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ANWAR GARGASH DIPLOMATIC ACADEMY

Centre for Climate Diplomacy

Climate, Biodiversity and Food Security Risks:

Global Perspectives and Solutions for the UAE

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October 2025

About the Author

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Summary

- Agricultural trade plays an important part in food security, allowing countries to have access to diverse food, all year round, and it is especially important to those countries that are unable to produce sufficient food within their own borders. However, reliance on agricultural trade comes with its own risks.

- The objective of this Working Paper is to examine those current risks within the agricultural trade and to suggest potential solutions that can help build a more sustainable and resilient trade system. It looks at some of the relevant risks for the GCC region such as conflicts affecting food prices, climate change and environmental degradation affecting yields, global pandemic and disruptions along the supply chain, all of which make agricultural trade uncertain and vulnerable.

- The analysis takes a deeper look into how climate change and biodiversity loss are predicted to continue to impact agricultural yields, particularly in countries more vulnerable to climate change, such as water scarce regions, and in turn, impact agricultural trade. For example, maize yield is predicted to decrease by 24% under a high emission scenario by the late century. Spread of pests and diseases due to changing temperatures, and facilitated by international trade, is also likely to impact economically important crops. The nutritional value of food is predicted to decline due to higher concentrations of CO_2.

- This Working Paper highlights the alarming nature of current projections and emphasizes the need to address the role of agricultural trade in tackling climate change, biodiversity loss, while ensuring food security.

- It also looks at how some of the countries around the world are tackling this issue. For example, the BRICS's new Laboratory on Trade, Climate Change and Sustainable Development, and the new trade agreement between New Zealand, Switzerland, Costa Rica and Iceland on Climate Change, Trade and Sustainability (ACCTS) are both given as examples of multilateral efforts to achieve more sustainable trade that is resilient and does not cause environmental harm.

- Finally, the Working Paper examines potential solutions and initiatives tailored to the United Arab Emirates (UAE) that can advance climate and biodiversity goals through agricultural trade. As a country that imports approximately 90% of its food and serves as a major hub in global trade, the UAE is uniquely positioned to drive progress toward more sustainable trade practices.

- It concludes with a set of targeted policy recommendations.

    1. The UAE could strengthen the commitment to sustainable trade by integrating it into domestic and international food security and environmental policies (e.g. UAE's National Food Security Strategy 2051), leveraging global platforms (e.g. Global Food Security Summit) and partnerships to advance this agenda (ACCTS and BRICS).

    2. Building a robust trade-related evidence base through assessments, data collection and analysis with a view of aligning the food supply chain with climate and environmental goals could be a good starting point towards policies that shape sustainable trade. This could include assessing its own "virtual water trade" and assessing its own overseas agricultural practices.

    3. Embedding sustainable trade into the UAE's National Cluster Strategy by fostering collaboration, innovation, and capacity building across the food sector could help design food security ecosystem that helps UAE achieve its

climate change and biodiversity goals. The UAE could consider boosting regional and local production that is of a high-quality, is environmentally friendly, and results in healthy food, and that meets or exceeds the standards of imports from more distant sources.

4. Promoting sustainable consumption by encouraging behaviour change towards a plant-based diet could help tackle the issue domestically. For example, government could follow the principles of the EAT-Lancet Report on the planetary health diet and promote a shift towards reduced meat consumption and greater inclusion of plant-based nutrients.

Introduction

Countries such as the USA, Canada, Australia, New Zealand, and Kazakhstan all achieve food security through self-sufficiency, i.e. they produce sufficient food domestically. These countries are all characterised by high GDP, richness in natural resources that support agriculture, and sparsely populated areas. European countries, on the other hand, achieve high domestic production through the intensification of agricultural production in a relatively small area, aided by the use of technology and innovative approaches to food production.[1] Countries such as Singapore and the United Arab Emirates, rely on international trade to achieve their food security.[2] Ensuring food security in an increasingly interconnected world requires addressing the complex relationship between agricultural production and international trade.

The heavy reliance on trade has led to many other countries opening their agricultural trade by removing trade barriers (quotas and tariffs). Indeed, an open trade policy has been shown to have a positive impact on food security, specifically on calorie consumption, dietary diversity and diet quality (food utilisation).[3] It also contributes to global sharing of the new technologies that improve lives, services, and the dissemination of knowledge.[4] Research focussing on the Middle East and North Africa (MENA) has also shown that opening trade has the potential to positively impact the welfare of the population in those countries.[5]

As an arid country with limited water and soil resources, the UAE's open trade policy helps it achieve and maintain food security. Food self-sufficiency[1] for the UAE is unfeasible in the traditional sense, given that it would require an increase in agricultural land area by around 1110%[6]. Additionally, 90% of the UAE's food is imported; and its open trade policy is what allows it to have access to a diverse, nutritious and year-round food.[7] In this sense, the UAE's food security is closely linked to its economic activity and its ability to create ties with other countries.

The UAE has also been working on diversifying its trade sources to protect itself from external food supply risks such as conflicts, with the Russia-Ukraine conflict affecting global wheat prices and supply. For context, 13% of the UAE's imported wheat came from Russia (approximately 262kt) in 2022, whereas before the conflict, in 2019, Russia exported 671k t of wheat to the UAE and was the main exporter, with a 39% stake.[8]

Furthermore, a wheat price spike of 40% since 2022 has prompted India to stop exports of wheat to the UAE for uses other than domestic (impacting UAE's re-exports of wheat to other countries). This has had a significant impact on the UAE's wheat trade, given that prior to the ban, India was the UAE's main source of wheat imports, with 41% of all wheat coming from India in 2022.[9] Since then, starting from 2023, the UAE has managed to close the Indian gap by importing wheat mainly from Russia again, Australia, Canada, Romania, Turkey and Ukraine (through the Black Sea routes).[10] [11]

Other recent disruptions were caused by the insecurity of the Red Sea passage that started in December 2023 and ongoing in July 2025, diverting ships around the Cape of Good Hope and causing significant delays.

Environmental disruptions resulting in the Indian rice ban or global crises such as the COVID-19 pandemic have also affected agricultural trade in the UAE and globally in 2022 and 2020/2021, respectively.[12]

a. Defined as "the ability of a region or country to produce enough food (especially staple crops) without needing to buy or import additional food." (The IPBES assessment report on land degradation and restoration. 2018)

Currently, the UAE imports its food products from over 170 countries.[13] Despite the supply challenges, and thanks to its food security policies, the UAE ranks relatively high on the Global Food Security Index – in 23rd place (Table 1).[14]

Table 1 Global Food Security Index Rankings (2022)

Rankings	Country	Overall Score
1st	Finland	83.7
2nd	Ireland	81.7
3rd	Norway	80.5
4th	France	80.2
5th	Netherlands	80.1
6th	Japan	79.5
=7th	Sweden	79.1
=7th	Canada	79.1
9th	United Kingdom	78.8
10th	Portugal	78.7
11th	Switzerland	78.2
12th	Austria	78.1
13th	United States	78
=14th	Denmark	77.8
=14th	New Zealand	77.8
16th	Czech Republic	77.7
17th	Belgium	77.5
18th	Costa Rica	77.4
19th	Germany	77
20th	Spain	75.7
21st	Poland	75.5
22nd	Australia	75.4
23rd	United Arab Emirates	75.2
24th	Israel	74.8
=25th	Chile	74.2
=25th	China	74.2
27th	Italy	74
28th	Singapore	73.1
29th	Bulgaria	73
30th	Qatar	72.4
31st	Greece	72.2
32nd	Kazakhstan	72.1
33rd	Uruguay	71.8
34th	Hungary	71.4
35th	Oman	71.2

36th	Slovakia	71.1
37th	Peru	70.8
38th	Bahrain	70.3
39th	South Korea	70.2
40th	Panama	70
…	…	…

As a high-income country, the UAE can satisfy its population's food needs through imports. However, the UAE's population is expected to further increase by over 60% by 2050, and the population has a high appetite for diverse and high-quality food which will need to be imported.[15] This is likely to further increase the pressure on the volume and diversity of the UAE's agrifood trade.

Agriculture, forestry and other land use are one of the main drivers of climate change, contributing between 13 and 21% of global GHG emissions.[16] Global food systems are also among the main drivers of biodiversity loss, with agriculture accounting for 80% of all land use change globally putting 24,000 of the 28,000 known species at risk of extinction.[17] Trade also plays a role in the spread of pests and diseases that threaten economically important crops and the environment. It is therefore important for countries whose food security relies on food imports to fully understand the environment and climate change impacts and to actively engage in shaping a more sustainable global trading system.".

Navigating Environmental Challenges associated with Agricultural Trade

Today's agrifood trade, while critical to global food security, often operates independently of broader challenges such as climate change and biodiversity loss.[18] As such, it has not been adequately addressed within the United Nations Framework Convention on Climate Change (UNFCCC) or the Convention on Biological Diversity (CBD) processes, although some progress has been made in the last two years; namely, at UNFCCC COP28 in 2023 and at CBD COP16 in 2024, where one day was dedicated to trade at each conference. Additionally, the Forest, Agriculture and Commodity Trade (FACT) dialogue was adopted at COP26 and centres on protecting forests and other ecosystems, while promoting sustainable trade and development and addressing the climate and biodiversity crises.[19] Although increasing dialogue at these international events is a positive thing, it is still far from enough.

BOX 1: BRICS as a path towards sustainable trade

BRICS, as a group of 11 countries - Brazil, South Africa, Saudi Arabia, China, Egypt, the United Arab Emirates, Ethiopia, India, Indonesia, Iran and Russia - represents the Global South, and serves as a platform to voice the Members' concerns and interests on the international stage. Currently, BRICS accounts for 40% of the world's economy.20

Trade is one of the three main pillars of BRICS, with the group committed to enhancing the trade between member countries by promoting trade facilitation measures. In parallel, sustainability and environment have become increasingly prominent on the BRICS agenda, highlighting the potential to foster more sustainable trade practices within the group. Brazil's concurrent presidencies of BRICS and UNFCCC COP30 in 2025 presents an opportunity to advance a coordinated agenda on climate action and sustainable trade.

At the BRICS meeting in April 2025, the members agreed to the creation of the BRICS Laboratory on Trade, Climate Change and Sustainable Development, with the aim of "promoting collaboration on mutually supportive approaches to trade and environmental policy". The Laboratory could be a valuable platform to address environmental issues embedded within agricultural trade such as biodiversity loss, environmental pollution and GHG emissions. Through the Laboratory, members could advocate for more sustainable land use associated with agriculture and encourage fellow members to assess their impacts on biodiversity and to take action.

Food system, which includes production, transportation, processing, packaging, storage, retailing, consumption, and food waste, is responsible for one third of all global emissions.[21] Globally, agriculture and land use change are responsible for 71% of those emissions while retail, transportation, consumption, fuel production, waste management, industrial processes and packaging are responsible for the remaining 29%.[22] Through agricultural trade, the global dietary needs of nations that are less able to produce their own food, continuously shape the agricultural production and food systems in producing countries.

1. Agricultural Production

Intensive agriculture vs conservation agriculture

Intensive agriculture, which prioritises high crop yields, depends heavily on inputs such as fertilizers, pesticides, and water. The overuse of these resources poses significant risks to ecosystems, including the degradation of water and soil quality, biodiversity loss, reduced availability of these resources, weakened ecosystem resilience to pests and diseases, and increased greenhouse gas (GHG) emissions, all of which threaten environmental stability.[23,24]

On the other hand, conservation practices can play a pivotal role in achieving climate and biodiversity goals. Conservation approaches can also enhance the resilience of food systems and provide crucial support to local communities by securing land tenure. This is an especially important consideration for rural communities in developing countries, as it is in those farming households that one third of the world's food is produced, feeding around 80% of people in those regions.[25]

Small-scale farmers and local communities—who not only produce the food but also play a crucial role in safeguarding natural resources—are frequently marginalized within the food supply chain. Globally, small farms (less than 2 hectares) occupy only 12% of arable land, produce around 35% of all food, and are also responsible for 3.5% of total global GHG emissions or around 32% of agricultural emissions.[26,27] Small farms are one of the areas where the potential for biodiversity and climate action lies by applying environment-friendly agricultural practices.

One example of such practice is regenerative agriculture which is becoming increasingly popular among agriculturists, civil society, governments, and corporates. At the heart of this practice are five principles with emphasis on improving and building soils. These principles are as follows: minimise soil disturbance, keep the soil covered, maintain living roots in the soil, maximise plant diversity, and reintroduce livestock.

When these principles are applied in the right context (considering climate, soil type and other resources), evidence has shown that it has the potential to improve the functionality and health of soils, improve water retention, increase resilience to environmental variability, sequester carbon, and improve air quality and biodiversity.[28]

In Sub-Saharan Africa, regenerative agriculture already has and is predicted to continue to bring economic, societal, and environmental benefits to smallholder farmers and to degraded land. For example, one company has seen an 80% increase in cotton lint yields after applying regenerative practices, another company boosted annual yields by 68% through its agroforestry programme and through a training programme; individual farmers are seeing up to 300% yield increases after applying practices such as pruning and rejuvenation.[29]

Some of the future predictions for increased uptake of regenerative agriculture in Africa include support of nearly 5 million jobs by 2040 in addition to increasing revenue and food security for smallholder farmers. By reducing inputs such as fertilisers and pesticides, the annual savings to farmers across Sub Saharan Africa may be as high as USD 17 billion by 2040.[30]

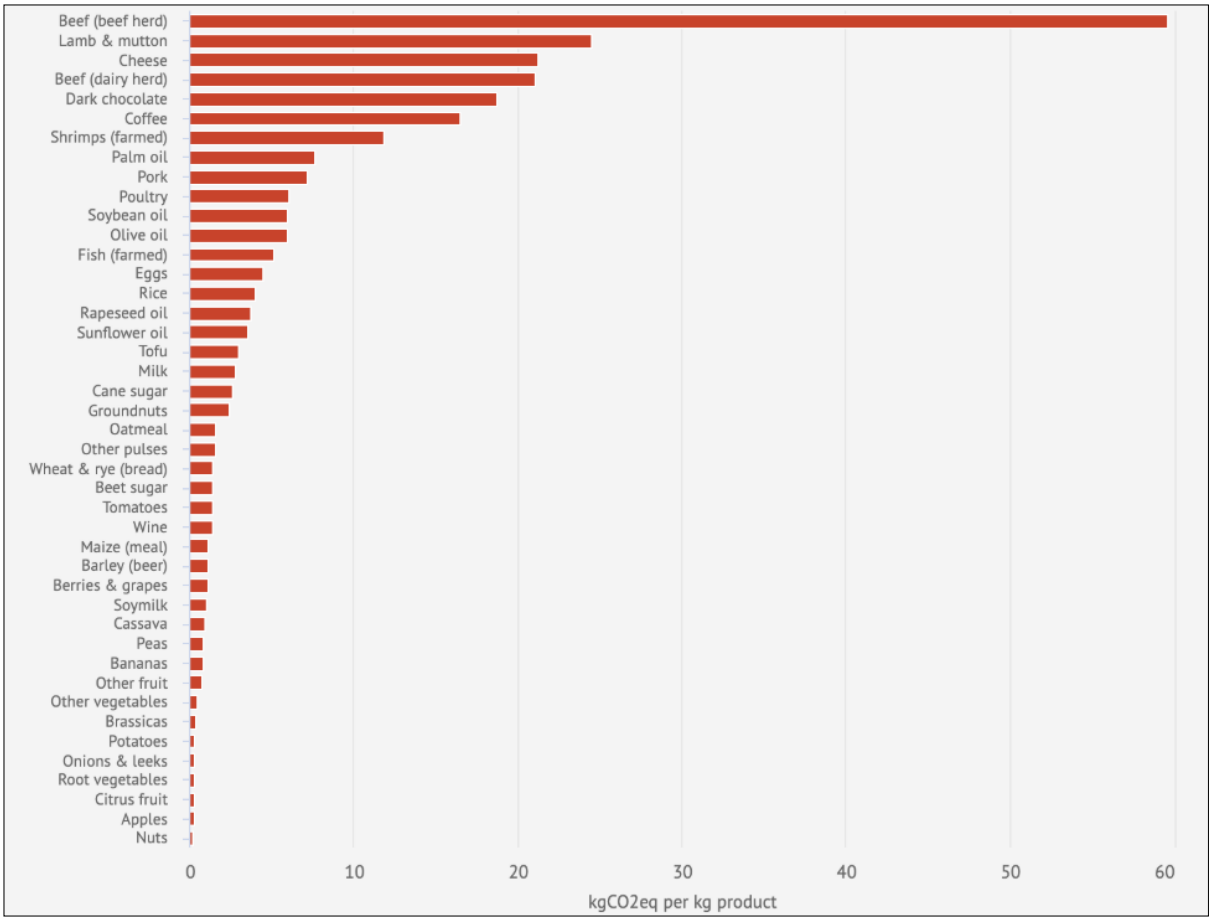
There are other practices similar to regenerative agriculture that could work well on small farms, such as organic agriculture, agroecology, and climate-smart agriculture. Investing in these practices and encouraging them could support local communities and contribute towards global climate change and biodiversity goals.

Land Use Change and Meat Production

A major challenge in agricultural production is land use change. When land is converted from its natural state to agricultural or grazing land, it becomes a significant CO_2 source. Trees and soil that act as a carbon sink are no longer there to sequester CO_2. It has been estimated that almost one third of all global forest loss can be attributed to permanent deforestation for commodity production, which includes the production of beef, soy, palm oil, and wood fibre.[31]

When taking a closer look at agricultural production, global meat production poses a particularly significant environmental challenge due to its GHG emissions. This is because meat production includes CO_2 emissions from land use change, as well as methane emissions from enteric fermentation and manure management for cattle and poultry. When these emissions are combined, they total to up to 27% of total food system emissions or around 12% of total global GHG emissions.[32] On average, it has been estimated that emissions from animal products are 10 to 50 times higher than emissions from plant-based food (Figure 1).[33,34] Methane gas particularly, is 28 times more potent at trapping heat in the atmosphere than CO_2.[35]

Figure 1 GHG emissions per kilogram for different food groups (Source Carbon Brief and Data source: Poore & Nemecek (2018).



Areas with the most drastic land use changes are Central and South America, including Brazil, where significant parts of forests have been converted to row crop agriculture and cattle grazing lands. Southeast Asia also deals with major land use changes, specifically Indonesia and Malaysia, where forest land has been converted to palm oil plantations.[36]

Decisions regarding trade partners can have indirect implications for biodiversity and climate change in those countries. For example, the UAE's main partner country for beef imports is Brazil, followed by Australia and India, and as such, it will also have an impact on land use in Brazil, Australia and India. Indonesia and Malaysia are the main import partners to the UAE (but also globally) for palm oil, which in turn drives land use change in those countries.[37]

BOX 2: Sustainable investments in overseas agricultural land

Even though the UAE does not have extensive domestic food production, the country is investing in food production abroad with the aim of safeguarding itself from market fluctuations and supply chain disruptions. These investments are mostly in the Americas, Cambodia, Egypt, Namibia, Pakistan, Romania, Serbia, Sudan and Vietnam, and then imported into the UAE or exported elsewhere.38

For example, one such agricultural investment company, has a portfolio covering 135,000 acres of summer and winter crops in Romania, 45,000 acres of farmland in Serbia, including dairy production, over 66,000 acres in Egypt, with the main crops being wheat, corn, and citrus. In the United States, the company farms on 30,000 acres, allowing it to export 700,000 tonnes of various crops globally, with their main crop being the animal feed crop - alfalfa.39 In Africa, particularly Namibia and Morocco, the company farms olive trees, apples, dates, and grapes.

This approach is part of the UAE Food Security Strategy 2051, and it presents an opportunity to encourage sustainable production in those places.

In the same way that countries are looking to improve and sustain their own natural resources to support their domestic productions, the UAE should apply these principles to agricultural land that is leased or owned abroad. Preserving natural resources, such as healthy soil, biodiversity, pollinators, and water is crucial for ensuring the continued provision of agricultural services. Equally important, is fostering collaboration with local communities, who share and depend on these resources, as part of promoting sustainable and inclusive practices.

Trade of virtual water

A critical issue with the current agricultural production system is water consumption. Water is a valuable natural resource, and becoming increasingly critical as 4 billion people face severe water scarcity around the world.[40] Agriculture exerts significant pressure on domestic water systems and contributes to the existing strain through food exports.

The term "Virtual Water Trade" (VWT)[2] was developed in 1991 to account for water consumed during agricultural production and then traded on international markets.[41] Global VWT estimates range from 960 km^3/year to 4,250 km^3/year, and around 20% of the water used for agricultural production is then exported rather than used domestically. The majority of the VWT can be attributed to livestock production and a handful of crops, namely wheat, maize, soybean, palm oil, coffee, and cocoa.[42]

Future changes in available water for agricultural production will affect global food production. As a water scarce country, the UAE depends on imports of water-intense crops. For example, one kilogram of beef uses 1545 litres of water and one kilogram of rice uses 2497 litres of water.[43]

Understanding the country's own water footprint and the virtual water trade associated with imported food, could

b. Virtual water trade (VWT) is the amount of water, either green (soil moisture) or blue (renewable and non-renewable), that is consumed in the production of agricultural goods that are then traded in the international market (Source: Allan, J. A. (1998). Virtual water: a strategic resource. Ground Water 36, 545–547.) Blue water is freshwater stored in lakes, rivers, groundwater, glaciers, polar ice caps; and green water is the soil moisture from precipitation, used by plants.

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2. Transport and other supply chain impacts

Mode of transport

Transportation is a significant contributor to climate change in the food supply chain, with emissions varying based on key factors, one of which is the mode of transportation used.[44] In general, air transport has the highest emissions per ton, however, road transport is responsible for 69% of all transport related emissions. This is because road transport accounts for the majority of agricultural goods movement. International shipping has somewhat lower contribution, at 0.8 $GtCO_2$- eq or 9% of the sector's total, while international aviation contributes 0.6 $GtCO_2$-eq, or 7%.[45]

International transport, which includes international shipping and international aviation, is however not included in the national GHG inventories.[46] In the context of food, it is important to note that some of the food produce is perishable, meaning that it has a short life, and needs to be transported quickly, thus affecting the choice of transport mode.

The shipping industry supports more than 80% of global trade in grains and oilseed[47] however it also contributes to GHG emissions and negatively impacts the environment. These environmental impacts include accidental oil and chemical spills, air pollution, the release of ballast water containing invasive species, garbage, and noise pollution, among others.[48]

The International Maritime Organization (IMO) adopted a new strategy in 2023 with the intermediate goal of a 5% - 10% uptake of zero or near-zero emission fuels and energy sources by 2030 and reaching net-zero GHG emissions from international shipping by or around 2050.[49]

Most recently, the IMO has approved the draft legal text for the IMO Net Zero Framework, set to come into force in 2027. The Framework will require ships to comply with a global fuel standard (reducing emission of GHG per energy unit) and for those ships exceeding agreed targets, remedial units will need to be acquired.

To support this, the IMO is also setting up a Net-Zero Fund to manage these revenues with a focus on rewarding low-emitting ships, supporting innovation, research and infrastructure, capacity building and training, and mitigating negative impacts on the most vulnerable states.[50]

One of the innovative solutions for climate change and environmental challenges in shipping, in line with the IMO 's Net-Zero Strategy, is the development of "green corridors" for the shipping industry. An initiative that started at COP26 in Glasgow under the 'Clydebank Declaration for green shipping corridors', has been adopted by 27 countries (including the UAE), committing to work together to support the establishment of green shipping corridors – zero-emission maritime routes between two or more ports.[51]

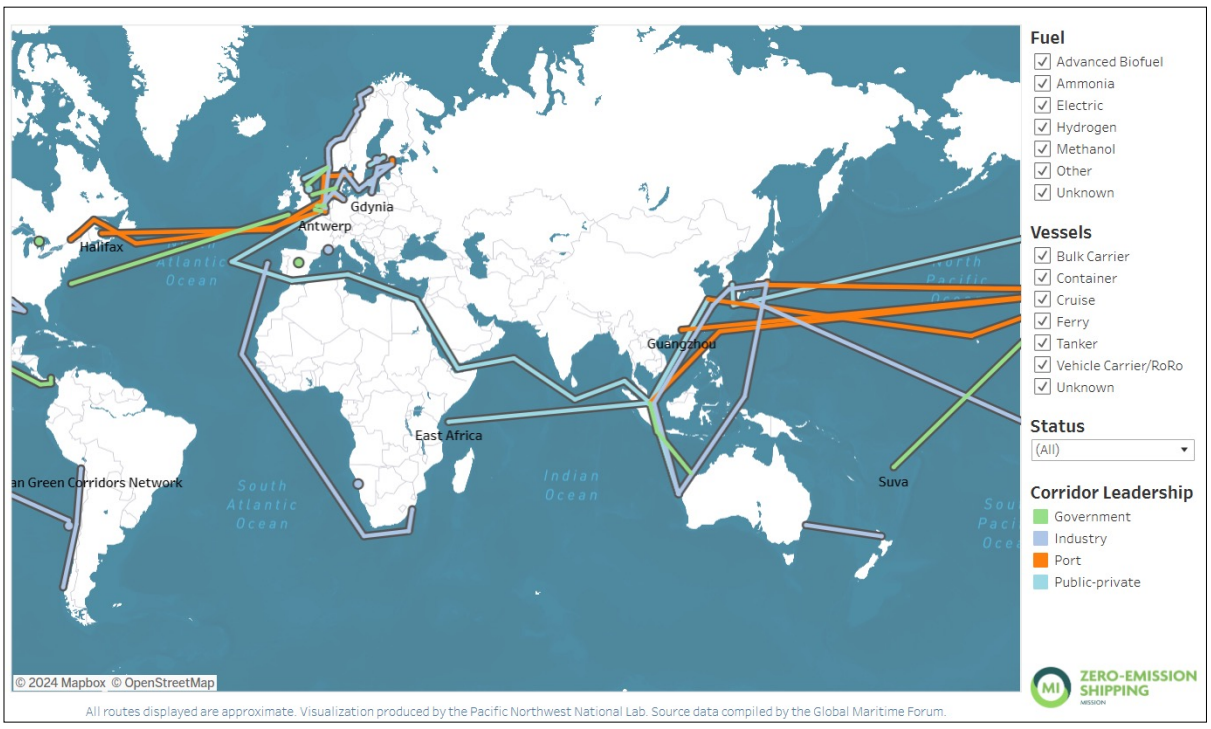
The green shipping corridors bring together countries, the private sector, research institutes, and civil society to "develop, demonstrate, and deploy zero-emission fuels, ships, and fuel infrastructure together by 2030".[52] The green corridors connect the major ports on trade routes in which net zero solutions are implemented and demonstrated (Figure 2).

They enable a coordinated ecosystem that addresses the shared challenges across the value chain and between the countries, achieving positive impact.[53]

The net zero solutions within the green shipping routes include:

- Fuel: zero-emissions fuels, including renewable energy for electric vessels;
- Ports: infrastructure development to support fuel storage and bunkering;
- Ships: technological development;
- Voyage: optimisation including Just in Time arrivals, port optimisation and advanced vessel dynamics.54

Figure 2 Example of the 'green corridors' connecting major ports around the world. Source: Zero Emission Shipping[55]

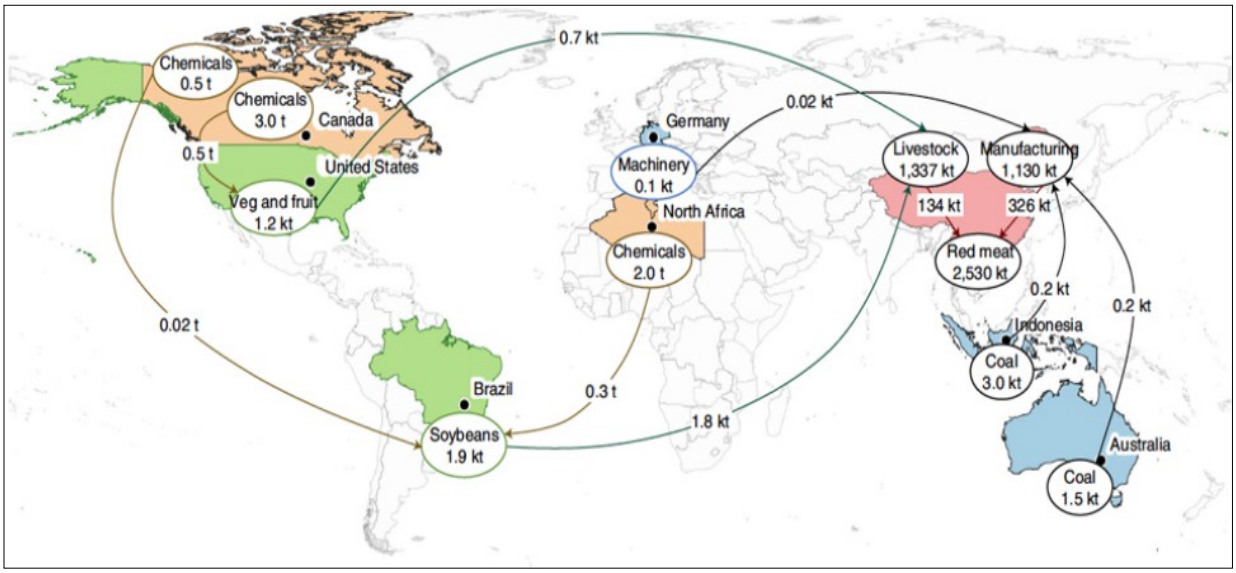


Food miles emissions

Another factor affecting emissions within the food system is the distance between the trading countries. 'Food miles emissions', or emissions associated with transportation of food, account for around 20% of total food systems' emissions.[56] This estimate includes a holistic approach to looking at the food related emissions as it includes the entire supply chain and not just transporting food from the place of production to the destined country (Figure 3).

For example, meat production emissions do not only mean methane from manure and from enteric processes. Often overlooked, the supply chain emissions related to red meat consumption are far more complex. In the example in Figure 3, emissions include feed for livestock, machinery, fertilisers and chemicals, and various modes of transport covering various distances to supply red meat to China. This shows the complexity of agricultural production supply chain which needs to be considered when evaluating emissions within the food supply chains. This more holistic approach to assessing emissions stemming from the food supply chain allows for better decisions to be made along the whole supply chain.

Figure 3 Example of the supply chain emissions for red meat consumption in China (in tonnes or kilotons of CO2e). Source: Li et al (2022)



For the UAE, a significant part of its food supply chain is related to transport. Therefore, maintaining existing food supply chain corridors is critical for the UAE's food security. For example, 70% of the UAE's imported food transits through the Bab el-Mandeb Strait making it vulnerable to the recent vessel attacks in the Red Sea. [57]

Further demand for food will drive further land conversions, biodiversity loss, desertification (water and soil loss), and GHG emissions. Agricultural production and its supply chain are areas where countries can make better decisions to support global action.

For the UAE, eating 100% locally is not an option and trade is likely to always be part of its food security mix. However, reducing the pressure on international agricultural trade by focusing more on domestic and regional food production, would lower the emissions footprint associated with agrifood trade. Taking a closer look at the whole food supply chain could help policy makers with more informed decisions on trading partners and trading modes while lowering their carbon footprint.

Sustainable trade of the future

Geopolitical dynamics will always play a critical role in shaping agricultural trade and those should be carefully considered when designing agricultural trade policies. However, it is also important to recognise climate change, environmental degradation, and biodiversity loss as a serious risk to long-term food security.

For instance, in a study that estimated future changes in trading of virtual water, it was found that future virtual water trading may triple by 2100 while non-renewable groundwater trading may at least double.[58] Currently, crops responsible for significant amount of traded green water are oil crops such as soybean, however further increase in consumption of oil crops, as well as corn and wheat, will drive this stark increase towards the turn of the century. The same study has also found that significant pressure arising from traded water exports will be concentrated in the Nile River basin while the Middle East will continue to heavily rely on traded virtual water.[59]

The key challenge will be in designing and adapting trade policies that are resilient to these future shocks—particularly those arising from changes in the natural systems underpinning food production—while actively supporting climate and biodiversity goals. Agricultural trade and food systems should be part of the solution, rather than exacerbating the problem.

The world is facing increasing weather extremes, such as droughts, floods, intensifying heatwaves, wildfires, and tropical cyclones, which are only expected to intensify over the next decade.[60] In addition to these extremes, longer-term impacts are expected such as increasing mean temperature, altered seasonality, combined heat and drought stress, heavy rain events, water stress, changes in the occurrence of pests and diseases, sea level rise, and ocean acidification.[61] These changes will have significant impact on agriculture worldwide and will continue to affect the yields of important food staples.

For example, under climate and crop modelling, maize yield is predicted to decrease by 24% under a high emission scenario by the late century.[62] Availability, access, utilisation and stability, all four pillar of food security are predicted to be affected by climate change (Figure 4). Besides impacts on yields, some of the other examples include reduced food quality (food spoilage and loss from mycotoxins), decline in nutritional quality due to increases in atmospheric CO_2, and widespread crop failure contributing to migration and conflict.

Figure 4 Impact of climate change on availability, access, utilisation and stability of food. Source: IPCC, 2019[70]

Food security pillar	Examples of observed and projected climate change impacts
Availability *Production of food and its readiness for use through storage, processing, distribution, sale and/or exchange*	Reduced yields in crop and livestock systems
	Reduced yields from lack of pollinators; pests and diseases
	Reduced food quality affecting availability (e.g., food spoilage and loss from mycotoxins)
	Disruptions to food storage and transport networks from change in climate, including extremes
Access *Ability to obtain food, including effects of price*	Yield reductions, changes in farmer livelihoods, limitations on ability to purchase food
	Price rise and spike effects on low-income consumers, in particular women and children, due to lack of resources to purchase food
	Effects of increased extreme events on food supplies, disruption of agricultural trade and transportation infrastructure
Utilisation *Achievement of food potential through nutrition, cooking, health*	Impacts on food safety due to increased prevalence of microorganisms and toxins
	Decline in nutritional quality resulting from increasing atmospheric CO_2
	Increased exposure to diarrheal and other infectious diseases due to increased risk of flooding
Stability *Continuous availability and access to food without disruption*	Greater instability of supply due to increased frequency and severity of extreme events; food price rises and spikes; instability of agricultural incomes
	Widespread crop failure contributing to migration and conflict
Combined *Systemic impacts from interactions of all four pillars*	Increasing undernourishment as food system is impacted by climate change
	Increasing obesity and ill health through narrow focus on adapting limited number of commodity crops
	Increasing environmental degradation and GHG emissions
	Increasing food insecurity due to competition for land and natural resources (e.g., for land-based mitigation)

The UAE is already experiencing direct impacts of climate change on agriculture and trade. The most recent case is the Indian rice ban of 2023 which was triggered by the fear of a predicted dry monsoon event in India, El Niño. India is one of the world's key rice exporters and is especially important to countries in Africa. The ban, coupled with unfavourable weather events had a serious impact on rice trade around the world in 2023, including the UAE. As a result, there was a significant increase in rice exports from Pakistan (64% increase from 2022/2023) and the US (32% increase from 2022/2023) as exports from India, Vietnam and Thailand decreased.[64]

Towards more sustainable trade policies

The UAE does not impose many trade barriers such as tariffs on agricultural goods to help with food availability and affordability. The open trade policy, especially when it comes to food, helps with trade diversification, and in turn helps the UAE to protect itself from trade shocks. Box 3 shows the UAE's most significant agricultural imports and exports showcasing the diversity of its trade partners.

BOX 3: UAE trade and production data

When it comes to domestic production, there are around 38,000 farms operating in the UAE contributing around 1% to the GDP. The UAE grows 156,000 tonnes of vegetables and produces 200,000 tonnes of fruit annually (including dates, citrus, and mangoes).[65] Dates are one of the UAE's main domestic exports, and the UAE is the second largest exporter of this fruit in the world.[66] This trade is worth $287 million for the country and its main importing partner countries are India, Morocco, Bangladesh, Indonesia, and Somalia.

However, despite limited domestic production, the UAE has a well-established agricultural trade. Thanks to its re-export capacity, the UAE is supplying the region with agricultural products. The table below shows the top importing and exporting agricultural commodities, along with the main importing and exporting countries.

Table 2 UAE's most significant agricultural imports, exports and domestic production. All data reflects year 2022.[67]

Agricultural Imports			Agricultural Exports		
Commodity	Country	Value	Commodity	Country	Value
Fruit, Veg, Nuts	US, India, South Africa, China, Saudi Arabia	3.4$ bn	Fruit, Veg, Nuts	Saudi Arabia, Iran, Oman, India, Yemen	2.1$ bn
Meat	Brazil, Australia, Pakistan, India, US	2.7$ bn	Oilseeds	China, Somalia, Malaysia, Oman, Kuwait	1.5$ bn
Oilseeds	Australia, Indonesia, Malaysia, Canada, Argentina	2.2$ bn	Dairy, Eggs, Honey	Oman, Saudi Arabia, Somalia, Yemen, Iraq	1.3$ bn
Dairy, Eggs, Honey	New Zealand, Saudi Arabia, Turkey, Netherlands, Australia	2.1$ bn	Stimulants, Tobacco, Spices	Saudi Arabia, Iran, Iraq, Oman, Russia	1$ bn
Cereals	India, Australia, Pakistan, Argentina, Romania	1.9$ bn	Cereals	Israel, Oman, Romania, Saudi Arabia, Sri Lanka	657$ m

High importing countries, such as the UAE, can play a critical role in leading the way and shaping a more sustainable trade policy. Figure 5 lists some of the policy measures developed by Bellman, C. (2022), that countries can implement in order to support sustainable trade. The measures are divided into different types – border measures, economic incentives, regulatory measures and technical assistance, and capacity building and support measures.

The trade system presents significant opportunities to promote sustainable agriculture and food systems. As suggested in Figure 5, implementing import and export bans on harmful pesticides and hazardous chemicals in food products can discourage environmentally damaging production practices and encourage agriculture that is environmentally friendly, such as organic agriculture and conservation agriculture. Providing subsidies to support the production and consumption of healthier, minimally processed foods could also stimulate a demand for products with a lower environmental impact.

Similarly, imposing higher tariffs on imported foods produced using unsustainable methods can incentivise more sustainable practices while encouraging consumers to choose environmentally responsible options.

The most readily actionable measures suggested in Figure 5 are regulatory measures. Enhancing food safety standards, such as setting stricter pesticide residue limits and nutrition requirements for processed foods, can drive meaningful change. Improved labelling schemes that provide clear information on nutritional values, environmental impact, and biodiversity considerations can also promote greater demand for foods aligned with biodiversity conservation and climate change goals. However, labelling schemes often come with an associated cost for producers and in turn for consumers.

c. Wheat, Rice, Maize, Barley, Oats

Figure 5 Examples of potential trade measures to encourage sustainability in Agriculture. Source: Bellmann, C. (2022)[63]

Measures		Discouraging unsustainable production and trade	Encouraging sustainable production, consumption, and trade
Trade and trade-related policy measures	Border measures	▪ Removing tariff protection on domestically produced goods with high environmental footprint (e.g. meat products) ▪ Applying market-correcting measures on imports to internalize negative environmental externalities ▪ Import and export bans of harmful pesticides and hazardous chemicals	▪ Conditioning market access concessions to compliance with specific sustainability requirements (e.g. through tariff rate quotas or trade preferences) ▪ Removing tariff and non-tariff measures on environmentally preferable products and services) ▪ Trade facilitation measures for healthier but perishable products (e.g. fruits and vegetables)
	Economic incentives	▪ Removing environmentally harmful subsidies (e.g. subsidies for fossil fuels, fertilizers, pesticides, etc.) ▪ Removing domestic support encouraging the production of goods with high environmental footprint ▪ Removing free allowances on carbon-intensive goods	▪ Payments for environmental purposes (e.g. conditioning the provision of subsidies to environmental performances, cross compliance schemes) ▪ Payments for extension and advisory services, research, or pest and disease control, including for alternatives to pesticides and hazardous chemicals that are appropriate for local climate and environmental conditions ▪ Subsidizing the consumption and distribution of healthy food
	Regulatory Measures	▪ Food safety standards and regulations (e.g. maximum pesticide residue limits, nutrition requirements for processes foods) ▪ Mandatory environmental requirements (e.g. requirements concerning the acceptable level of nutrients, airborne pollutants, wildlife and habitat protection) ▪ Mandatory due diligence requirements (e.g. on deforestation-free supply chains)	▪ Mandatory labelling schemes indicating the nutritious content of food (e.g. traffic light approaches for processed food) ▪ Voluntary standards and environmental labelling ▪ Private standards (e.g. carbon footprint)
International cooperation	Technical assistance & capacity building and support measures	▪ Support for subsidy reform including repurposing subsidies to advance sustainability goals.	▪ Technical assistance and capacity building, transfer of technology, financing, and flexibilities in trade agreements to promote a just transition, invest in sustainable production methods and technologies, and meet environmental requirements in export markets

As part of an effort to tackle environmental degradation from international agrifood trade, the European Union Parliament adopted a deforestation regulation in April 2023 whereby companies must ensure that products sold within the European Union have not led to deforestation and forest degradation globally. This includes food imported from around the world, specifically products from cattle, cocoa, coffee, palm oil, soya, wood, rubber, charcoal, and printed paper.[64] This type of regulatory measure is something that could also be replicated in the UAE to ensure that

produce consumed locally does not cause environmental harm abroad. Similarly, banning the sale of soil compost harvested from peatlands could help protect these valuable ecosystems which are the key to carbon sequestration, storage, and biodiversity. Other countries could follow the lead of England which is banning all sales of peat soil by 2030.[65]

BOX 4: New trade agreement between New Zealand, Switzerland, Costa Rica and Iceland on Climate Change, Trade and Sustainability (ACCTS)

In 2024, New Zealand, Switzerland, Costa Rica, and Iceland entered a new trade agreement centred around climate change and sustainability.[66] The agreement's main outcome is elimination of tariffs on 360 environmental goods. This agreement is designed to be an open plurilateral agreement, meaning that other countries are encouraged to join. The environmental goods include technologies in the areas of environmental protection, renewable energies, and circular economy, as well as energy efficiency.

As part of the agreement, parties commit to "ensure the conservation and sustainable management of the ecosystems relevant for the production of environmental goods, with the objective of reducing greenhouse gas emissions and biodiversity loss, including those resulting from deforestation, forest degradation, land use, and land-use change including for agricultural and mining activities."[67]

This is a significant shift from the traditional trade agreements, which have not placed environmental protection and climate change at the centre of it. As such, it has the potential, with more countries joining, to seriously address environmental and climate change challenges embedded in the trade system. It serves as an example of efficient multilateral trade negotiations that are decisive and produces actionable outcomes.

The agreement also covers 114 environmental services and environmentally related services subsectors. Some examples of these environmental services are Research and Development services including agricultural sector consulting services supporting sustainable agricultural approaches, and services incidental to fishing which includes monitoring of stocks and catches.

Another relevant part for agriculture and food security in this agreement is the framework to discipline and eliminate harmful fossil fuel subsidies, which are closely interlinked with environmental harm coming from the subsidised agricultural production. The chapter on the fossil fuel subsidies and its framework is in line with the WTO's policy on industrial, agricultural and fisheries subsidies.

This is the first international agreement of its kind and one in the direction towards decarbonising trade and ensuring it works with environment and ecosystem, not against. As more countries join, this common goal will become more impactful and could serve as a blueprint for the action within the WTO policy development.

Conclusion

Countries that heavily rely on imports for food have an important role to play in shaping the future of trade. It is important that those countries understand the full picture of food and agricultural trade, including the impact on the environment, climate change, and local communities. Countries are often committed to climate change and biodiversity action within their borders but may lack incentive to act beyond them. It is however in the importing countries interest to preserve those natural resources and support local communities, as this is where their food will come from – as such they also have a stake in this.

Trade of food and agricultural products is responsible for a significant amount of GHG emissions through production and transport; agriculture drives biodiversity loss through irresponsible agricultural practices which involves land conversion, it causes pollution of land and seas, driving further desertification of soils. Trade also contributes towards the spread of harmful pests and diseases, posing risks for local biodiversity and agricultural production.

And yet, trade is what feeds most of the world, especially important to countries which do not have suitable conditions to be food self-sufficient. These challenges should not be ignored, and better policies should be put in place both by individual countries and the World Trade Organisation. Investing in better policy measures at borders and domestically, encouraging better agricultural practices in the countries where food is grown (especially on smaller farms), knowledge sharing, capacity building, and technology improvement, should all be part of the way forward towards sustainable trade.

Knowing where food on the table originates from and how it was made is what can make a consumer make better choices – which can support governments and industries in their journey towards sustainable practices. Changing the behaviour of consumers and encouraging positive choices is not a small task but empowering them with knowledge could make a difference. This can be achieved through better labelling and food standards ensuring consumers know the carbon and environmental footprint of the product.

Recommendations

1. Strengthening the commitment to sustainable trade by integrating it into domestic and international food security and environmental policies, leveraging global platforms and partnerships to advance this agenda.

   The UAE could consider addressing sustainable trade topics within its food security and environmental policies and initiatives. For example, the UAE's National Food Security Strategy 2051 has trade related targets which could be further enhanced by adding sustainability aspects to these targets.

   Furthermore, the UAE is host to the Global Food Security Summit which represents an ideal platform to address this issue. The BRICS group represents another platform through which the UAE can address this challenge on an international stage, especially now that members have agreed to create a Laboratory on Trade, Climate Change and Sustainable Development. And lastly, the UAE could consider joining the newly formed trade agreement between New Zealand, Switzerland, Costa Rica and Iceland on Climate Change, Trade and Sustainability (ACCTS) which places the issues of climate change and environmental challenges at its core.

2. Building a robust evidence base through assessments, data collection and analysis with a view of aligning the food supply chain with climate and environmental goals.

The UAE could undertake an exercise to assess its entire food supply chain, including the assessment of its own 'virtual water trade' associated with the country's food import to better understand linkage between its agricultural supply chain, environment, and climate change. The UAE is set to host the United Nation's water conference in December 2026 which presents a timely opportunity to address this topic, showcasing its commitment to climate and environmental goals.

To compliment this, the UAE could consider evaluating its own overseas agricultural practices, adopting climate and biodiversity-friendly approaches in these regions while supporting local communities.

3. Embedding sustainable trade into the UAE's National Cluster Strategy68by fostering collaboration, innovation, and capacity building across the food sector.

   As a part of the Food Cluster initiative, the UAE is bringing together multiple stakeholders with the aim of strengthening the country's food security, sustainability, and innovation in the food sector. One of the key areas of impact is trade development which seeks to enhance the UAE's presence in international trade; however, environmental and climate change consideration are currently not included within this theme.

   The government could collaborate with industry, academia, farmers, and other stakeholders to explore what sustainable trade could look like for the UAE and the wider region. This may involve boosting regional and local production of high-quality, environmentally friendly, and healthy food, that meets or exceeds the standards of imports from more distant sources. Achieving this would require investments in innovative technologies, improving access to technical expertise, strong collaboration, new talent development, and comprehensive capacity building across the food industry, goals that the UAE's Food Cluster platform is well positioned to support.

4. Promoting sustainable consumption by encouraging behaviour change towards a plant-based diet.

   The government can support consumers by fostering an ecosystem that encourages the purchase of local, fair-trade, and environmentally friendly produce. Additionally, policies could promote a shift towards reduced meat consumption and greater inclusion of plant-based nutrients, following the principles of the EAT-Lancet Report on the planetary health diet. This report, published in 2019 is the first full scientific review of what constitutes a healthy diet, from a sustainable food system that respects planetary boundaries.69

   The UAE already has a presence on the EAT-Lancet Advisory Board, however, better engagement with the initiative could encourage wider adoption of its principles. For example, the UAE's universities and research institutions could join the network of knowledge partners and collaborate on EAT programs that are of strategic importance to the UAE.

Endnotes

1. Baer-Nawrocka, A., & Sadowski, A. (2019). Food security and food self-sufficiency around the world: A typology of countries. PloS one, 14(3), e0213448. https://doi.org/10.1371/journal.pone.0213448
2. SG101. Singapore's Food Challenge. Accessed 23/04/2025 from https://www.sg101.gov.sg/economy/case-studies/sg-food-challenge/
3. Dithmer, J., & Abdulai, A. (2017). Does trade openness contribute to food security? A dynamic panel analysis. Food policy, 69, 218-230. https://doi.org/10.1016/j.foodpol.2017.04.008
4. Remaking Trade for Sustainable Future. (2024). Villars Framework for a Sustainable Trade System https://remakingtradeproject.org/villars-framework
5. Fathelrahman, E., Davies, S., & Muhammad, S. (2021). Food Trade Openness and Enhancement of Food Security—Partial Equilibrium Model Simulations for Selected Countries. Sustainability, 13(8), 4107. https://doi.org/10.3390/su13084107
6. Navarre, N., Schrama, M., de Vos, C., & Mogollón, J. M. (2023). Interventions for sourcing EAT-Lancet diets within national agricultural areas: A global analysis. One Earth, 6(1), 31-40. 10.1016/j.oneear.2022.12.002 (see supplementary material)
7. MOCCAE. (2023). A Guide to Food Security in the UAE. https://www.moccae.gov.ae/en/bullentins/13/7/2023/a-guide-to-food-security-in-the-uae.aspx
8. ResourceTrade.Earth. Data retrieved on 04/05/2025 from https://resourcetrade.earth/?year=2019&importer=784&category=52&units=weight&autozoom=1
9. Atlantic Council. (2024). Ensuring the UAE's food security in an unstable region by Hadi Fathallah. https://www.atlanticcouncil.org/blogs/menasource/uae-food-security/
10. Gulf News. (2023). UAE food importers successfully replace wheat supplies from India - but prices need to drop. Accessed: 04/05/2025 from https://gulfnews.com/business/retail/uae-food-importers-successfully-replace-wheat-supplies-from-india---but-prices-need-to-drop-1.1678852276551
11. The Observatory of Economic Complexity (OEC). Wheat in the United Arab Emirates. Retrieved on 04/05/2025 from https://oec.world/en/profile/bilateral-product/wheat/reporter/are
12. Ali, B. M., Manikas, I., & Sundarakani, B. (2022). Food security in the United Arab Emirates: External cereal supply risks. Cogent Economics & Finance, 10(1). https://doi.org/10.1080/23322039.2022.2149491
13. World Integrated Trade Solutions. Accessed 23/01/2025 from https://wits.worldbank.org/CountryProfile/en/Country/ARE/Year/2022/TradeFlow/Import/Partner/all/Product/16-24_FoodProd
14. Economist Impact. (2022). Global Food Security Index. Accessed 20/12/2024 from https://impact.economist.com/sustainability/project/food-security-index/explore-countries/united-arab-emirates
15. United Nations. UN Data. Retrieved 18/03/2025 from https://data.un.org/Data.aspx?q=united+arab+emirates&d=PopDiv&f=variableID%3A12%3BcrID%3A784

16. Nabuurs, G-J., R. Mrabet, A. Abu Hatab, M. Bustamante, H. Clark, P. Havlík, J. House, C. Mbow, K.N. Ninan, A. Popp, S. Roe, B. Sohngen, S. Towprayoon, (2022). Agriculture, Forestry and Other Land Uses (AFOLU). In IPCC, 2022: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change[P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. doi: https://doi.org/10.1017/9781009157926.009

17. Benton, T. G., Bieg, C., Harwatt, H., Pudasaini, R., & Wellesley, L. (2021). Food system impacts on biodiversity loss. Three levers for food system transformation in support of nature. Accessed 21/08/2024 from https:// www.chathamhouse.org/2021/02/food-system-impacts-biodiversity-loss.

18. See Reference 4: Remaking Trade for Sustainable Future. (2024).

19. Fact Dialogue. What is The FACT Dialogue?. https://www.factdialogue.org/

20. BRICS. (2025). BRICS GDP outperforms global average, accounts for 40% of world economy. Accessed 05/05/2025 from https://brics.br/en/news/brics-gdp-outperforms-global-average-accounts-for-40-of-world-economy

21. Crippa, M., Solazzo, E., Guizzardi, D. et al. (2021). Food systems are responsible for a third of global anthropogenic GHG emissions. Nat Food 2, 198–209 https://doi.org/10.1038/s43016-021-00225-9

22. Ibid. See reference Crippa, M., Solazzo, E., Guizzardi, D. et al. (2021).

23. Chabert, A., & Sarthou, J. P. (2020). Conservation agriculture as a promising trade-off between conventional and organic agriculture in bundling ecosystem services. Agriculture, Ecosystems & Environment, 292, 106815. https://doi.org/10.1016/j.agee.2019.106815

24. Dudley, N., & Alexander, S. (2017). Agriculture and biodiversity: a review. Biodiversity, 18(2–3), 45–49. https://doi.org/10.1080/14888386.2017.1351892

25. IFAD. 2021. Why land tenure is crucial for sustainable food systems. https://www.ifad.org/en/w/opinions/fs-thematic-land

26. Lowder, S.K., Sánchez, M.V., & Bertini, R. (2021). Which farms feed the world and has farmland become more concentrated? World Development. https://doi.org/10.1016/j.worlddev.2021.105455

27. Vermeulen, S. & Wollenberg, E. (2017). Info Note: A rough estimate of the proportion of global emissions from agriculture due to smallholders. CGIAR. https://hdl.handle.net/10568/80745

28. British Ecological Society (2025). Regenerative Agriculture in the UK: An Ecological

29. Perspective. London, UK. ISBN 978-1-0369-1546-9 Available at: https://www.britishecologicalsociety.org/our-policy-work/

30. Africa Regenerative Agriculture Study Group (2021). Regenerative Agriculture: An opportunity for businesses and society to restore degraded land in Africa. 62pp. https://iucn.org/sites/default/files/2022-06/regnererative_agriculture_in_africa_report_2021_compressed.pdf

31. Ibid. See reference: Africa Regenerative Agriculture Study Group (2021). Regenerative Agriculture: An opportunity for businesses and society to restore degraded land in Africa

32. Curtis, P. G., Slay, C. M., Harris, N. L., Tyukavina, A., & Hansen, M. C. (2018). Classifying drivers of global forest loss. Science, 361(6407), 1108-1111. DOI: 10.1126/science.aau3445

33. FAO. (2022). Livestock emission data at a glance. Retrieved 18/03/2025 from https://foodandagricultureorganization.shinyapps.io/GLEAMV3_Public/

34. Carbon Brief. Article: Interactive: What is the climate impact of eating meat and dairy? Accessed 19/12/2024 from https://interactive.carbonbrief.org/what-is-the-climate-impact-of-eating-meat-and-dairy/index.html

35. Poore, J., Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. Science 360,987-992. DOI: 10.1126/science.aaq0216

36. United States Environmental Protection Agency. (2025). Importance of Methane. https://www.epa.gov/gmi/importance-methane

37. Ibid. See reference Curtis, P. G., Slay, C. M., Harris, N. L., Tyukavina, A., & Hansen, M. C. (2018). Classifying drivers of global forest loss

38. World Integrated Trade Solution. Accessed 05/12/2024 from https://wits.worldbank.org/Default.aspx?lang=en

39. UAE Government. About the UAE, The UN's 2030 Agenda, Zero Hunger. Accessed 18/03/2025 from https://u.ae/en/about-the-uae/leaving-no-one-behind/2zerohunger

40. Al Dahra. Farming. Accessed18/03/2025 from https://aldahra.com/farming/

41. Mekonnen, M. M. & Hoekstra, A. Y. (2016). Four billion people facing severe water scarcity. Sci. Adv. 2, e1500323 10.1126/sciadv.1500323

42. Allan, J. A. (1998). Virtual water: a strategic resource. Ground Water 36, 545–547.

43. Mekonnen, M.M., Kebede, M.M., Demeke, B.W. et al. (2024). Trends and environmental impacts of virtual water trade. Nat Rev Earth Environ 5, 890–905 https://doi.org/10.1038/s43017-024-00605-2

44. The National (2021). You need to worry about your <virtual water> consumption. Accessed 10/12/2024 from https://www.thenationalnews.com/opinion/comment/2021/11/21/you-need-to-worry-about-your-virtual-water-consumption/

45. World Trade Organisation. (2021). Trade and climate change. Information brief No 4. https://www.wto.org/english/news_e/news21_e/clim_03nov21-4_e.pdf

46. Jaramillo, P., S. Kahn Ribeiro, P. Newman, S. Dhar, O.E. Diemuodeke, T. Kajino, D.S. Lee, S.B. Nugroho, X. Ou, A. Hammer Strømman, J. Whitehead. (2022). Transport. In IPCC, 2022: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change[P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. https://doi.org/10.1017/9781009157926.012

47. IPCC. (2019). IPCC Updates Methodology for Greenhouse Gas Inventories. https://www.ipcc.ch/2019/05/13/ipcc-2019-refinement/

48. OECD (Organisation for Economic Co-operation and Development). (2022). Maritime Transportation Costs in the

Grains and Oilseeds Sector: Trends, Determinants and Network Analysis. OECD Food, Agriculture and Fisheries Papers 179. Paris, OECD Publishing. https://doi.org/10.1787/b1cdf6b7-en

49. Walker, T.; Adebambo, O.; Feijoo, M.; Elhaimer, E.; Hossain, T.; Edwards, S.; Morrison, C.; Romo, J.; Sharma, N.; Taylor, S.; Zomorodi, S. (2019). Environmental Effects of Marine Transportation. In World Seas: an Environmental Evaluation (Second Edition) Volume III: Ecological Issues and Environmental Impacts (pp. 505-530). Elsevier Ltd. 10.1016/B978-0-12-805052-1.00030-9

50. IMO. IMO's work to cut GHG emissions from ships. Accessed 19/03/2025 from https://www.imo.org/en/MediaCentre/HotTopics/Pages/Cutting-GHG-emissions.aspx

51. IMO. (2024). Draft regulations will set mandatory marine fuel standard and GHG emissions pricing for shipping to address climate change. Accessed from https://www.imo.org/en/MediaCentre/PressBriefings/pages/IMO-approves-netzero-regulations.aspx

52. GOV.UK. COP26: Clydebank Declaration for green shipping corridors. Accessed 19/03/2025 from https://www.gov.uk/government/publications/cop-26-clydebank-declaration-for-green-shipping-corridors/cop-26-clydebank-declaration-for-green-shipping-corridors

53. Mission Innovation. Green Shipping Corridor Hub. Retrieved 19/03/2025 from https://mission-innovation.net/missions/shipping/green-shipping-corridors/

54. World Economic Forum. (2022). How green corridors can enable the transition to zero-emission shipping. How green corridors can enable zero-emission shipping | World Economic Forum (weforum.org)

55. Admiralty. Discovering the benefits of green shipping corridors. Accessed 19/03/2025 from https://www.admiralty.co.uk/decarbonisation/green-shipping-corridor

56. Mission Innovation. Green Shipping Corridor Route Tracker Accessed 19/03/2025 from https://mission-innovation.net/missions/shipping/green-shipping-corridors/route-tracker/

57. Li, M., Jia, N., Lenzen, M., Malik, A., Wei, L., Jin, Y., & Raubenheimer, D. (2022). Global food-miles account for nearly 20% of total food-systems emissions. Nature food, 3(6), 445-453. https://doi.org/10.1038/s43016-022-00531-w

58. Fathallah., H.. (2024). Ensuring the UAE's food security in an unstable region. Article published in Atlantic Council. https://www.atlanticcouncil.org/blogs/menasource/uae-food-security/

59. Graham, N.T., Hejazi, M.I., Kim, S.H. et al. (2020). Future changes in the trading of virtual water. Nat Commun 11, 3632 https://doi.org/10.1038/s41467-020-17400-4

60. Ibid. See reference: Graham, N.T., Hejazi, M.I., Kim, S.H. et al. (2020). Future changes in the trading of virtual water.

61. FAO. (2022). FAO Strategy on Climate Change 2022–2031. Rome, Italy. https://openknowledge.fao.org/handle/20.500.14283/cc2274en

62. Ibid. See reference: FAO. (2022). FAO Strategy on Climate Change 2022–2031

63. Jägermeyr, J., Müller, C., Ruane, A.C. et al. (2021). Climate impacts on global agriculture emerge earlier in new generation of climate and crop models. Nat Food 2, 873–885 https://doi.org/10.1038/s43016-021-00400-y

64. Mbow, C., C. Rosenzweig, L.G. Barioni, T.G. Benton, M. Herrero, M. Krishnapillai, E. Liwenga, P. Pradhan, M.G. Rivera-Ferre, T. Sapkota, F.N. Tubiello, Y. Xu. (2019). Food Security. In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D.C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.)]. https://doi.org/10.1017/9781009157988.007

65. International Food Policy Research Institute. (2023). India's export restrictions on rice continue to disrupt global markets, supplies, and prices. Blog by Joseph Glauber and Abdullah Mamum. https://www.ifpri.org/blog/indias-export-restrictions-rice-continue-disrupt-global-markets-supplies-and-prices/

66. MOCCAE. (2023). MOCCAE News. Ministry of Climate Change and Environment Launches National Dialogue for Food Security and Reviews Progress on National Farm Sustainability Initiative. Accessed on 04/05/2025 from https://www.moccae.gov.ae/en/media-center/news/21/3/2023/ministry-of-climate-change-and-environment-launches-national-dialogue-for-food-security-and-reviews-progress-on-national-farm-sustainability-initiative.aspx#page=1

67. FAO and AOAD. (2023). Value chain study – Date palm in the Arab region. Cairo, FAO. https://openknowledge.fao.org/items/056f87cf-29f6-4493-aa48-0312dbcbb127

68. See Reference ResourceTrade.Earth. Retrieved 04/05/2025

69. Bellmann, C. (2022). Trade and sustainability in the agriculture sector: Options for multilateral trade cooperation. Forum on Trade, Environment & the SDGs (TESS). https://tessforum.org/latest/trade-and-sustainability-in-the-agricultural-sector-options-for-multilateral-trade-cooperation

70. European Parliament. (2023). Press release: Parliament adopts new law to fight global deforestation https://www.europarl.europa.eu/news/en/press-room/20230414IPR80129/parliament-adopts-new-law-to-fight-global-deforestation

71. GOV.UK. (2023). Media reporting on peat-ban for the professional Horticulture sector. https://deframedia.blog.gov.uk/2023/03/24/media-reporting-on-peat-ban-for-the-professional-horticulture-sector/

72. New Zealand Foreign Affairs and Trade. Agreement on Climate Change, Trade and Sustainability (ACCTS). Accessed 04/05/2025 from https://www.mfat.govt.nz/en/trade/free-trade-agreements/free-trade-agreements-concluded-but-not-in-force/agreement-on-climate-change-trade-and-sustainability-accts

73. New Zealand Foreign Affairs and Trade. Agreement on Climate Change, Trade and Sustainability (ACCTS). Chapter 2: Trade in Environmental Goods. Accessed 04/05/2025 from https://www.mfat.govt.nz/assets/Trade-agreements/ACCTS/ACCTS-Chapter-2-Trade-in-Environmental-Goods.pdf

74. United Arab Emirates Ministry of Economy. UAE National Cluster Strategy Accessed 07/05/2025 from https://www.moec.gov.ae/en/uae-national-cluster-strategy#:~:text=An%20economic%20cluster%20is%20a,boundaries%20of%20a%20specific%20field.

75. EAT. The EAT-Lancet Commission on Food, Planet, Health. Accessed 07/05/2025 from https://eatforum.org/eat-lancet-commission/

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