



Polycrises across the food-energy-water-environment nexus

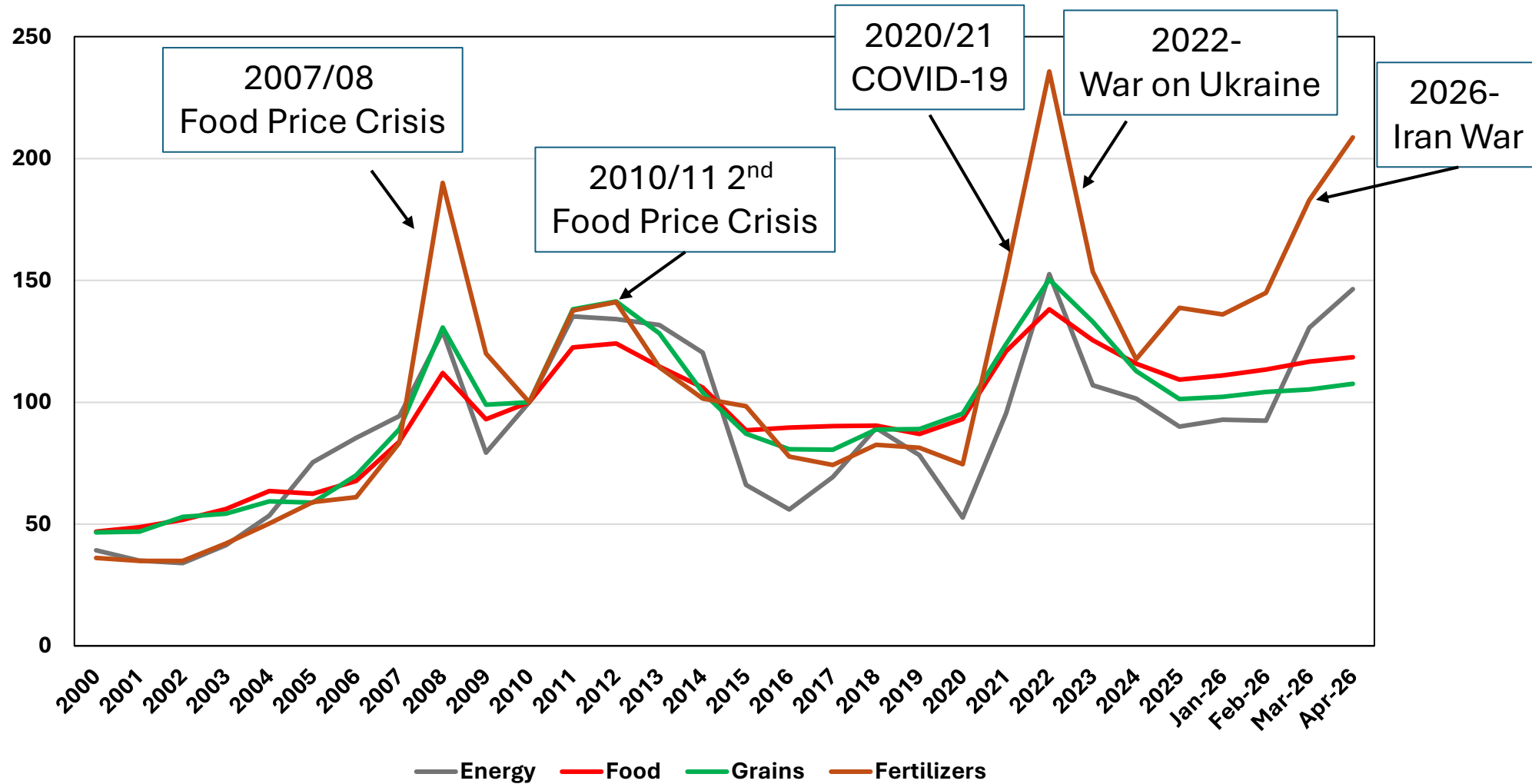
- Entry points for action from the Agrifood Innovation and Resilience Unit at IFPRI

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Director, Agrifood Innovation and Resilience
May 6, 2026 | ZEF, Bonn



Five Fuel-Fertilizer-Food Price Crisis in 20 years



Source: World Bank Pink Sheet Commodity Price Sheet (2010=100)



Conflict in the Persian Gulf

- Attacks on Iran by US and Israel and counter-attacks by Iran on US allies in Middle East has roiled energy and fertilizer markets and disrupted shipping in Persian Gulf.
- Region is highly dependent on food imports
- Large exporting region for fuel/energy, including fertilizer inputs and fertilizers



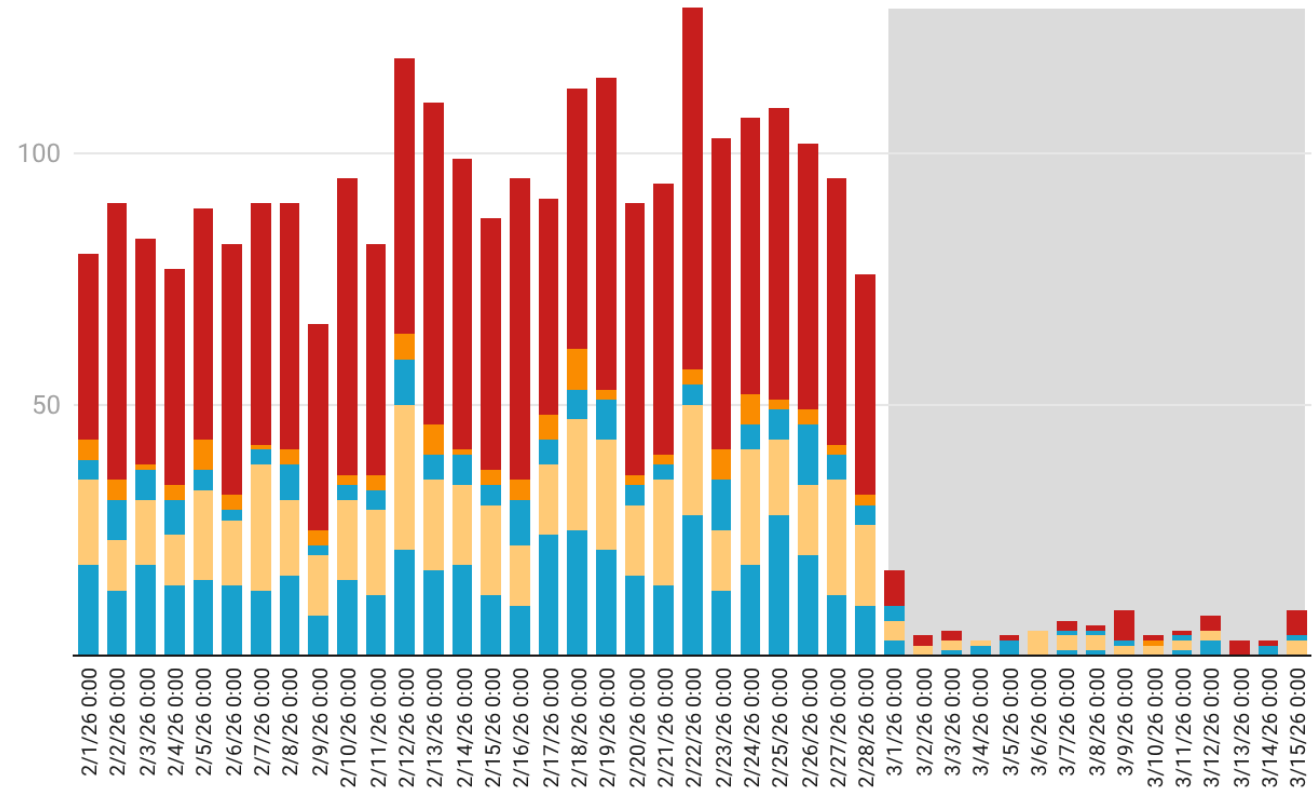
Disruption in Oil and Fertilizer Markets

- Straits of Hormuz:
 - 27% of world oil exports
 - 20% of liquified natural gas exports
- Almost 100% decline in shipping since the attacks began
- Private war risk insurance markets have pulled coverage

Arrivals of ships through Strait of Hormuz

Number of ships

Container Dry Bulk General Cargo Roll-on/roll-off Tanker



IMF Portwatch database

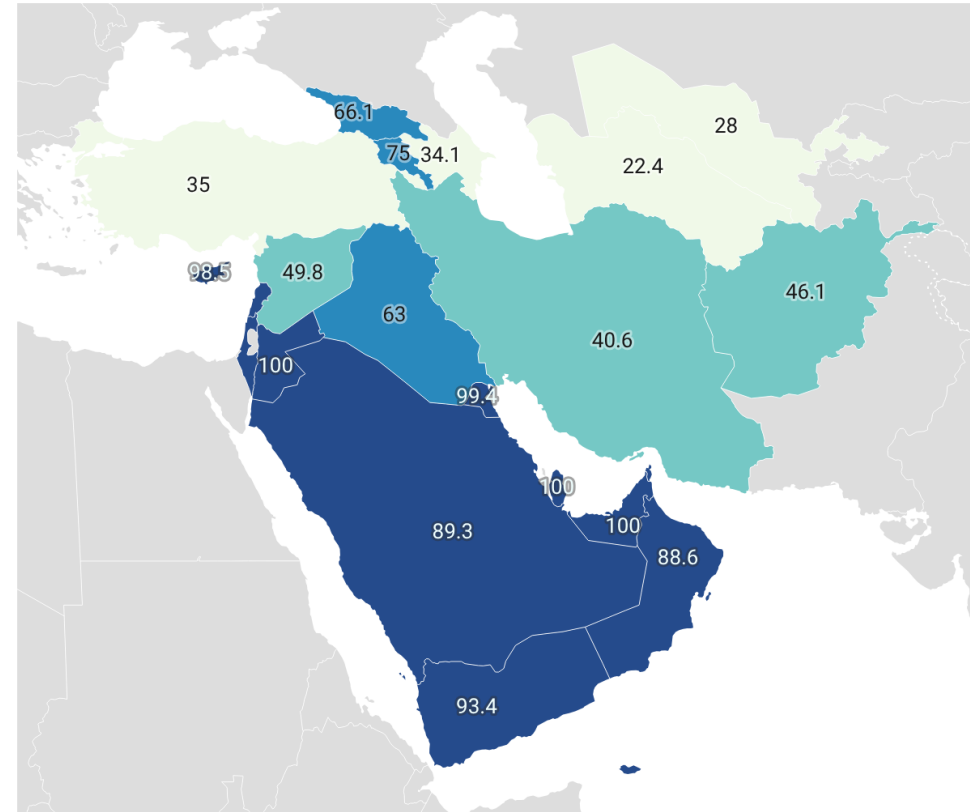
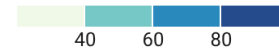


Implications for Regional Food Security

- High dependence on imports to meet grain and oilseed needs.
- Much of the imports transit to the region via the Straits of Hormuz
- Alternative routes:
 - Saudi Arabia—Suez Canal
 - Iraq via Turkey/Syria
 - Iran via Caspian Sea
- Implications beyond Gulf

Cereal import dependence in Persian Gulf Region

Percentage



2021-2023 average
Source: FAOSTAT

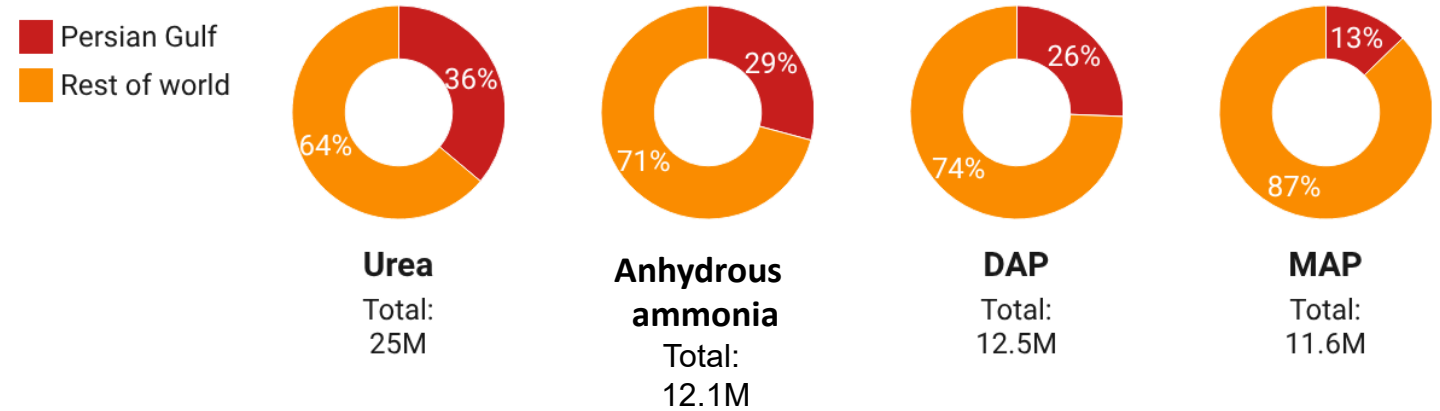


Impacts on Fertilizer Markets

- Straits of Hormuz:
 - 36% of global urea imports
 - 29% of anhydrous ammonia
 - 25% of DAP
 - 13% of MAP
- Saudi Arabia is largest exporter according to FAO data.

Share of selected fertilizer product imports originating from the Persian Gulf

Metric tons



Averaged over 2023-2025. Persian Gulf countries include Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates.

Source: TDM

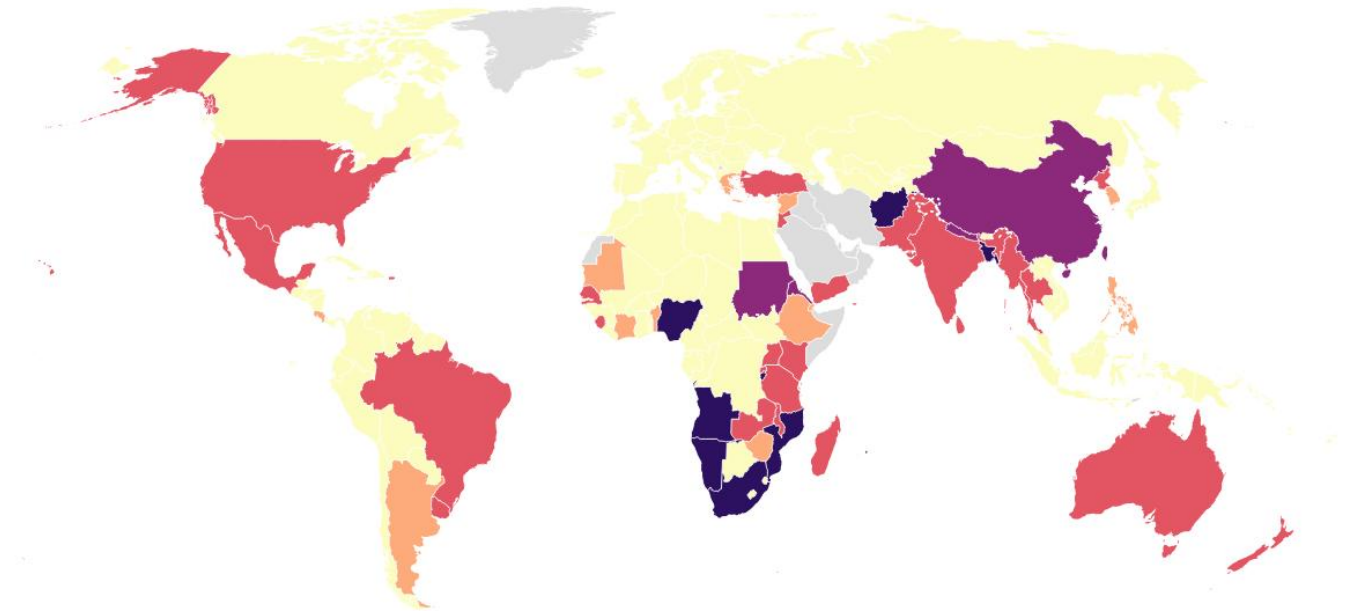
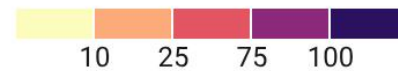


Dependence of World on Persian Gulf

- Several countries depend heavily on urea imports from Persian Gulf.
- As we saw with war in Ukraine, importers will likely find alternative sources but at significantly higher prices (urea prices running 30% higher)

Share of nitrogenous fertilizer imports from Persian Gulf, 2023

Percentage



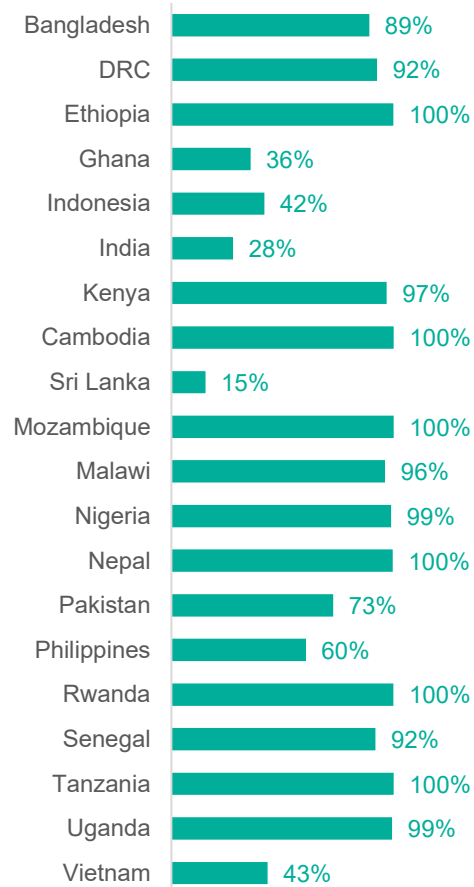
Persian Gulf includes Bahrain, Iraq, Iran, Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates. Fertilizers converted to N equivalents.

Source: FAOSTAT

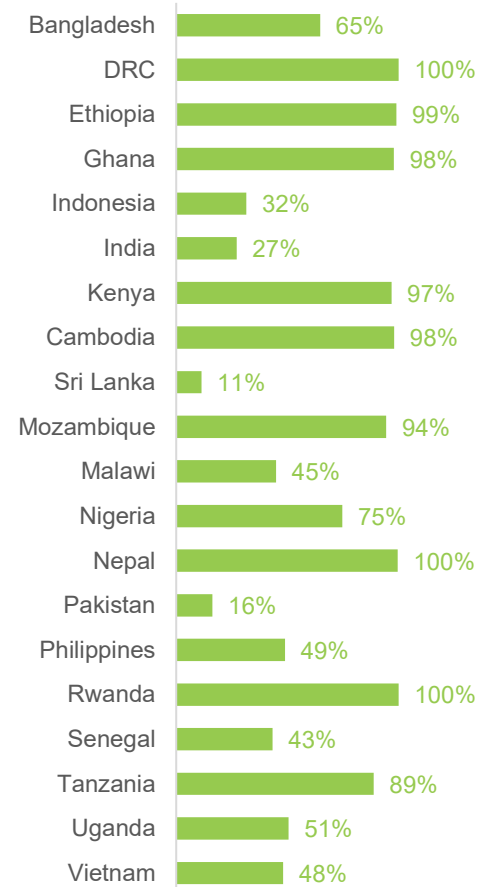


LMICs are Jointly Exposed to Fuel and Fertilizer Shocks

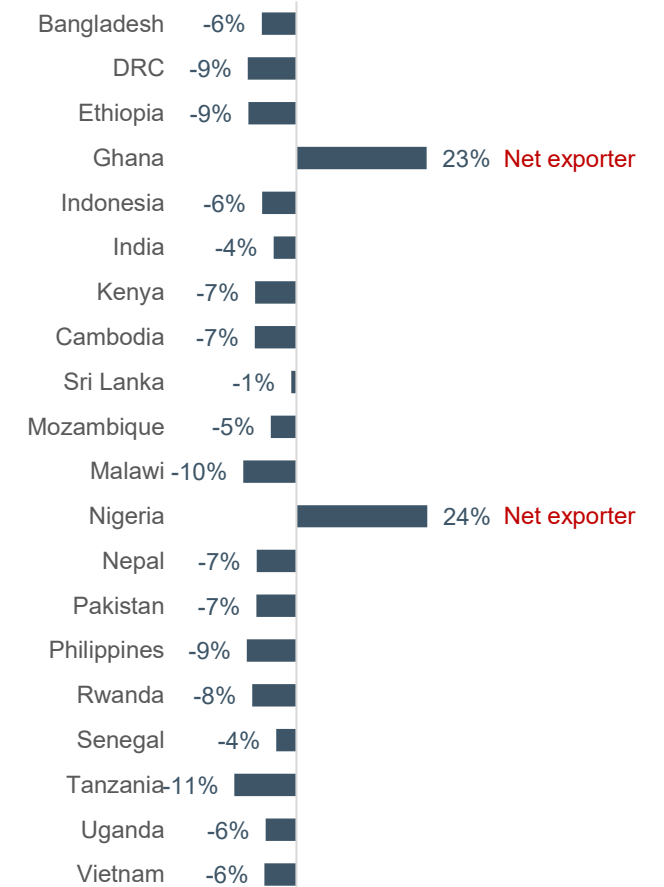
Fuel imports as a share of total fuel supply



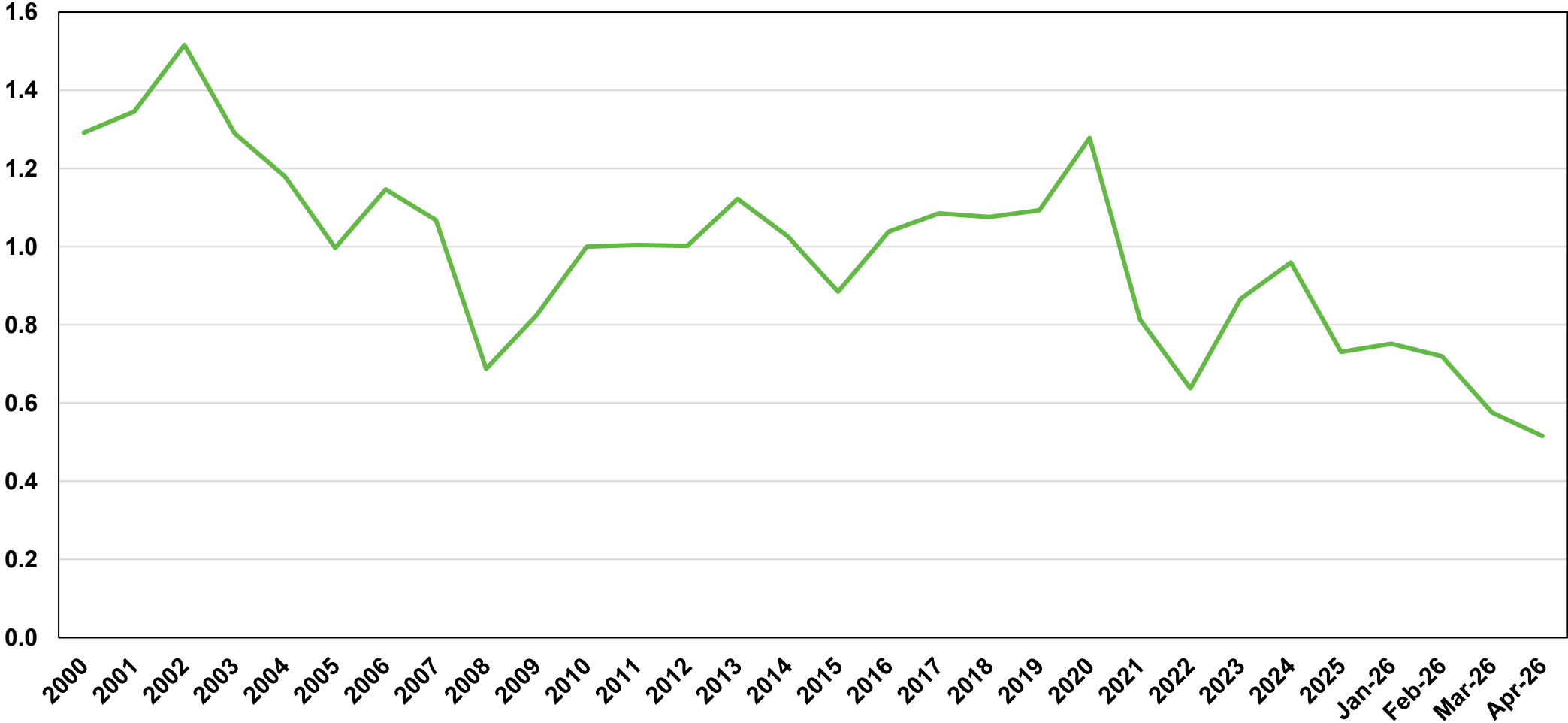
Fertilizer imports as a share of total fuel supply



Terms of trade effect of higher fuel and fertilizer prices



The grain-to-fertilizer price ratio continues to fall making agricultural production unprofitable



Source: World Bank Pink Sheet Commodity Price Sheet (2010=100)



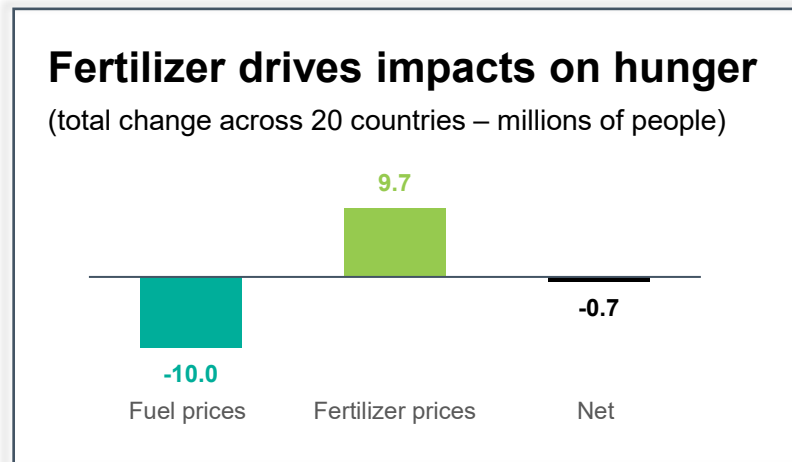
Results | Food Security Impacts

Undernourishment worsens in many countries

- Higher fertilizer prices explain more of the increase in undernourishment
- Some countries could see falling undernourishment alongside rising poverty (e.g., India)

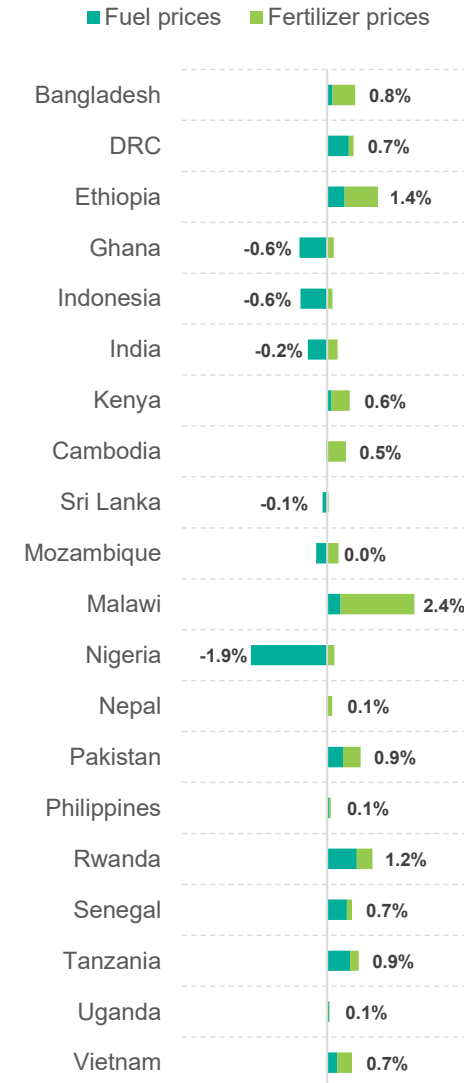
Impacts could worsen if fertilizer prices rise further

- Fertilizer production is paused in some countries
- Export bans could worsen outlook
- Planting seasons are staggered



Change in share of the population who are undernourished (%-point)

(model results | FAO calorie thresholds)



Change in undernourished population (1000s)

Bangladesh	1,303
DRC	722
Ethiopia	1,751
Ghana	-171
Indonesia	-1,575
India	-3,372
Kenya	339
Cambodia	83
Sri Lanka	-19
Mozambique	6
Malawi	494
Nigeria	-4,254
Nepal	34
Pakistan	2,279
Philippines	122
Rwanda	170
Senegal	117
Tanzania	561
Uganda	30
Vietnam	687



Differences and similarities with previous food price crises

	Food price crisis 2007-2008	Global droughts 2010-2012	COVID/Russia invasion of Ukraine 2020-2022	Iran war/closure of Strait of Hormuz 2026-Today
Demand shocks	US biofuel growth China soybean demand growth	Steady China soybean demand	China feed demand (post ASF)	Flat global feed demand
Supply shocks	Australian droughts reduce wheat crop	Triple La Nina; US drought	La Nina impact on S. America soybean and corn	Favorable growing conditions; El Nino
Physical stocks	Corn, wheat, rice tight s/u	Tight feed grains and soybeans	Ample stocks	Ample stocks
Macroeconomic	Weak US dollar	Weak US dollar	Weak US dollar	Relatively strong US dollar
Geopolitical	Export bans Argentina; Russia; India	Russia export ban	Black Sea disruption. Indonesia ban on vegetable oils (short-lived)	Hormuz closure. Restrictions on fertilizer sales (China)



Immediate responses

- **Energy price responses:** Lowered fuel taxes [mostly rich countries]; rationing of fuel, expansion of ethanol blending requirements [Indonesia/Zimbabwe], subsidized public transportation, free public transportation [2 states in Australia]; or higher bus fares [Egypt]; release of fuel reserves; ban of energy exports; price controls
- **Fertilizer price responses:** Food export and food import bans [Gulf region]; free fertilizers [Ghana]; subsidized fertilizers [Philippines]; changing in existing fertilizer subsidy programs (upward or downward); ban of fertilizer exports; price controls
- **Other responses:** Mobility responses (encourage teleworking), 4-day work weeks for civil servants [Sri Lanka], dress code relaxation [Japan]; temporary school and university closures [ex. Bangladesh and Pakistan]; changing food distribution parameters; changes in menus and fuel source for cooking [from LPG to wood]

Longer-term responses

- Acceleration of energy transition (e-vehicles, renewable energy investments)
- Changes in stock and input sourcing policies
- Agroecological approaches?



Other factors that could affect fertilizer-fuel-food price crisis

Super ENSO event possible

NOAA CPC ENSO Strength Probabilities (issued April 2026)

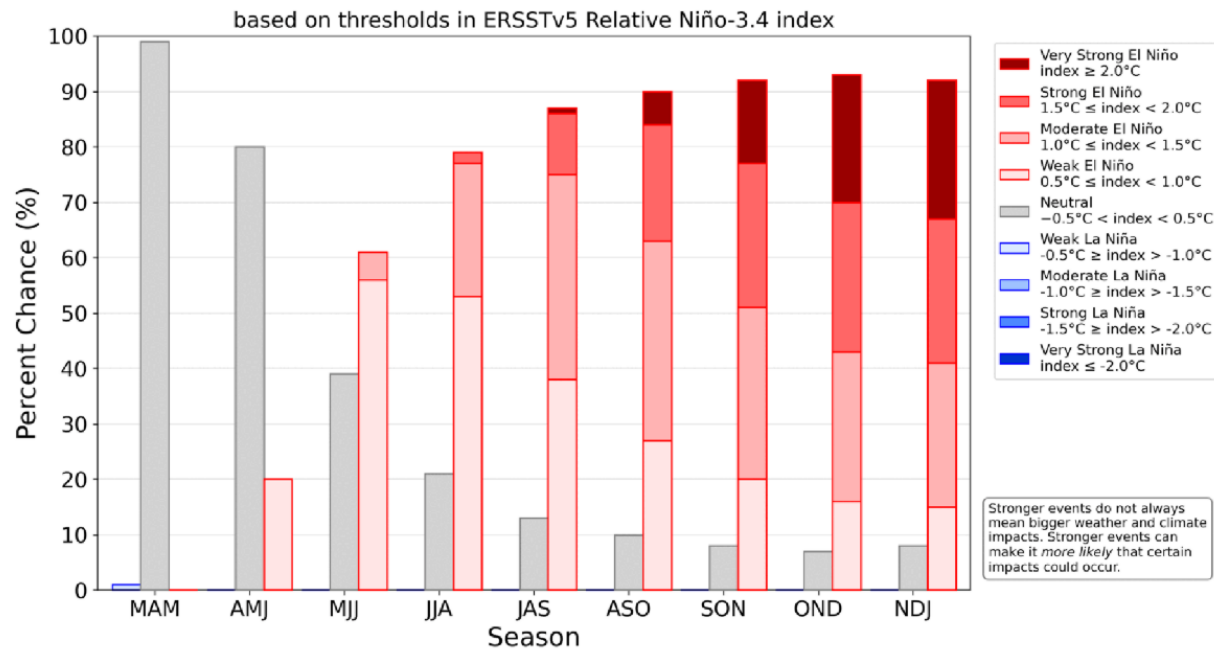
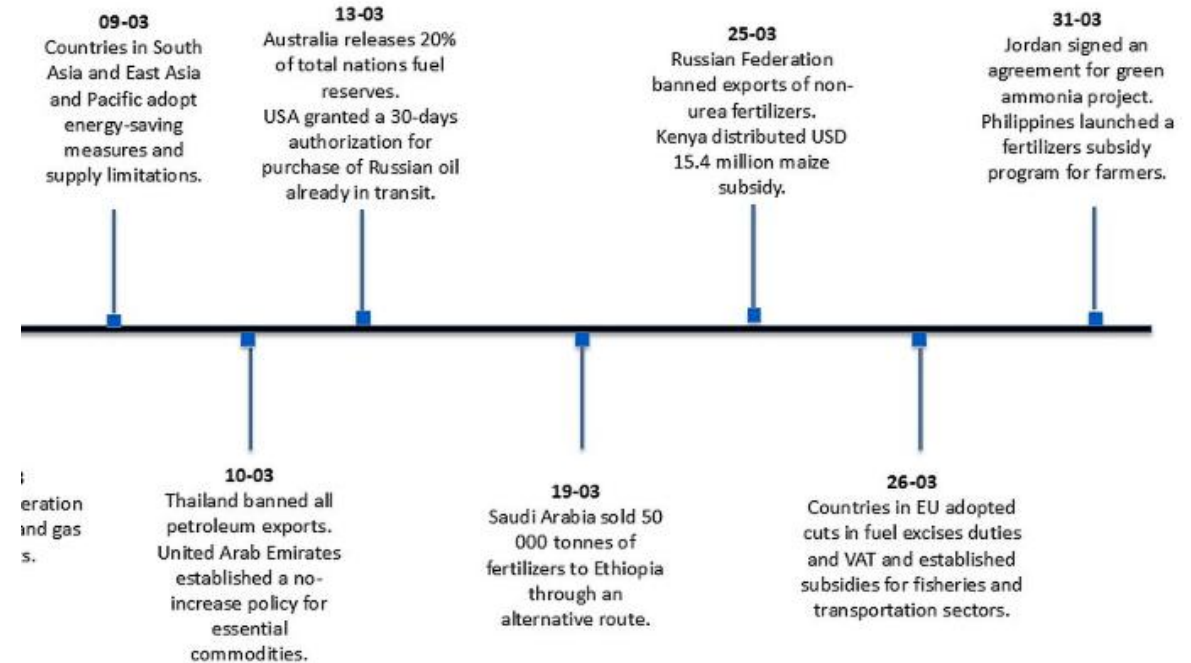


Figure 8. ENSO strength probabilities for the Niño 3.4 relative sea surface temperature index (5°N-5°S, 170°W-120°W) minus tropical mean (20°N-20°S). The relative index is re-scaled to match the variance of the traditional index. Figure updated 9 April 2026. Higher resolution

In a letter to MEPs, Ursula von der Leyen says the EU will consider authorising increased blending of renewable ethanol in petrol to reduce dependence on foreign oil

BRUSSELS, 24 April 2026 – European Commission President Ursula von der Leyen has confirmed to



Agrifood Innovation and Resilience

Unit Director: Claudia Ringler

AIR conducts interdisciplinary research to support tangible progress toward more productive, equitable, resilient, and environmentally sustainable food systems. Its work spans climate action, natural resource governance across the water, energy, food, environment nexus, responsible AI, enabling and scaling innovation and evidence of innovation impact. By integrating gender and equity considerations, fostering partnerships, and leveraging emerging technologies and institutions, the Unit informs policies and investments that enhance productivity, resilience, environmental sustainability, and equitable development outcomes across diverse agrifood systems.

	1 Equitable climate action	2 Enabling and scaling innovation	3 Natural resource governance & environmental sustainability	4 Responsible AI	5 Evidence of innovation impact
Challenges Addressed	Climate change undermines agrifood system productivity, livelihoods, nutrition, & health, & exacerbates inequalities	Need for actionable, evidence-based policy & regulatory options to accelerate investment in & impacts of science, technology & innovation (STI)	Biodiversity loss and water, land, and forest degradation affect agroecosystems and all life on Earth	Uneven access to data, AI, and digital innovation risk inequities .	Need for more robust evidence on the impact of innovation, delivery and scaling strategies, approaches, and programs
Research Areas	<ul style="list-style-type: none"> Analysis of climate change impacts on food security, nutrition, health, inequality Identification and testing of inclusive climate, CIS, & financial innovations and bundles, including through impact assessment 	<ul style="list-style-type: none"> STI policies, regulations, programs, and investments Innovation systems strengthening Strategic analysis of drivers, enablers, and barriers to the adoption and scaling of agricultural innovations 	<ul style="list-style-type: none"> Integrating economic valuation of biodiversity and environmental services into decision-making Systems and institutional analyses of natural resource management (NRM) interventions 	<ul style="list-style-type: none"> User-centered, responsible AI approaches Testing solutions for research & impact Enabling environment for AI & digital innovation Capacity sharing 	<ul style="list-style-type: none"> Impact evaluations of novel technologies, inputs, and practices, bundled with information, financial, digital, and gender-intentional services
Capabilities & Assets	<ul style="list-style-type: none"> Spatial mapping, foresight and scenario tools Expertise in mixed methods research, Established frameworks and metrics Strong partnerships and convening 	<ul style="list-style-type: none"> Recognized brands based on long-standing work on genetic resources policy, biofortification, biosafety, and innovation systems Mixed-methods assessments Political economy, systems, and institutional analysis 	<ul style="list-style-type: none"> Institutional analyses of natural resource management Participatory action research for building resilience Economic & institutional analysis of NRM Multistakeholder platforms 	<ul style="list-style-type: none"> Assessing AI performance, ethics, policy, and gender-responsiveness Capacity sharing for FAIR data sharing & data science methods Enabling data governance 	<ul style="list-style-type: none"> Strong country partners and networks; collaborations with experts in the biological and physical sciences; advanced tools for integrated analysis across scientific disciplines and at multiple scales

Specific activities of AIR

▪ Equitable climate action

- Scan of how women and girls are affected by the crisis [reduced access to cooking fuels; non-payment of wages; increased time on unpaid or little paid work, such as harvesting]
- Assessment of ENSO impacts [what measures were pro-poor during the previous large ENSO]

▪ Natural resource governance and environmental sustainability

- Review of potential of AE approaches in addressing the fertilizer price crisis
- Modeling of interventions to reduce fertilizer applications, including AE approaches
- Modeling of locations where solar-powered irrigation is cost effective & GHG emissions reductions

▪ Responsible AI

- Blog on energy intensity of computing for AI

▪ Enabling and Scaling Innovation

- Regulatory policy for more (energy) efficient seed technologies
- Interventions for more resilient seed systems in fragile areas

▪ Evidence of Innovation Impact

- Analysis of the potential effects of crisis-induced input prices and trade disruptions on smallholder farmers' profitability and livelihoods (scenario-based simulations using household surveys for some selected countries).
- Impact analysis on the implications of smallholder adoption of (energy) efficient seed technologies.



A few conclusions

- Improve data / monitoring of high-risk countries to better understand local implications of these crises; consider AI / RS but rarely sufficient
- Review learnings from previous crises to stop re-committing errors committed just 2 years prior
- Use a systemic approach (at a minimum considering the agrifood and energy nexus jointly, but climate-water linkages also matter); this includes considerations for poorer countries from policy choices by richer countries
- More seriously review virtual and other stocks of fertilizers and food
- Given quasi-continuous crises, stronger engagement in humanitarian and resilience efforts required, both in countries very directly affected by this crisis [f.ex. Afghanistan] and those forgotten along the way [Sudan, Gaza, etc.]

