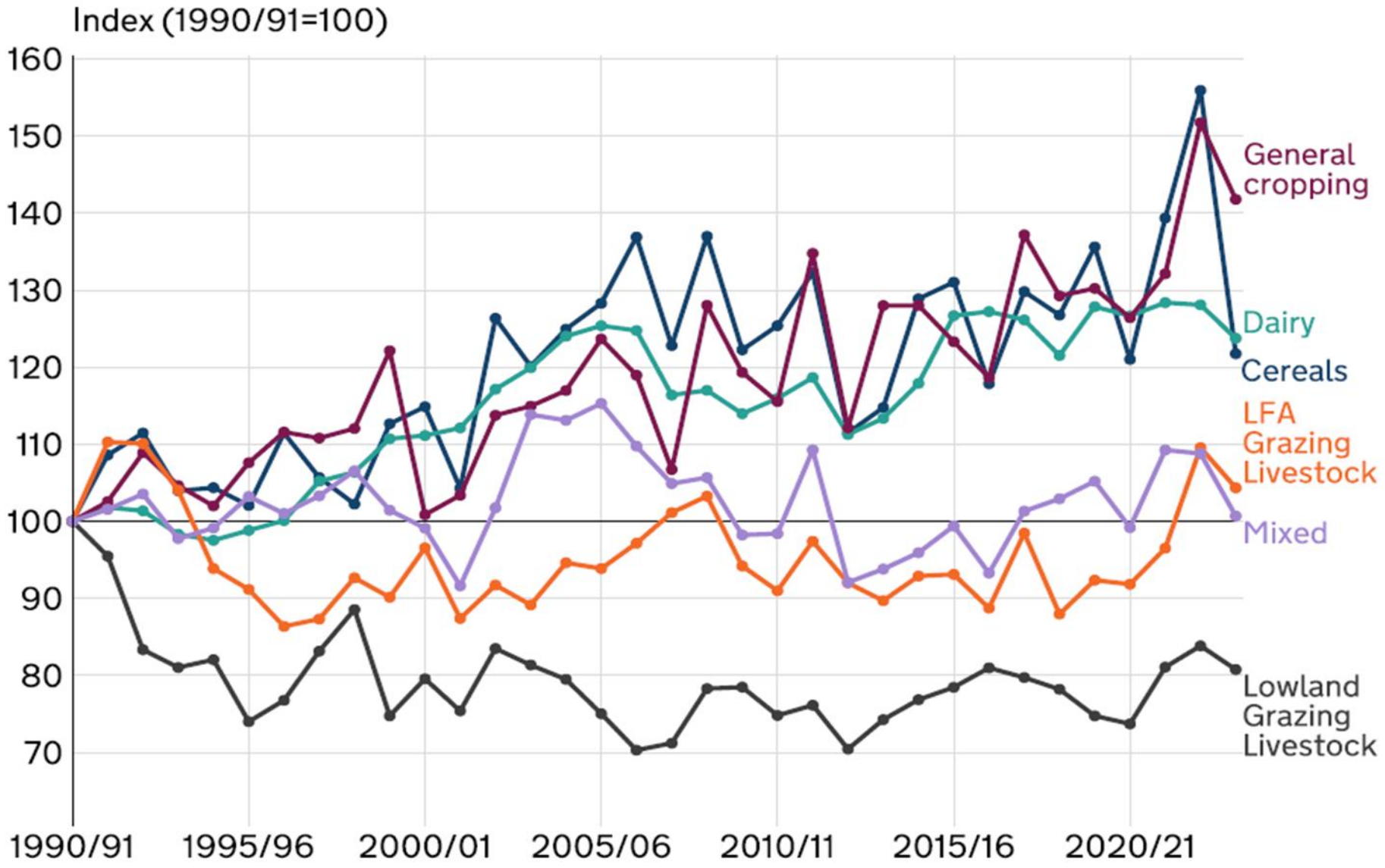


Source: Defra
https://www.gov.uk/government/statistics/total-factor-productivity-of-the-agricultural-industry/total-factor-productivity-of-the-united-kingdom-agricultural-industry-in-2023

TFP growth varies by farm type – labour productivity is key

Source: Defra
https://www.gov.uk/government/statistics/total-factor-productivity-for-england-by-farm-type/total-factor-productivity-for-england-by-farm-type-199091-to-202324-statistical-notice

Figure 4: Total Factor Productivity for farms in England by farm type, 1990/91 to 2023/24



Source: Defra, Farm Business Survey

Success?
Perhaps only in part

Net Zero - Complexities

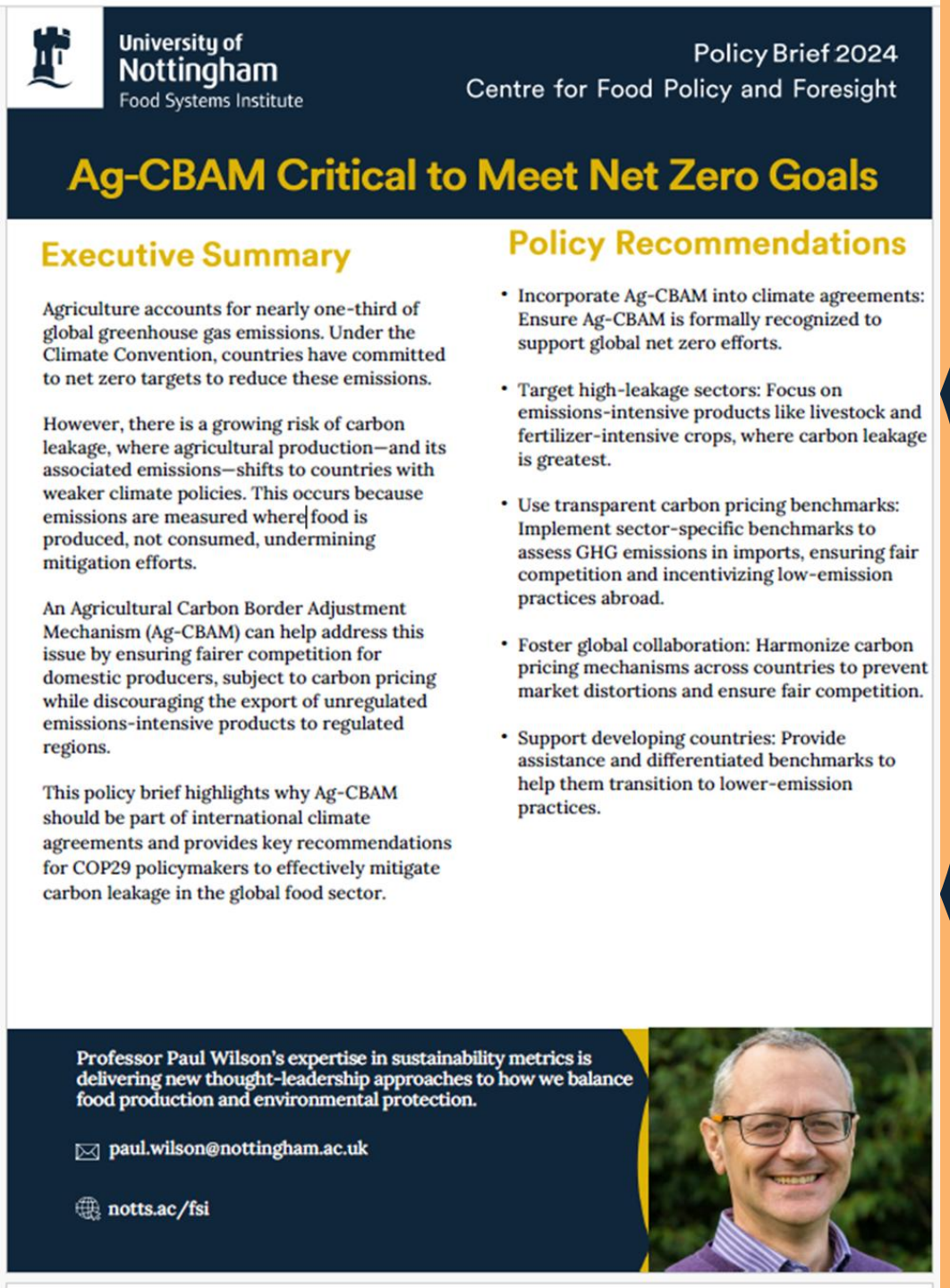
- Agriculture large impact on global GHGs
- Extensive farm level variation
- System and product GHG variation
- Scope 1, 2, 3 emissions
- Agriculture offers the “big win” to reduce GHGs – Scope 3 for the Food Industry
- **Ag Input** Carbon Border Adjustment Mechanisms (CBAM)

Ag-CBAM

Agricultural Carbon Border Adjustment Mechanism (**Ag-CBAM**) needed for level playing field

Ag-CBAM to support global **Net Zero ambitions**

Climate agreements need to include **carbon consequence of food consumption**



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Policy Brief 2024
Centre for Food Policy and Foresight

Ag-CBAM Critical to Meet Net Zero Goals

Executive Summary

Agriculture accounts for nearly one-third of global greenhouse gas emissions. Under the Climate Convention, countries have committed to net zero targets to reduce these emissions.

However, there is a growing risk of carbon leakage, where agricultural production—and its associated emissions—shifts to countries with weaker climate policies. This occurs because emissions are measured where food is produced, not consumed, undermining mitigation efforts.

An Agricultural Carbon Border Adjustment Mechanism (Ag-CBAM) can help address this issue by ensuring fairer competition for domestic producers, subject to carbon pricing while discouraging the export of unregulated emissions-intensive products to regulated regions.

This policy brief highlights why Ag-CBAM should be part of international climate agreements and provides key recommendations for COP29 policymakers to effectively mitigate carbon leakage in the global food sector.

Policy Recommendations

- Incorporate Ag-CBAM into climate agreements: Ensure Ag-CBAM is formally recognized to support global net zero efforts.
- Target high-leakage sectors: Focus on emissions-intensive products like livestock and fertilizer-intensive crops, where carbon leakage is greatest.
- Use transparent carbon pricing benchmarks: Implement sector-specific benchmarks to assess GHG emissions in imports, ensuring fair competition and incentivizing low-emission practices abroad.
- Foster global collaboration: Harmonize carbon pricing mechanisms across countries to prevent market distortions and ensure fair competition.
- Support developing countries: Provide assistance and differentiated benchmarks to help them transition to lower-emission practices.

Professor Paul Wilson's expertise in sustainability metrics is delivering new thought-leadership approaches to how we balance food production and environmental protection.

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notts.ac/fsi

Global Trade

- GHG measurement is complex
- Protocols; directives and reporting standards (eg ISO)
- Science Based Target initiative and IPCC Tiers
- Farm Level Carbon Calculators lack comparability
- Farm to Enterprise / Product / Functional Unit challenges

OECD

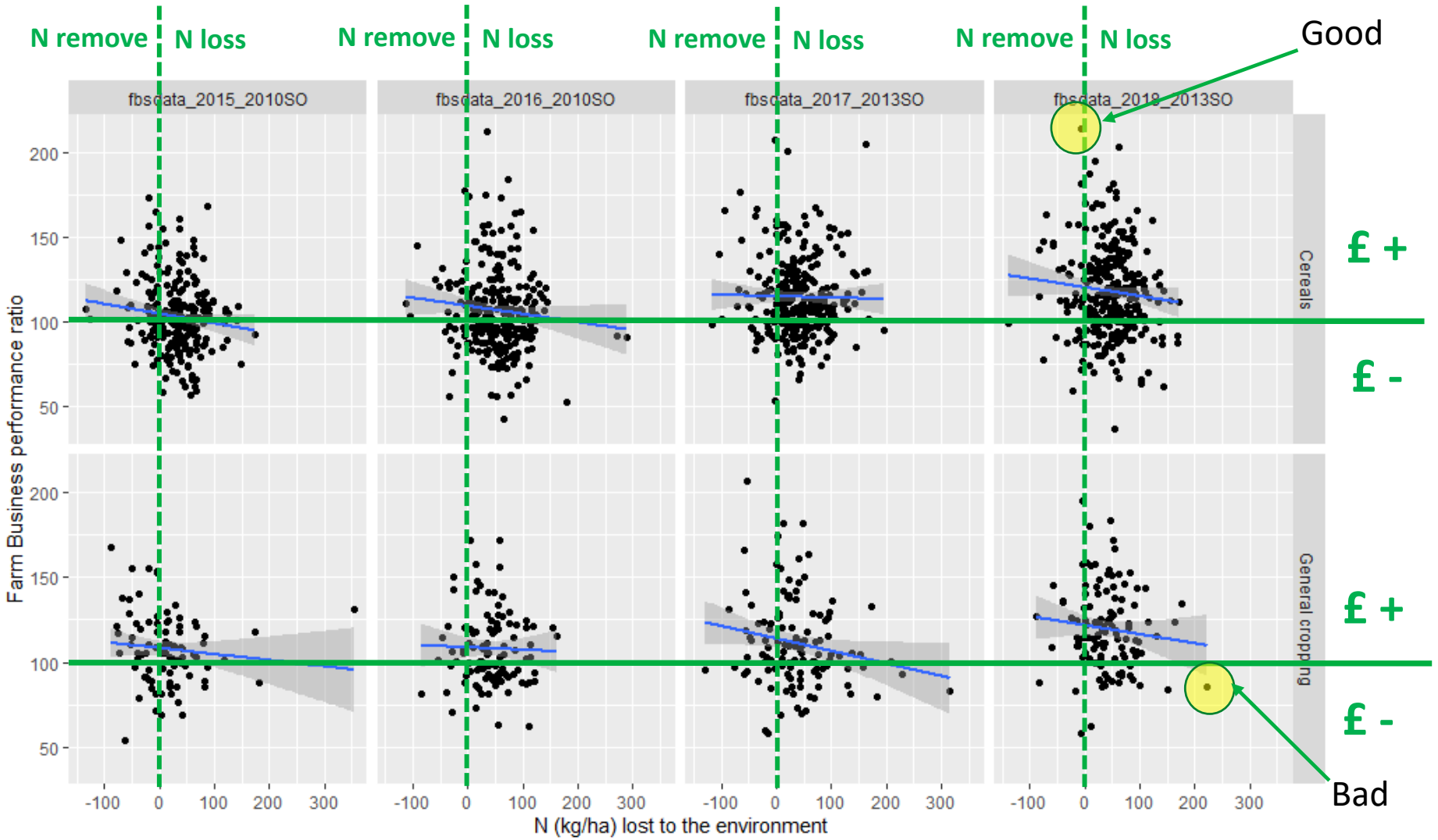
Measuring Carbon Footprints of Agri-Food Products

Eight Building Blocks

Farming just got **more** complex

Win-wins?

How is farm gate N balance related to economic performance?



Gray Betts, C., Hicks, D., Reader, M. and Wilson P. (2023). Nitrogen balance is a predictor of farm business performance in the English Farm Business Survey, *Frontiers in Sustainable Food Systems,* **7**:1106196 https://doi.org/10.3389/fsufs.2023.1106196

General Cropping

Farms that lose most N to environment (>60kg/ha) are **poorer £ performers**

Own **FACTS advice** leads to **better £ performance**

No link between N-loss to environment and source of fertiliser advice

Resource Use Efficiency Matters and is a win-win opportunity.

Farm Business Survey (England) 2015/16 to 2018/19 Cereals and General Cropping Farms n = 1475

Confused?

Let’s simplify

RBR

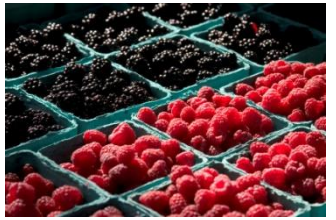
Rural Business Research

Paul Wilson's 10 key drivers of farm business performance

University of Nottingham

UK | CHINA | MALAYSIA

- Typically larger farm size
- Educational attainment
- Information seeking
- Environmental objectives
- Specialisation
- Focus on Margins (*not yields*)
- Cost control
- Attention to detail
- Open to new opportunities
- Business planning



Farming Futures for UK Agriculture

Professionalisation
Precision
Planning

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Thank you for your attention

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