CLIMATE IMPACTS ON UK FOOD IMPORTS

SPOTLIGHT ON: THE MEDITERRANEAN

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Energy&Climate
INTELLIGENCE UNIT

Executive summary

Climate change is driving more extreme weather, including hotter, longer and more frequent heatwaves. Extreme heat, along with resulting drought, wildfires and subsequent flooding when rain comes, destroys crops and harms agriculture.

With half the UK's food imported from overseas, worsening climate impacts threaten our food security by impacting British staples. This could lead to food shortages and price rises, on top of those already caused by the gas crisis.

Figure 1: Food imported from the Mediteranean as a proportion of imports

The Intergovernmental Panel on Climate Change (IPCC) has declared unequivocally that humans have heated the planet by an average of 1.1˚C since pre-industrial times; scientists working to attribute the effect of climate change on extreme weather phenomena work on the basis that it is now closer to 1.2˚C. Europe is warming at twice the rate of the global average over the last three decades.

And the nations in southern Europe and northern Africa, around the Mediterranean, have experienced some of the worst heat extremes ever in the last few years.

Europe saw its hottest summer in 2022; extreme heat that was estimated to have caused more than 61,000 additional deaths, nearly 3,500 of which were in the UK. It also led to widespread drought which harmed food harvests. 2023 has seen the world's hottest June on record; a succession of the hottest days ever recorded; the hottest sea surface temperatures and, in July, the hottest month ever experienced by modern humans.

The Mediterranean Sea itself hit a new high, with surface temperatures recorded at 28.7˚C in late July. And prolonged hot, dry weather created tinderbox conditions that led to more severe and intense wildfires.

All of this has caused harm to food production as water shortages, extreme heat and fire damage crops, reduce quality and lower yields.

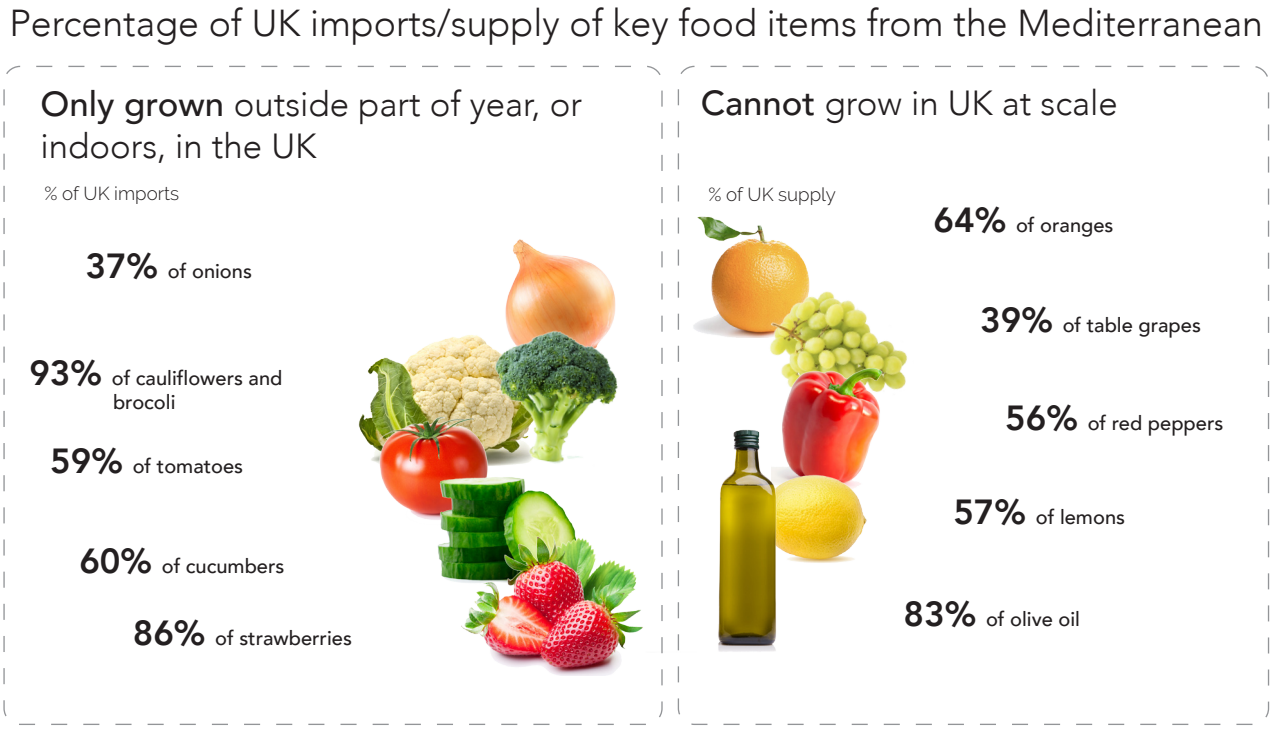
In 2022, the UK imported around half its food from overseas: 37 billion kilograms, worth £58 billion. Half of that was food that we do not grow here. Just over a quarter of UK food imports – 9.8 billion kilograms, worth just over £16 billion – came from the Mediterranean region, most of which was staple fresh produce like fruit and vegetables, core to a healthy diet.

Spain alone, which is experiencing some of the worst climate impacts in the region, accounted for 7% of our food imports - worth £4 billion.

Some of the commodities we import from the Mediterranean are foods that we can grow outside in the UK for at least parts of the year, or that we can grow indoors, using more expensive and energy-intensive processes to protect them and heat the growing space.

But many are foods that we simply cannot grow in the UK at-scale. In the former category, this includes nearly all of the cauliflowers, broccoli and strawberries, and nearly two-thirds of the cucumbers and tomatoes which we import, as well as nearly a fifth of our overall supply of onions. In the latter category, more than half of our lemons and sweet peppers come from the Mediterranean, along with two thirds of all our oranges and 40% of our table grapes. We rely on the region for over 80% of our olive oil – a commodity that has surged in price so much recently that it comes near the top of the list of foodstuffs behind the UK's sharp food price rises, and therefore contributing to overall inflation.

Figure 2: Food imported from Mediteranean as a proportion of imports



Reduced yields mean less food in our shops and markets, and higher prices for the commodities affected.

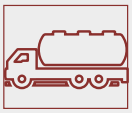
UK households have already seen food price rises averaging £400 last year, as a result of climate impacts and fossil fuel price volatility.

The growing threat from climate impacts this year shows every sign of adding to this, thus exacerbating the cost-of-living crisis, worsening the impact on poorer families, and threatening nutrition levels.

It is sometimes suggested we replace commodities at risk by switching suppliers, repurposing land to grow more here, or even growing new foods as our own climate warms. However, climate impacts do not respect borders.

Could the UK just grow it here instead?

Replacing a shortfall in imported crops would require investment in energy- and cost-intensive growing environments, like polytunnels and glasshouses.



Growing replacement crops in indoor environments would create a dependence on volatile international gas markets

We still don't know how our climate will change, and what will become the new 'normal'. Climate change is already bringing extreme weather and instability. Unpredictable rainfall and extremes of both hot and cold would make predicting which replacement crops to grow very difficult.

Even if our climate does warm to the point that we can grow new commodities outside in the UK, it will take time to develop the skills, methods and supply chains needed to cultivate them at scale.

The UK has seen new and dangerous high temperatures, droughts and fires in recent years, along with extremes of rainfall and unseasonal cold spells. All of these can harm UK crop yields, as 2022's drought did most recently, adding to the pressure which high energy prices have had on pushing down or delaying planting – particularly of crops which rely on energy- or fertiliser-intensive growing methods. The types of soil required to grow, for example salad crops, outdoors could also lead to greater water-stress and risk maintaining high emissions from agriculture.

Even if the world succeeds in keeping temperature rises to 1.5˚C, food producers in the UK, and worldwide, already face the need to adapt to these new climate extremes of higher average temperatures than humans have been used to for most of our existence on Earth. Sharing best practice, as well as both government and private investment in that adaptation, can be an important means of mitigating the scale of the threat to food supplies.

Climate impacts worsen as temperatures rise. We can, according to the IPCC, only adapt to those impacts up to a certain point; and temperature rises up to and beyond 2˚C lead to irreversible losses of ecosystems. The only means currently available of stopping climate change and

limiting temperature rises, is to phase out reliance on fossil fuels and ramp up deployment of renewable power and other clean technology to reach net zero greenhouse gas emissions globally by mid-century.

It is this that the nations of the world have committed to under the Paris Agreement, with wealthier developed countries getting to net-zero earlier, while supporting poorer and developing nations with climate finance to adapt to climate impacts, cut emissions themselves, and to recover from climate disaster.

Climate change is a global threat and a threat multiplier. Impacts in a globalised world are felt on the other side of the planet, as crucial supply chains are affected. Solutions are similarly global and shared, with the IPCC's sixth assessment report clear that we not only have the solutions we need to halve emissions this decade, and get on track for net zero, but also that to do so is cheaper than the alternative of bearing the ever-growing costs of climate impacts.

For the UK, and other major industrialised economies, this means living up to our international commitments and the climate leadership we have shown in the past. But it is also increasingly a matter of protecting our national security and that of our food supplies.

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Introduction

Europe experienced its hottest summer ever in 2022. Climate change was heavily implicated, having made the drought caused by the extreme heat some 20 times more likely than before the last 150 years of human-induced heating. The heat caused around 61,000 additional deaths in Europe, long-lasting drought across large swathes of the continent, helped fuel wildfires and, when heavy rains eventually fell on parched and hardened ground, led to flooding in many countries.

That hottest summer has been followed by even more extremes in 2023. The world saw its hottest June on record and several of the world's hottest days ever, and July 2023 was the hottest month ever experienced by modern humans.

At the heart of that month was an intense and lingering series of heatwaves across southern Europe that would have been virtually impossible in the absence of anthropogenic climate change. New heat records have been set across European nations, as well as in north Africa, China and north America – all three of which have seen temperatures in excess of 50˚C. At the same time, Antarctic sea-ice was at its lowest level ever, by some margin, as the Mediterranean Sea hit its highest surface temperature, at 28.7˚C – some 5˚C above normal.

Climate-drive extremes have hit food production in affected areas hard. Droughts – prolonged dry periods caused by a lack of rainfall – are becoming more frequent and intense as climate change and intensifying heat affect the water cycle. Since Europe's droughts in summer 2022, there has been a steady flow of stories about the impacts on farmers and food producers around southern Europe in particular – Italy, Spain, Portugal and Greece – but also other countries in the Mediterranean region. In 2023, drought impacts are already visible in France, Spain, Italy, the Maghreb and Turkey, and are predicted to worsen as the summer progresses

Not just drought, but also wildfires, have harmed agricultural land, destroyed crops and harmed nature and wildlife as many countries in the region saw a more severe fire season in Europe's 2022 summer of heat.

These and other climate change fuelled extremes – to be joined and potentially intensified in 2023 by the arrival of El Niño – have hit food production in many countries. In southern Europe, olive oil prices have risen sharply as olive harvests have suffered; olive oil is one of the top drivers of food inflation in the UK. Tomato, pepper and other fresh salad veg shortages in the UK in 2023 were attributed to drought and heat in north Africa and southern Europe. And more recently there are reports of cereal yields in Europe falling sharply this year.

In the United Kingdom, we import half of the food we consume. Around half of that is made of commodities that we do not, or cannot, grow in the UK – at least not outdoors, out of season, and therefore not without expensive and energy-intensive growing infrastructure.

EU nations and other near neighbours remain a huge part of our trade relationships, not least for fresh produce. In 2022, we imported nearly 10 billion kg of food, worth more than £16 billion from the Mediterranean region alone.

This report covers some of the major foods we import from the region around the Mediterranean. Many of these are fruit and vegetables – eaten fresh, of course, but also often core ingredients for home, restaurant and takeaway cooking, as well as ready-meal preparations; all containing important micronutrients we need to be healthy.

For the purposes of our definition of the Mediterranean, we include the following countries: Albania, Algeria, Bosnia and Herzegovina, Croatia, Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Libya, Malta, Monaco, Montenegro, Morocco, Portugal, Slovenia, Spain, Syria, Tunisia and Turkey.

As the Intergovernmental Panel on Climate Change (IPCC) has made clear in its sixth assessment report, climate impacts are worsening as the planet heats. At 1.1˚C+ of temperature rise, we are already seeing devastating impacts, many progressing faster than expected; nearly half the planet's population are now living in areas vulnerable to those impacts. With average warming in Europe running at twice the global average, and as the summers of 2022 and 2023 demonstrate, the countries in this region are particularly exposed to these impacts.

The harm to food harvests and production is already clear, and the effects include shortages, and price rises. On top of the £400 that climate impacts and rising energy prices have added to UK consumers' bills already, and rising inflation over the last year, this is another pressure that British households could well do without.

Commodities

The UK imports a range of fresh produce from around the Mediterranean. The Department for Environment, Food and Rural Affairs (DEFRA) categorises these commodities as either 'indigenous' or 'non-indigenous'. Their definition of indigeneity is "whether a product can be grown in the UK on a commercially viable level".

'Indigenous' therefore means that we grow the commodity in the UK, or could grow it here, even if not year-round. These crops can survive outside for some or all of the year, i.e. they are suited to our climate and soils, but in some cases we grow them in energy intensive indoor environments to produce higher yields. For example, strawberries and cauliflowers are seasonal in the UK and grow well outside, although the growing season in the UK for strawberries has been extended by use of poly-tunnels or glasshouses, for most of the UK's crop, which also ensures higher quality.Cucumbers and tomatoes can also be grown outside, but as they like warmth and lots of light, they are often grown in polytunnels or glasshouses.

'Non-indigenous' means we do not grow the commodity in the UK because it is not resource- or cost-effective to do so. These crops do not thrive outside as they are not suited to our climate and soils, and the energy required to grow them inside means it is not commercially viable to produce them at scale. For example, citrus fruits require consistent high temperatures and humidity. Although physically possible to grow them here with lots of intervention, it is more cost effective to import them from countries with climates that naturally provide these conditions.

For the analysis in this report, we looked at a range of fruits and vegetables that we import from the Mediterranean that are widely eaten in the UK. This was to assess the impact of extreme heat in the region on British consumers.

Indigenous commodities

We rely on the Mediterranean region for:

60% of the cucumbers we import
121 million kilograms worth £149 million

Whilst it was not possible to establish what proportion of our cucumber supply is made up of imports, cucumber growers report that the UK is nearly self-sufficient for cucumbers during the summer, and imports around 90% of our supply during the winter. However, they also report that gas and fertiliser prices have meant much lower levels of planting this year.

59% of the tomatoes we import
227 million kilograms worth £311 million

Imports account for more than four fifths of our overall tomato supply, the rest being produced at home.

86% of the strawberries we import
Nearly 51 million kilograms worth just over £167 million

Imports account for around a third of our overall strawberry supply, the rest being produced at home.

93% of the cauliflowers and broccoli we import
112 million kilograms worth £151 million

Imports account for just under half of our overall cauliflower and broccoli supply, the rest being produced at home.

37% of the onions we import
125 million kilograms worth £80 million.

Imports account for around half of our overall onion supply, the rest being produced at home.

Non-indigenous commodities

We rely on the Mediterranean region for:

39% of all our table grapes
104 million kilograms worth £208 million

64% of all our oranges
337 million kilograms worth £302 million

Which includes several varieties like navel, sweet, white, mandarins etc.

57% of all our lemons
60 million kilograms worth £64 million

56% of all our sweet peppers
121 million kilograms worth £184 million

83% of our olive oil
65 million kilograms worth £254 million

Which includes extra virgin (EU Category 1), virgin (EU Categories 2 and 3) and olive oil (EU Categories 4 and 5)

Case study: Spain

Spain is one of the UK's biggest food suppliers. It accounts for a quarter of the food we import from the Mediterranean and is our top supplier of cucumbers, strawberries, cauliflowers and broccoli, grapes, oranges, lemons, sweet peppers and certain types of olive oil. We also get tomatoes, lettuce, onions, celery, courgettes, aubergines, spinach, cabbage, avocados, apples, raspberries, cherries, peaches, nectarines, plums, watermelons, melons, garlic, wheat and even some types of rice – among many other things – from Spain.

Like many European countries, including the UK, Spain experienced an extreme heatwave in summer 2022 that led to prolonged drought and increased wildfire activity. Several temperature records were set above 40˚C and many people were evacuated as fires that consumed 306,000 hectares of land raged across the country. A recent public health study by ISGlobal Insititute in Barcelona has found that 61,672 people died of heat-related causes in Europe between 30 May and 4 September 2022, with Spain having the third highest mortality rate at 11,324.

Copernicus, the EU's Earth Observation Programme, has said that "although exceptional, these events were not unexpected. They are in line with the evidence presented in the latest IPCC Assessment Report, which indicates that the frequency and intensity of heatwaves continues to increase. These changes are attributed to human-induced climate change with high confidence and are expected to last, or maybe even amplify, as the climate warms globally".

Greenpeace's Science Unit at the University of Exeter recently released a report outlining the effects of climate change in Spain. It states that the country is warming faster than the global average: for every 1˚C of global warming, Spain is predicted to see 1.5˚C.

Therefore, unfortunately, these trends are continuing in 2023. Spain – along with Portugal, Morocco and Algeria – was hit by a heatwave in April. Temperatures were up to 20˚C higher than normal for the time of year, breaking records and hitting a new high of 38.8˚C in Spain. World Weather Attribution scientists quickly calculated that this heat would have been "almost impossible" without climate change.

The latest heat, in July, has been particularly difficult. Around midway through the month, as the heatwave named Cerberus hit, temperatures in parts of Spain got as high as 45˚C. This led to fires, for example in the Canary Islands where 150 firefighters from the Spanish army, plus local firefighters arriving by boat from neighbouring islands, were needed to battle the blaze. Then, just a week later, a second heatwave named Charon hit. Both heatwaves were named by Italian meteorologists as characters associated with hell and the underworld, given the scale of the heat.

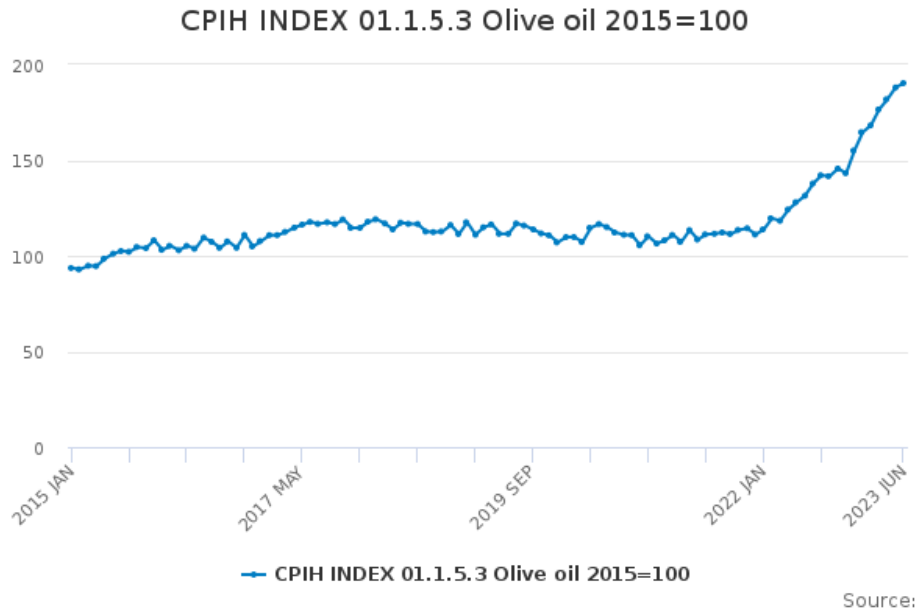
Throughout the summer, locals have been advised to keep hydrated and stay inside, while the UK's Foreign Office issued a warning to British tourists on 26 July. And it's not just air temperatures

over land that are elevated; sea surface temperatures around the coast of Spain have reached the high 20s, making it unsafe to enter the water. Many organisations like the Red Cross have been providing emergency support.

Such extreme heat is having huge impacts on the country's agricultural sector. In 2022, the Spanish government announced that climate change had incurred damages of up to €684 million in the first 10 months of the year alone. Olives, a quintessentially Spanish crop, had their flowers "literally burnt away" in the heat. In early 2023, La Coordinadora de Organizaciones de Agricultores y Ganaderos (COAG), the Spanish farming association, reported that drought had 'asphyxiated' 60% of the countryside and created 'irreversible losses' of more than 3.5 million hectares of rainfed cereals. Some farmers chose not to plant crops for fear of losses, while those that went ahead suffered reduced yields of 60-80%.

Given that the UK imports almost 7% of its food from Spain alone (nearly 2.5 billion kilograms worth around £4 billion), extreme heat events there will have implications for consumers here. This is particularly stark with olive oil which, until April, was the top food type fuelling food inflation in the UK. Its price has continued to rise as olive crops have been hit, and it remains second in the list of drivers of the CPI index, behind sugar.

Figure 3: Olive oil prices rising in the Consumer Price Index including owner occupiers' housing costs (CPIH)



Source:

How will this affect British consumers?

Reduced yields mean there will be less of each commodity to go around, making them more difficult to access for UK consumers. Extreme weather in the Mediterranean could therefore make it harder to find our favourite fruits and vegetables at the supermarket, as we saw earlier this year with the salad shortage.

Restricted supplies create higher prices. This will apply to all UK consumers, both households and businesses. Poorer families will be disproportionately affected as they are the least able to pay, which is especially concerning given that the energy and cost of living crises have left many struggling to make ends meet. The hospitality industry could also see their costs increase, as basic ingredients like tomatoes, peppers and olive oil are likely to be affected. It could become more expensive to run these businesses and for consumers to eat out as a result, as costs are likely to be passed on.

If key fruits and vegetables are missing from our shelves for prolonged periods of time, and we can't find more affordable sources from elsewhere, poorer families could have reduced access to healthy, balanced diets. Malnutrition can take various forms and undernutrition (e.g. vitamin deficiencies) could impact child development if children are unable to access the vitamins they need for prolonged periods. Shortages could also contribute to the UK's obesity problem, as cheaper foods tend to be ultra-processed. Obesity is a risk factor for other non-communicable conditions like diabetes, heart disease, cancer and stroke.

The point is that, in the very worst case, prolonged fruit and vegetable shortages could have unforeseen public health impacts. The World Health Organisation (WHO) states that "people who are poor are more likely to be affected by different forms of malnutrition. Also, malnutrition increases health care costs, reduces productivity and slows economic growth, which can perpetuate a cycle of poverty and ill-health".

Can we grow our way out of this problem?

One might think we can 'grow our way out' of this problem by producing these crops in the UK instead. This could bring benefits. For example, it could provide farmers with more income, given the high value nature of these crops. It may also increase the supply of healthy fruit and vegetables in the UK market, though not necessarily if it was simple substitution for reduced imports. Unfortunately, however, the solution is not that simple.

Non-indigenous crops do not thrive outside in the UK. Indigenous crops can only thrive outside for a few months of the year, and in many cases we already use indoor environments (polytunnels, glasshouses) to boost production. Replacing a shortfall in either type of crop would necessitate more of these facilities, which use lots of energy to provide the extra light and heat the plants need to grow. Growing crops in this way creates dependence on the volatile international gas market, as gas is used to produce energy, thereby threatening our food security. For example, yields were down last year during the gas crisis because farmers could not afford the energy needed to grow them, meaning many consumers were unable to access staple produce like salad vegetables.

Some say that, as warming is also happening here, we won't need more glasshouses to grow these crops; the UK's climate could change enough that we will be able to grow them outside. However, climate change brings instability. As we are already seeing, unpredictable rainfall and extremes of both hot and cold are all possible. For example, the salad shortage earlier this

year was caused by unseasonable cold weather in the Mediterranean, the same region that is now experiencing dangerous heat. We still don't know how our climate will change, and what will become the new 'normal', which makes it difficult to know which crops will be viable. It might be possible to increase UK production in response to these risks, but to do so requires a strategic approach; the Government recently scrapped the Horticulture Strategy that was meant to address this.

Even if our climate does warm to the point that we can grow new commodities outside in the UK, it will take time to develop the skills, methods and supply chains needed to cultivate them at scale. This is unlikely to be fast enough to meet immediate shortfalls, meaning consumers will still lose out. It will be challenging enough to replace just one Mediterranean crop with a UK-grown version, let alone several at once, given that we import such a variety of produce from the region.

There are also important environmental costs to consider. Many of these crops typically require the best agricultural land which, in the case of lowland peat, produces significant greenhouse gas emissions. Efforts are currently being made to reduce emissions from these peat soils, but increasing production of crops such as salads and field vegetables would inevitably make this harder, potentially maintaining emissions at unsustainably high levels.

Given that climate change is the root cause of this problem, it is important that any solutions do not add to it. Additionally, many of these crops require significant irrigation, creating questions about water availability. This is particularly important given that they would likely be grown in the east and southeast of England, an already water-stressed region. Although this might result in less overall water stress for the environment, compared to equivalent irrigation requirements in countries like Spain, it is important to ensure that any additional water abstraction is done within environmental limits, as the UK is also warming and experiencing more heatwaves and drought.

What can we do?

Adaptation

Around half the food the UK imports comes from climate vulnerable nations around the world. As we will examine in a future food report, there are direct and tangible means of support the UK can offer to nations whose farmers and food producers face the need to adapt to climate impacts and recover from climate disaster, via various forms of climate finance and investment.

Whilst some of that is also true for one or two of the nations in the Mediterranean, for the most part these are wealthy, developed, and relatively climate resilient nations. That is not to say they are not exposed to climate impacts; the content of this report shows that they are. But wealthy, industrialised and developed nations are better placed to access, invest in and support adaptation measures to increase their resilience to impacts, and mitigate – to some extent – the harm done by climate extremes.

That can be in terms of direct investment in innovation to adapt to hotter, drier weather – seeds and crops that are more resilient to heat or flooding, for example, or means of more efficiently irrigating and retaining water in soils when they are subject to extreme heat. Or it can mean the support, subsidy and even welfare interventions that can be used to support farmers and food producers when disaster hits.

The IPCC is clear that we need to adapt to a hotter climate, but that there comes a point beyond which we cannot adapt – a point at which a place becomes unliveable, or impossible to grow crops, for example. This means that if we want to limit temperature rises, and therefore even more extreme impacts, then we need to mitigate, as well as to adapt. There is no longer a choice between the two.

Net zero – cutting emissions

Net zero emissions by mid-century is the only means we currently have of arresting climate change and limiting temperature rises. Cutting emissions from burning fossil fuels, and balancing that with natural systems and technology to remove and store carbon, offers the route to prevent the current impacts we are seeing at 1.1˚C+ from getting worse, to the point at which we can no longer adapt.

The Paris Agreement commits the world to keep warming to 'well below 2˚C', aiming for 1.5˚C'. Since the Agreement – struck in 2015 at COP21 – commitments have firmed up around 1.5˚C at COP26 and COP27, as well as at other international fora like the G7 and G20. The IPCC's 2018 assessment of 1.5˚C made clear just how much worse impacts could become beyond 1.5˚C, with many more irreversible beyond 2˚C.

The UNFCCC process, where the Paris Agreement is negotiated and delivered, gives all parties equal status around the negotiating table. This means that small island states, low-lying nations like Bangladesh, and climate vulnerable developing nations from all parts of the world are on an equal footing with the major economies – and emitters – when it comes to deciding where the UN's focus should lie. For many of those nations, the impacts from temperature rises beyond 1.5˚C become existential.

The IPCC sixth assessment report is clear that we have the tools we need to halve emissions globally this decade, and that this is key to getting on track for keeping heating to 1.5˚C. That means decarbonising our global energy system – power, transport, heating and cooling, and industry.

In the UK, we have had most impact in cutting emissions from our power system, with around half of our power generation now from low-carbon sources, and around a third just from wind and solar. The International Energy Agency expect that renewable power generation will overtake coal power generation globally by 2027 as wind and solar capacity is deployed at an increasing pace that outstrips new fossil fuel infrastructure.

However, the rate of investment in the clean transition is soaring in the world's biggest economies – the US, EU and China – which are also the biggest emitters. At the same time, it has stalled in the UK, even as a race to subsidise clean technology is underway between the US' Inflation Reduction Act (IRA) and the EU's Net Zero Industry Act, introduced to compete and to end reliance on Russian gas, in the wake of Putin's invasion of Ukraine. Having cut emissions by just over 1% a year for the last eight years, the UK's expert advisors, the Climate Change Committee, suggest we now need to cut them by 4% a year for the next eight, to get on track for its own ambitious targets contributing to the global race to net zero.

The progress made in clean transition to-date has already delivered enormous benefits for the UK, with net zero industries contributing £70bn a year to the British economy and employing some 840,000 people all over the country.

Globally, transport – which drives oil use – accounts for 16% of greenhouse gas emissions; in the UK it is the single biggest source, responsible for over a quarter of our annual emissions. The transition to electric vehicles is, advise the IEA, IPCC and Climate Change Committee, key to cutting those emissions in a world reliant on cars, vans and lorries. The US' IRA incentives, and huge growth in China's EV companies, are fuelling a booming market globally.

Many countries, including the UK, are committed to ending the sale of new petrol and diesel vehicles by or shortly after the end of this decade; this has been crucial to driving the market in electric vehicles, as well as the charging infrastructure to make it possible. Shipping and aviation are more complex, but no less urgent, each accounting for 2% or more of global emissions.

Industry is the single biggest source of emissions globally, at near a third. Much of that is from the iron, steel, cement and chemicals industries. Some also comes from oil and gas production, which will decline as oil and gas use declines in other sectors. However, this subset contains fugitive methane emissions which have been shown to be quick and cheap to cut now. Decarbonising industry globally relies partly on electrification and the increased supply of clean electricity to power it, but also on developing green hydrogen production and carbon capture and storage (CCS) technology, both of which are currently unproven at scale.

Agriculture, land and waste account for nearly a fifth of global emissions: the very food system that is threatened by climate change is also, itself, contributing to the problem. In the UK, the agriculture sector makes up 11% of all emissions, a share that is projected to grow as other sectors decarbonise faster. Although more needs to be done to adapt our food and farming system to climate change and build resilience, the scope for this to deal with the impacts of climate change will be limited. With the UK Government assessing climate change as the biggest medium to long term risk to domestic food production, reducing agricultural emissions should be an aim for the sector, in order to mitigate the impact of climate change on our food security.

Alternative sourcing

We have already touched on some of the issues presented by seeking to replace Mediterranean supplies with those grown in the UK. However, Mediterranean countries are not the only growers

of the commodities outlined; for example, Brazil also grows oranges. Like simply looking in another shop if the first doesn't stock the product we want, it might be tempting to think we can 'shop around' and seek alternative suppliers outside the Mediterranean.

However, even if we were to switch the source of our orange supplies from Spain and North Africa to Brazil, for instance, this would only be a short-run fix that would fail to avert the threat posed by climate impacts for several reasons.

Firstly, climate change does not respect borders and Brazil is not immune from climate impacts; far from it, and indeed it scores far lower than many Mediterranean countries in its resilience and capacity to adapt. So, even if supplies could be replaced in the short run, this is unlikely to offer a long – or even medium – term solution to the problem.

Secondly, no country operates outside of global commodity markets. In other words, even if Brazilian orange production is thriving, their price is still likely to rise as the global supply would be affected by losses in the Mediterranean. In buying oranges from Brazil instead of Spain, the UK would already likely be paying a higher price for a supply-constrained commodity on a global market. We would also be doing that in direct competition with poorer nations who are far less able to afford higher prices for the commodities they need. We would therefore be fuelling the price issue and potentially helping further constrain food supplies for the poorest nations.

And thirdly, as both of those points illustrate, this is a shared, collective problem in a globalised world. Wealthier purchasing nations and companies are able to work with food producers to help them to adapt to the changing climate – to build resilience so that we can collectively protect future food supplies, rather than scrabble for a diminishing supply. That support for adaptation is one of the central pillars of the Paris Agreement, alongside the collective process to accelerate emissions reductions towards net zero.

The UK agricultural sector is not immune from the need to adapt to climate impacts. As we adapt in this country, we can learn from and share best practice with food producers in other countries. And in the case of poorer, developing nations, that can be backed by overseas development assistance, climate finance and UK export finance investment, to support and enable adaptation. Examples of UK adaptation to provide greater resilience to climate impacts include:

- Incorporating trees and shrubbery into crop and livestock farming systems, to manage flooding, provide shade, improve soils, sequester carbon, and foster biodiversity.
- Managing longer-term soil health through organic fertilisers, diversity in crop rotations, reducing movement and disturbance of soil, and using nutrient management plans to lock nitrogen into soils.
- Sustainable water management through re-wetting land, buffering water-courses by introducing woodland alongside them, and protecting them from run-off from fertiliser used on neighbouring land.

Methodology

Though the Mediterranean Sea has clear physical limits, land boundaries for 'the Mediterranean' are less well defined. The United Nations Environment Program Mediterranean Action Plan (UNEP/MAP) definition includes the 21 countries that have coastline on the Mediterranean Sea and are Contracting Parties to the Barcelona Convention. These are Albania, Algeria, Bosnia and Herzegovina, Croatia, Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Libya, Malta, Monaco, Montenegro, Morocco, Slovenia, Spain, Syria, Tunisia and Turkey.

We have included all these countries in our analysis except Monaco, for which there was no data. We also added Portugal which, although it doesn't have coastline on the Mediterranean Sea, is often included in definitions of the region as it shares many biogeographical similarities with other Mediterranean countries.

Two datasets were overlaid for this analysis: the Government's Trade Tariff data for commodity item codes and HMRC's international trade data for commodity flows.

Several events have occurred over the past few years that may have affected UK imports (the pandemic, Brexit, the energy and cost of living crises), but using 2022 as the study year provided insight into current levels of demand. 2023 is incomplete so was not chosen.

The government's Trade Tariff dataset provides classifications for imports and exports. Commodity codes encompass the type of product, what it's used for, what it's made from, how it's produced and packaged. Food items are classified as either 'indigenous' or 'non-indigenous', defined in the 'Commodities' section above. It was important to explore indigenous and non-indigenous commodities separately for two reasons. Firstly, these groups contain distinctly different produce. Indigenous commodities include those that we might think of as being traditionally British, for example strawberries or cucumbers. Non-indigenous commodities include more 'exotic' produce that we don't associate with British growers, for example citrus fruits and olives, yet we have become accustomed to eating them regularly due to trade with the Mediterranean.

Exploring both groups together allowed us to build a comprehensive picture of the range of fresh produce eaten by a typical British family. Secondly, extreme weather in the Mediterranean may have different implications for each group. As we already have experience of growing indigenous commodities at a commercially viable level, it might be easier to replace shortfalls ourselves. We cannot grow non-indigenous commodities at this level, so they would likely be harder to replace. However, the difficulties outlined in the section entitled 'Can we grow our way out of this problem?' are still true for both groups.

The international trade dataset provides the values (in GBP) and volumes (in kilograms) of imports to the UK for each commodity from each country. The data is compiled monthly, quarterly and annually using transaction information collected by HMRC. EU to UK import data incorporates both EU to Great Britain (England, Scotland and Wales, excluding Northern Ireland) customs import declaration data and Northern Ireland Intrastat survey import data. For non-EU trade, HMRC uses data from Customs declarations forms.

The two datasets were overlaid in Power BI, so they could be explored simultaneously, and some filters were applied. The first was for the 21 countries included in our definition of the Mediterranean, to ensure that results only showed imports coming from the region of interest. The second was for indigenous status. First, 'indigenous' was selected. This highlighted the top commodities, both in value and volume, that the UK imports from the Mediterranean and we also grow here. This process was then repeated with 'non-indigenous' as the filter, to highlight the top commodities we import from the Mediterranean that we do not grow here. Proportions

were then calculated to highlight the importance of these imports to the UK.

Many commodities are processed outside of their producer countries and/or transported via intermediary countries. For example, the Netherlands functions as the logistics hub for Europe and receives produce from all over the world to then be re-exported elsewhere. To calculate the proportions outlined above, we used the amount (in kilograms) of each commodity coming to us from the study region out of the total of that commodity reaching us from everywhere. However, due to the complex nature of supply chains, our numbers are likely to be conservative and lower than the true total. Let's take olive oil as an example.

The datasets above show that we import olive oil from Ireland, Belgium, Germany and the Netherlands. However, these countries do not grow olives themselves. They are likely importing the raw materials from neighbouring Mediterranean countries for several reasons: geographic proximity, economic proximity (i.e. shared membership of the EU) and the fact that the Mediterranean is the world's main olive oil producing region (i.e. a natural choice of supplier). Therefore, the amount of olive oil that ends up in the UK, that originated from Mediterranean-grown olives vulnerable to climate impacts, is likely greater than this report indicates. This is also true for some other commodities featured. For example, the datasets above indicate we import grapes, oranges and lemons from the Netherlands. The Netherlands does not grow these commodities and instead imports them from producer countries, likely those in the Mediterranean for the reasons outlined above, and then re-exports them to countries like us.

To be certain that Mediterranean countries produce the crops highlighted in this report, desk-based research was conducted.