Under the weather

What British food businesses tell us about climate risk



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Autonomy Institute

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The Autonomy Institute creates data-driven tools and policy to strengthen democracy and build the future economy.

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Director's introduction

This first of its kind study assesses the growing exposure of business in the UK to climate change, via machine-assisted analysis of very large volumes of company filings. Importantly, our analysis centres on climate and extreme weather impact, not on transition impact. These are direct risks incurred by the climate, rather than secondary risks incurred through adaptation.

Our analysis collates "risk" data – self declared reports of risks by business in the UK. These are a form of "grey" literature – non-commercial writing with a bureaucratic or procedural purpose, not intended for a general audience – but they are also hugely revealing. Millions of annual reports are made to Companies House each year, and it would not be possible for a single analyst or even a team of analysts to meaningfully grapple with it all. Our in-house software, the Risks to British Business (RtBB), therefore makes an analysis possible by filtering this massive volume of text and extracting filings which concern risk of specific kinds.

There are some limits to this database: businesses are not required to be comprehensive, and the character and granularity of data varies significantly. At the same time, very small businesses do not tend to file detailed reports as they lack the capacity or personnel to draft them; while many large businesses prefer to file paper reports which are not accessible within the Companies House database in the same way. For this reason, the data offers a view into the world of medium-sized companies especially well.

What we offer is therefore not a primary analysis of climate risk. Instead, we shed light on the perception of climate risk among a key social constituency: medium-sized business owners. We can think of it as a window onto a "petit bourgeois" perception of climate risk.

Both adverse climate effects and mitigation strategies are described in remarkable detail within filings – indicative of an understandably high level of preoccupation with climate conditions. As one agricultural firm writes, very literally, "The weather has been the main topic of conversation."

Both the buildings & infrastructure, and leisure industries also demonstrate a significant – if less granular – preoccupation with adverse climate effects.

↳ Focus on: food production

This report takes agriculture – the industry most acutely aware of extreme weather and climate risk – as a focal case study of risk disclosure. We find a remarkable amount of human disclosure and testimony: first hand descriptions of the devastating impact of extreme weather on food systems in the UK and elsewhere, and strategies for mitigation or adaptation which might be expanded upon. But we also find a prevalence of financial and commercial strategies which do little to address problems in the food system itself, but rather protect businesses by displacing costs, frequently onto consumers, and driving inflation.

We offer recommendations in two categories: first for business disclosure itself – changes to record keeping which would make monitoring risk more comprehensive – and second for agriculture – best practice from the existing food system and interventions to prevent negative patterns which are currently prevalent.

The Autonomy Institute is committed to maintaining a record of this index over time, to trace emerging climate and geopolitical risk across the economy alongside adaptation strategies and failures through Companies House records.

Will Stronge
Chief Executive, The Autonomy Institute



Executive summary

Executive summary

This report presents the first findings from the Autonomy Institute's Risks to British Business (RtBB) tool. RtBB uses large language models to extract and categorise risk disclosures from the millions of annual reports filed by UK companies at Companies House each year.

Specifically, it looks at extreme weather risks in food production filed between 2022-2024 (years which saw record drought and flooding). Agriculture is the sector most saturated with climate risk disclosures and among the most candid in describing them, and so makes a compelling case study. Rather than offering a primary analysis of climate risk, we take filings as a form of testimony: a window into how British businesses (in particular medium-sized firms, which are very prominent in the Companies House dataset) are experiencing and responding to a changing climate.

↳ Key findings

→ Extreme weather has become a defining business risk in the UK food system.

Agricultural firms report heatwaves, drought, prolonged rainfall, and flooding with striking frequency and granularity. The 2022 drought — the worst in 50 years for some crops — was followed by two consecutive years of abnormally wet conditions. Some businesses refer to this as “a new normal”, a chronic feature of global supply chains.

→ Food production and quality have been significantly disrupted.

Successive extreme weather years have reduced yields, damaged crop quality, and disrupted harvests across fruit, vegetables, tubers, and grain.

→ Climate disruption appears to be driving food price inflation.

Many companies are reporting that they have responded to supply shortfalls by passing costs onto consumers. More troublingly, a number of large firms in our sample have leveraged shortages to achieve record profits. Mercian Limited, the UK's largest supplier of crisping potatoes, for instance, recorded its "strongest year to date" precisely because the worst drought in fifty years had generated "the highest potato prices we have experienced." Olive oil brand Filippo Berio similarly grew its turnover during a period of declining consumption.

→ Large, geographically diversified firms are well insulated from climate risk and can leverage this to profit from crises.

Companies operating across multiple climatic regions describe absorbing localised crop failures while profiting from the price rises those failures generate elsewhere. By contrast, smaller businesses with farms located in just one region struggle to cope with extreme weather related shocks. In some cases farms report reliance on unsustainable borrowing and face an uncertain future.

→ Capital investment in the agricultural sector may be declining.

Machinery suppliers in our sample report a drop-off in customer confidence and investment following consecutive bad harvests. Growers who cannot meet their costs are deferring or forgoing equipment replacement. If this pattern is sustained it could impact the productive capacity of the UK food system.

→ Disruption to global supply chains is compounding domestic pressures.

UK food businesses that import food are exposed to climate shocks in the global food systems. Extreme weather events in Spain, the Mediterranean, South America, and sub-Saharan Africa, El Niño-related disruption in South America, drought in southern Europe, and heat stress affecting African growing operations all appear directly in UK company filings.

Introducing the Risks to British Business

Introducing the Risks to British Business

Our Risks to British Business (RtBB) database is software tool developed in-house at the Autonomy Institute to collate, categorise and analyse risk disclosures reported by British businesses in their annual reports to Companies House.

Business filings represent a significant body of grey literature – seemingly banal writing which exists for bureaucratic purposes. Buried within this corpus is a great amount of insight, but because of its volume, exploring it systematically is simply not possible for human readers. RtBB can identify where geopolitical or climate related disclosures have been made in these reports, and then categorise them by type of risk with a link to the original report. Once this is done we can analyse these disclosures in more conventional ways – either statistically, for instance by sector, or as rich qualitative data and testimony.

This is our first report using RtBB. It offers just one application of the toll: a deep-dive into climate related risk in food production. We intend to regularly maintain RtBBF and publish findings related to emergent risks.

The most prominent organisations maintaining existing risk monitors are multinational investment firms – such as Blackrock. These firms maintain these monitors to inform their investment decisions – allowing them to hedge their bets in locations of uncertainty – or to sell as services to other firms looking to do the same thing. To a certain extent they also function as tools in a political landscape, promoting forms of stability that are more favourable to investment.

Our reasons for monitoring risk, unsurprisingly, differ from those of investment firms. For us, risk offers a window into forms of testimony and disclosure that are ripe for political, economic and ecological analysis. They allow us to catch trends early, and understand how these are being encountered and digested by businesses – both as particular kinds of social actors (i.e. as organisations with interests), and also as a location in which much geopolitical and ecological activity takes place.

↳ The Risks to British Business methodology

RtBB uses the following general process:

- ↳ Download annual reports submitted by businesses to Companies House.
- ↳ Identify when climate or geological risk is being discussed in these reports.
- ↳ Classify these risk disclosures according to a robust and broad taxonomy.
- ↳ Compile disclosures and links to the original report in which they were made.

Extracting risk data

Companies within the UK file their annual reports at Companies House where they can be downloaded by the public (and machines). 14.3 million fillings were submitted to Companies House in the 2023/2024 year – a volume which well exceeds the capacity of any human to read, let alone comprehend. RtBB however, can read this huge volume of text, identify risk disclosures within it, and then categorise them according to categories for risk.

Extracting risk data from these documents does represent some challenges, however:

↳ Sparsity

The size of a company determines how much information it must include within any annual reports submitted to Companies House. While large companies often draft bloated accounts running into the hundreds of pages, including some discussion of risk, small or very small companies rarely draft reports that exceed several pages in length. Frequently, these contain no discussion of risk at all.

↳ Standardisation

In the UK there is no standardisation of risk disclosure in company filings.1 Such a standardised form would be conducive to algorithmic analysis as any text in this section has essentially already been classified by the authors as relevant to risk. Instead risk discussion can be found throughout reports, as for instance strategy or in the director's remarks – though some reports choose to include sections like 'Principal Risks and Uncertainties'. Any software trawling for risks is therefore required to search through the entire document rather than simply parse out a single section. Until recent advances in large language models (LLMs), this lack of standardisation made extracting risks particularly challenging.

↳ Machine-readability

Some companies do not submit annual reports to Companies House in a machine-readable format, instead submitting scanned PDF files. These tend to be the largest companies, such as those that make up the FTSE. Medium to smaller companies are likely to file electronically – and therefore their accounts can be downloaded as HTML files containing the machine-readable report with data labelled in the XBRL format.

Due to the lack of existing research on the risks reported by the UK's medium to small companies, coupled with the difficulties in curating machine-readable copies of the UK's larger companies, our initial prototype is designed to monitor only the companies that file their accounts electronically. In 2022/2023, 90.7% of companies filed their accounts electronically. 79.8% of the 3,857,049 companies that filed in 2022/2023 are considered to be small or very small companies as they filed their accounts under the categories of micro entity, audit exempt or small.

1 Unlike, for instance, the US, where companies disclose risks within the Item 1A - "Risk Factors" section of their 10-K filings submitted to the Securities and Exchange Commission (SEC)

RtBB allows us to process this very large number of reports, many of which will contain no discussion of geopolitical or environmental risk at all, and which would be an exorbitant task to read manually.

From “text-mining” to large language model categorisation

“Text-mining” approaches – ones that crawl reports looking for pre-determined keywords – have until very recently been the industry standard method for risk analysis. This has historically been used, for instance, in Blackrock’s geopolitical risk dashboard, which tracks what it perceives to be the top-10 “geopolitical risks”, globally.

While text-mining can generate compelling quantitative visualisations of trends over time, it represents a fairly blunt analytical tool; one which can only measure the frequency with which specific words appear. If risks are described in the wrong terms, or if they are not identified by an analyst before running the tool, they will not appear in the final analysis. There is also a risk of false-positives, where words are used in different contexts than those expected by analysts.

Cutting edge risk analysis tools like RtBB utilise machine learning techniques and advanced large language models to capture more subtle expressions of risk by interpreting the context and semantics in which they are used (indeed, Blackrock has more recently migrated to a similar method). This allows us to achieve both a more precise and textually richer analysis of risk in which qualitative descriptions accompany headline statistics.

On the other hand, using LLMs on their own can be costly and inefficient. Our method therefore combines a string-searching algorithm with LLM categorisation: first, we use a very broad set of keywords to find a subset of data, not all of which will be relevant, and then we use LLM techniques to refine this to only the data which is useful. For instance, the keyword ‘flood’ might return thousands of businesses such as ‘Flood Audio Ltd.’ or ‘Flood & Partners’ which would constitute false positives – but the LLM allows us to remove these incidental results.

To carry out this kind of classification analysis, large language model-based tools require a taxonomy – a fixed vocabulary for comparing and analysing risks between documents or datasets. RtBB uses the Cambridge Taxonomy of Business Risks as a guiding taxonomy to identify and classify risks. This is a very broad taxonomy with an extensive vocabulary for risk, and is therefore highly suitable as a tool of discovery. In particular, it is suited to exposing emergent risks in a dataset, rather than pre-determining these at the outset of analysis.

Food production and extreme weather

Food production and extreme weather

This case study uses the RtBB methodology to investigate the impact of extreme weather on British food growers and producers through their financial reporting between 2022 and 2024.

It is perhaps not surprising that the weather forms a preoccupation of the agricultural sector. Indeed, firms grouped under that umbrella are notable for the habitual and detailed (sometimes conversational) ways in which they report the weather. Again and again, we see growers cite extreme weather as the major factor in their business: "The company is exposed to the vagaries of the climate", writes major potato grower E.Park & Sons Limited, for instance.

"A new normal is emerging in global supply chains"

Terradace Holdings Limited

As described by the parent company for one of the UK's leading suppliers of stone and exotic fruit, Direct Produce Supplies Limited, for instance, "a significant increase in climate related events" after the pandemic has destabilized global supply chains and led to the creation of a "new normal" in which extreme weather events as "chronic" occurrences. This statement is one of many which points to the increasing prevalence of climate-related extreme weather events in the global food system – and the increasing centrality of risk planning and mitigation in the production and distribution of food.

The weather is becoming increasingly unpredictable. So much so that extreme weather of varying kinds is now a mainstay for growers in the UK and throughout the global food system. Domestically, the picture is similar. Disruptive weather events, in particular wet weather events, are becoming more frequent and more unpredictable. The food system as represented in business filings is one in disarray, with yields, quality and predictability of harvests all suffering.

“Agriculture is influenced by many factors… however none have a larger affect [sic] than the weather”

Crop Services Scotland Ltd.

Extreme weather events do not only affect agriculture, but the whole food system. Take fishing, for instance, in which weather is frequently cited as the most impactful variable to business which cannot be directly controlled. Impacts from the weather on yields are noted by Dawnfresh Farming Limited, for instance, which is Scotland’s largest trout farmer.

In recent years the UK has experienced record-breaking climatic conditions. 2022 saw significant drought across the UK and Europe, with the UK seeing its highest ever recorded temperatures. On 19th July 2022 a temperature of 40.3°C was recorded in Lincolnshire. The following years, 2023 and 2024, have by contrast seen prolonged periods of unusually wet weather. March 2023, for instance, was the wettest March since 1981. The testimony of agricultural producers suggests these acute events have hugely impacted businesses, markets and the supply of food. The prospect of their increased frequency is being registered in the form of risk disclosure, in which we find a sense of anxiety about the unpredictability of weather and the adverse impact this will continue to have on food production.

Agricultural producers report extreme weather events with greater frequency than all other types of business. As might be expected, agriculture is especially vulnerable to extreme weather events, which directly affect the quality, volume, reliability and timing of harvests. Volatility in the climate and especially in the market for produce is leaving the future of food production uncertain. Where they can, firms are passing climate related costs onto consumers – in effect driving a cost of living crisis – where they cannot, they are facing growing precarity.

This manifests as uncertainty among farmers. The National Farmers' Union, for instance, has reported that farmer confidence is at its lowest level in England and Wales since their survey began – primarily a consequence of extreme wet weather and post-Brexit phasing out of EU subsidies. Meanwhile, disclosures suggest that growing even staple crops (such as potatoes) is growing increasingly risky – with the threat that bad weather might worsen or ruin harvests.

“The risk of growing potatoes is increasing significantly”

Mercian Limited

Successive years of extreme weather are increasing the reliance of agricultural producers on borrowing, with many believing their future is now uncertain. Horseway Holdings Limited, for instance, majority owner of a family farm in Cambridgeshire which is one of the UK’s largest growers of leeks, states for instance that “inflationary increases and extreme weather has hit agribusiness hard, which together with the wider economic conditions has seen significant increases to the cost of borrowing.” This farm has been forced to borrow more and more to remain in operation – and can no longer meet these costs without the support of inter-group lending.

There are a number of forms of extreme weather which are becoming commonplace. Recent years have brought drought, storms and wet conditions to the UK – each of which have impacted businesses in different ways.

Heatwaves & drought

In the summer of 2022, the UK saw sustained very high temperatures – reaching 40°C at their peak – which in turn led to drought events with negative impact on crop yields. This was felt, for instance, by potato farmers. Mercian limited – the largest single provider of crisping potatoes to UK industry – described it as the worst drought for potatoes in 50 years.

“worse [sic] drought in almost fifty years”

Mercian Limited

The drought was not limited to the UK – and affected the general productivity of crops in much of Europe. Adrian Scripps Limited, a grower of apples, blackcurrants and grapes, described "unprecedented weather impacting fruit quality across UK and Europe.." Similarly, Frederick Haim Limited, which produces potatoes, onions, parsnips, wheat, barley and sugar beets, described adverse impacts on yields resulting from the severe drought. Similar statements were made by a number of agricultural firms involved in the growing of crops – encompassing large industrial suppliers such as Providence Holdings Limited and small family farms, such as Tompsett Growers Limited.

As well as yields, drought had a negative impact on crop quality. Submissions describe them as being scorched or having stone burn/internal browning as a consequence of extreme heat. Similarly, the heat can lead to disease, such as a higher incidence of powdery mildew described by Terradace Holdings Limited. Perhaps surprisingly, a smaller number of growers reported healthy harvests. A H Worth and Company Limited, which grows a variety of vegetables, described a "very successful wheat crop" for instance. North Herts Farmers Grain Limited, which buys and sells grain, oil seeds and pulses, noted a "warm and dry growing season" but nonetheless viewed yields as "better-than expected." One dynamic at play here is the different impacts of dry weather on different crops – these disclosures suggest that fruit, vegetables and tubers were more severely impacted by the dry weather than grains, cereals or pulses.

The drought – though limited to the summer – continued to impact food systems throughout the year. Stewarts of Tayside Limited, Scotland's largest independent seller of strawberries, describes numerous shortages in fresh produce lines throughout the rest of the year. For farmers of some crops, severe drought can take years to recover from. Winterwood Farms Ltd., the largest grower of blueberries in Europe and Africa, described a 2019/2020 drought which "seriously effected" two newly established farms in the north-eastern region of South Africa. Kruger Berries, the farm most significantly impacted by the drought, had to remove 21 of 63 hectares of planted crop, and estimates the drought set the farm back three years. In spite of these weather related events, however, the company is very optimistic about its South African farms' capacity to operate in the UK soft fruit market, which it suggests will contract following Brexit related issues.

"outdoor agricultural workers are at greatest vulnerability to heatstroke"

Terradace Holdings Limited

Hot weather is not only dangerous for harvests, but also represents risks to people and livestock on farms. The advocacy group Open Cages Advocacy Ltd. reported the death of over four million chickens from heat stress through the summer of 2022, for instance. It is dangerous and difficult to work in the heat – with outdoor agricultural workers described by Terradace as "at greatest vulnerability of heatstroke." Not only this, but as the land becomes dryer and harder it becomes more difficult to work, resulting in farm machines wearing faster. As a consequence, international supplier of stone and exotic fruit, Terradace Holdings Limited, estimated that 140 billion work hours had been lost to extreme heat in the summer of 2022.

For some, however, the wearing out of machines in dry conditions is good for business. For Twinings Topco Limited, which supplies parts and equipment to the land management sector, "The summer heatwave led to hard land conditions resulting in high sales of wearing parts."

Heavy rainfall & flooding

"It's been another difficult growing season – two on the trot. I've never known it so wet. It basically didn't stop raining in [the] UK from October to April"

Nationwide Produce Holdings PLC

As the climate continues to warm, the UK is set to become milder. With this, as we have seen in recent years, comes rain.

After the very dry 2022, both 2023 and 2024 brought prolonged, unusually wet periods to the UK. This is reflected directly in the filings of many agricultural companies, such as those of Nationwide Produce Holdings PLC. In 2024, both England and Wales experienced their wettest March since 1981.

"The weather has been the main topic of conversation. Rainfall has been unprecedented"

G.H. & Co Limited

In keeping with a British stereotype, this appears to be a habitual preoccupation among some food producers. It is in this context that G.H. Dean & Co Limited, a privately owned family farm, writes that, following "unprecedented" rainfall, the weather has been the main topic of conversation. It had experienced 203mm of rainfall between March and April 2023, compared to just 52mm in the same period the previous year.

Excessive rainfall and storms has contributed to smaller yields and lower quality harvests of a variety of crops.

"One of the poorest harvests in recent memory"

FFF Holdings Limited

For a number of firms, excessive rainfall has also led to delays in planting. Among firms describing this in 2023 was NG25 Limited, the parent company of Lincolnshire based grower T.H.Clements, which described a wet April 2023 leading to late planting, and E.Park & Sons Limited, which experienced delayed potato planting. This was repeated in 2024. Chapmans Agricultural Limited, Europe's leading provider of wearing parts for agricultural machines, described for instance that unusually large number of storms, starting with storm Antoni in August 2023, leaving many farmers unable to drill their land well into March and April 2024.

> "The 2023 harvest was sporadic, weather hampered harvest progress, decreasing crop quality over time."
>
> Sentry Limited

Excessive rainfall brings an increased prevalence of flooding. We can see from company filings that this has contributed to poor quality produce for agricultural firms. Terradace Holdings Limited describes problems with rot and mould, defects including colour and size as well as impacts to soil health. One consequence of this is increased capital costs, incurred in attempts at mitigation – such as rain water capture and reservoirs. The flipside of this is that agricultural land drainage contractors, such as DMJ Drainage Ltd, owned by PBM Holdings Limited, have seen increased demand following the wetter weather.

“a lot of larger equipment is not able to cope with the ground conditions after heavy rain”

NG25

A further risk is that, once flooded, farmland can become difficult to farm or completely unusable. Neatcrown Corwen Limited, a North Wales based manufacturing business serving the agricultural sector, describes weather having rendered 10% of farmland unusable, for instance. Fidelis Holdings Limited, controller of Freshline Group and Keepstem Group, describes explicitly that amid adverse crop yields and increased harvesting costs, their business strategy was for “cost prices” to be “passed on to our customers”.

“The increases in input cost prices were able to be passed on to our customers”

Fidelis Holdings Ltd.

Unseasonal weather

Reliable harvests rely on normative conditions in the seasons. Recent years, however, have brought an increase in unseasonal weather patterns – which growers note impacts the quality, volume and reliability of harvests.

> "Climate change appears to be creating more volatile, uncertain and unpredictable weather events affecting volumes, quality and costs."
>
> Hugh Lowe Farms Ltd

If winters aren't as cold as usual, for instance, the risk of pests can be greater. Kappersfoods (UK) Limited reports increased risk of infestations following mild winters in which larvae are not killed off. At the same time, a variety of crops rely on climatic conditions for their growth patterns. Terradace Holdings Limited reports risks of advanced bud-break flowering and fruiting – which might leave plants exposed to risks such as frost, hail, pests or disease.

“yields on cherries were below budget having been heavily affected by the spring frosts”

Castleton Fruit Ltd.

In similar terms, late frosts can harm plants and impact yields, as reported by some of the UK’s largest vegetable growers. Kettle Produce Limited and Staples Brothers Limited – two significant growers of vegetables in the UK – report crop losses and supply chain disruption following frosts in Spring 2022. Gusbourne Estate Limited, a vineyard ultimately belonging to former conservative party chairman Lord Ascroft, reports similar impacts to grape yields.

In addition to hurting yields, increasingly prevalent climate change related unseasonal weather will impact the quality of harvests – not just quantity. As Terradance Holdings Limited indicates, this means food businesses will find it increasingly hard to match customer expectations. In general, fruit will be smaller, less sweet, and could change in flavour. All of this impacts their price.

In a few cases, unseasonal weather results in unexpected positive outcomes. Littywood Farm Limited, a Staffordshire producer of berries, notes that a cold Spring 2023 with less than normal amounts of daylight resulted in a slow and late harvest, but that their strawberries and raspberries were also larger and sweeter than usual. In almost all cases however, unseasonal weather appears to be having a negative impact on production.

Global food systems

In the face of the growing difficulty faced by agricultural firms growing food in the UK, the existing food system must look internationally. Indeed, Britain is a net importer of food: we are already highly reliant on global food systems.

“fresh produce issues… may result in the UK importing product to satisfy demand”

Embeck Group Limited

A significant number of firms note that, amid poor yields in the UK, they are having to import produce. This is noted, for instance, by a fresh produce farm based in Nottingham (Hammond Produce Limited), the major support of potatoes for processing and retail (E.Park & Sons Limited), a family farm which is one of the UK’s largest growers of leeks (Horseway Holdings Limited) and a major salad grower (Valefresco Limited). This has the effect of reducing the margins of producers, and “can lead to inflation”, as noted by catering supplier Embeck Group Limited – exposing a number of food related industries to higher costs.

The other effect of poor yields at home is a much greater exposure to global food systems. Unfortunately the situation globally is not dissimilar from that in the UK. A recently leaked investor memo from senior professionals working in the food system has suggested that “predictability in supply from some of our most critical sourcing regions is not something that we will be able to rely upon over the coming years.”

In other words, with global food systems increasingly fraught, the UK may not be able to rely upon predictable imports of food in the future – this is an observation borne out by our own analysis. From food importers, we can see that a number of global weather events impacted British businesses in 2023/2024.

For instance, large amounts of fruit eaten in the UK are grown in South Africa. Winterwood Farms Ltd. reports drought in 2019/2020 impacting berry imports to the UK, while Terradace Holdings Limited describes stormy weather in September as having destroyed 80% of the apricots grown on a 50 hectare farm.

In West Africa, poor weather and related plant diseases have caused havoc in the production of cocoa. We see this cited in the filings of a leading supplier of heavy machinery across Africa, Paterson Simons & Co (Africa) Ltd., and leading supplier of intermediate ingredients for artisanal baking, IRCA Manufacturing Limited. IRCA writes that "Unfavourable weather conditions, cocoa plant diseases, and unattractive prices paid to farmers led to lower production, particularly in Côte d'Ivoire and Ghana" – problems which cascaded into the global supply chain.

And in Spain heatwaves in the 2022 to 2023 period led to a poor olive crop, and a shortage of oil – correlating to widely documented soaring prices in British supermarkets. This is noted, for instance, by Nationwide Produce Holdings PLC. Particularly interesting, however, is the account offered by leading olive oil brand Filippo Berio. The company remarkably describes growing turnover, despite "a substantial decline in consumption" – this was achieved by passing on losses to consumers.

"As a result of the poor olive crop in Spain during the 2022/23 harvest, there has been a shortage of olive oil which has resulted in very significant price inflation... [that] has given rise to an increase in turnover"

Filippo Berio UK Limited

FEX Farming Limited, a prominent grower of salad in Europe and exporter to the UK, describes an expectation that drought will continue to become more prevalent in Spain. Meanwhile, Terradace Holdings Limited describes the country as "one of the countries most affected globally by water stress and extreme heat globally."

Similarly, large parts of the Mediterranean and the Middle East are now at chronic risk of drought. Odysea Limited, an importer of Mediterranean food products to the UK, anticipates these as recurrent features of the market.

Meanwhile, according to Family Tree Farms UK Limited, adverse weather patterns in South America have impacted fruit yields. Similar observations were made by Nationwide Produce Holdings PLC, one of the UK's largest produce companies.

> "El Nino caused chaos to the supply chain in South America"
>
> Nationwide Produce Holdings PLC

Price inflation

Chaos in the global food system is not necessarily bad news for food importers, however. As Nationwide Produce Holdings PLC notes, disruption to food supply "meant short supply and high prices again." Indeed, Nationwide Produce Holdings PLC reports a record year, "with turnover up 5.5% to £186.3m and profit before tax up 66% to £3.54m". Many firms, including for instance fruit and vegetable importer John Henshall (Fruit Salesmen) Limited, similarly report positive impacts on turnover following price rises.

Unsurprisingly, we see a number of firms describe record price inflation. Seed and potato merchant Scott & Newman Limited describes this happening for potatoes, for instance. Similar observations are made about the price of raw teas by tea producer Punjana Limited, part of Thompson's Teas.

Mercian Limited, which described the 2022 drought as bringing on the "highest potato prices" it had ever experienced, also had its "strongest year to date" as a consequence of those price rises. Other firms reporting strong growth in turnover despite lower unit sales include Scotland's largest independent grower of strawberries, Stewarts of Tayside Limited, and the Californian fruit growers Family Tree Farms UK Limited.

“The company achieved its strongest financial results to date with sales and profits up by over 20%. This was achieved by having the highest potato prices we have experienced brought on by the worse [sic] drought in almost fifty years”

Mercian Limited

As in these cases and (already described) Filippo Berio olive oil, a number of firms describe doing very well out of price shocks by not only passing on rising prices to consumers, but leveraging them for record profits. Price rises are both a mitigation strategy and an opportunity for these firms.

Capital expenditure

One consequence of repeated adverse weather in agriculture has been a drop off in some forms of capital expenditure, widely reported by firms supplying and maintaining machinery for the sector – including Hunt Forest Group Limited, Parris Tractors Limited, Reco JCB Limited and Compass Tractors Limited. Such firms report drop-offs in customer confidence follow repeated bad yields, principally as a consequence of bad weather.

> "The increased incidence of extreme weather events due to climate change can have an impact on our customers' risk of crop failure and subsequent reduction in funds to invest in machinery replacement."
>
> –Oliver Agriculture Limited

This is even though – as previously mentioned – bad weather increases the wear on some heavy machinery. Some firms, such as farm equipment dealer Robert D. Webster Limited, remain confident that these sales are merely "delayed". However this will require that squeezed firms are able to pull the capital together to replace old equipment, which becomes less likely after subsequent years of bad weather.

Mitigation

A number of agricultural firms are seeking out diversification of different forms as a way of combating growing risk of failure or low yields. Local climate events (such as frost or heavy rain) can be combated by growing or sourcing produce from multiple distinct locations.

It is for this reason, for instance, that Gusborne Estate Limited, a producer of English sparkling wine, operates vineyards in both West Sussex and Kent (around 50 miles apart). Some growers achieve climatic diversity within a single farm or region by identifying 'microclimates': distinct local atmospheric zones with different conditions to the surrounding area. T.H. Clements & Son Limited, for instance, which supplies brassica crops to Tesco, operates across nine microclimates to maximise resilience to bad weather conditions. One example is on Lincolnshire's east coast, where the sea breeze protects plants from frost and the earth comprises alluvial silts unique to the region. T.H. Clements credits these unique microclimates as leading to a 2024 brussel sprouts crop 25% larger than usual.

"We have seen historically where regions can become over farmed and so always look for the next emerging markets"

Fountain Fresh Imports Limited

In the most developed version of this strategy, a number of the larger producers operate across countries or continents. These businesses are the most resilient to localised weather events. Europe's largest grower of salad crops, Fex Farming Limited, is for instance scaling down its UK operations in favour of better performing Spanish operations.

As firms search for new growing regions, there is an acknowledgement that a changing climate may open new regions to specific crops – this is noted by AB InBev UK Limited, the UK division for the largest brewer in the world (brewing Beck's, Budweiser, Corona and Stella Artois, among other beers), in relation to barley.

> "It is also possible that new barley growing regions could develop due to changes in climate"
>
> – AB InBev UK Limited

At the same time, cultivating climatic diversification brings risk, particularly in the early stages of identification and developing new operations. Fountain Fresh Imports Limited lost a new crop of tomatoes in Morocco to a virus, for instance, with no financial return on its investment. Its response was to abandon its Morocco operation entirely.

With a similar logic, a number of growers are pursuing product diversification. Extreme weather conditions which cause failure in one crop, may not in another – a strategy adopted by Farndon Fields Property Ltd, a farm and shop in Market Harborough. For Grovetree Limited, product diversification allows for demand to be distributed across the year.

The largest grower and packer of daffodils in the world, Varfell Farms Ltd., has been breeding novel varieties which can be harvested as early as January and as late as April (the standard harvest is February to March) to maintain production when supply is generally low.

Parallel strategies are being adopted by buyers, who seek to distribute the risk of poor yields or poor quality products by sourcing from a number of suppliers. For firms operating further down the supply chain such as Grovetree Limited, JW European Limited, Nature's Finest Food Products Limited and Kestrel Foods Limited this means regularly auditing existing suppliers and identifying new ones. In cases like frozen vegetable supplier, JE Hartley Ltd., this is explicitly understood as a strategy of geographic diversification.

> "risk is mitigated by... dual sourcing geographical areas where appropriate"
>
> – JE Hartley Ltd.

And such diversification can be leveraged against suppliers to keep costs as low as possible, even in a general atmosphere of food inflation – a strategy described by caterers Thomas Franks Limited.

“The Group has the ability to flex between a number of suppliers within each category, ensuring it obtains the best price and maximises on product offers”

Thomas Franks Limited

But diversifying supply is not a panacea for these firms, with many in the supply chain reporting price pressure regardless, as is the case for Tanners Wine Limited who describe a “backdrop of uncertainty” in the industry.

“[We] are well diversified with suppliers all around the world but we cannot be immune to price pressures from reduced yields in particular.”

Tanners Wine Limited

Frequently, mitigation involves financial strategies to keep businesses operational after poor or failed harvests. Scunthorpe Produce Limited, which supplies Waitrose, for instance, describes close relationships with its suppliers in Europe and Africa, including a director who holds “interests in a number of suppliers”, and is therefore able to “exert some control on those businesses’ response to Climate Change risk”. In another example, Winterwood Farms Ltd, a UK based farm with operations in Africa and Europe, made a significant loan of £13.1 million to a South African subsidiary. Winterwood Holdings SA (Pty) Ltd, through which it aims to develop longer term production. When drought set one of the South African farms back by three years, this was met with leniency on the basis that the long term prospects of the farm were considered excellent. Both case studies underscore the need for sufficient financing – and for a long-term approach to risk in which short term failure is accepted – when attempting climate diversification.

Amid weather volatility some growers, such as G H Davies Holdings Limited and JE Hartley Ltd, and processors, such as Moulton Bulb Company Limited, are fixing a proportion of their crop sales value through mechanisms like forward contracts. Forward contracts are financial agreements between two parties to buy or sell a specific quantity of a commodity (such as grain) at a predetermined price on a specified future date. By securing a forward contract, the company guarantees a fixed price for a part of its harvest, regardless of how the global market price fluctuates after the contract is signed. Similarly, Wight FarmEnergy 2 Limited, which runs a renewable biogas generation site, secures long-term supply agreements for feedstock, which require the other party to provide alternate sources of feedstock in the event of poor harvests. Bio Capital Finance Limited, another biogas producer, similarly maintains diversified feedstock sources and long term relationships with local authorities to maintain a constant supply.

"global weather conditions [are]... mitigated by forward contracting many of our supply and sale contracts back to back and dual sourcing from distinct geographical areas where appropriate."

–JE Hartley Ltd

But fixed price contracts can also result in losses for growers when prices are rising. Tompsett Growers Limited and Scott & Newman Limited both describe being caught between these contracts, low yields, and widespread inflation, which has left them unable to recover growing costs through sales. Amid price volatility, some contracts are being renegotiated in response to surprise extreme weather events – as is the case for Heathpatch Limited, which renegotiated feedstock prices after droughts in 2022. But sometimes renegotiation is not enough: Mercian Limited describes a 20% uplift for growers being insufficient in the face of repeat dry weather.

"We have also suffered from rampant inflation within the sector, with many costs being un-recoverable from customers on fixed priced contracts."

Tompsett Growers Limited

Market volatility is itself a risk to producers, Yorkshire-based grain merchant Argrain Ltd describes speculation "at the world level". Within this environment, we can see the emergence of firms with expertise in trading within a market with significant price volatility. One such example is Dewing Grain Limited, which buys and sells grain on the futures market. Here, grain functions as a speculative asset as much as a commodity.

“Weather conditions throughout the world create speculation at the world level creating price volatility in commodity markets like grain. This creates risk as well as potential to profit … through physical and futures contracts”

–Argrain Ltd

Adaptation

Business filings reveal that many agricultural firms are already heavily involved in climate adaptation work of one kind or another.

One form of adaptation is converting land to grow crops for which local climates were previously inhospitable, but is becoming more suitable as they change. For instance, some parts of the UK (particularly the South of England) appear to be becoming more suitable for growing grape vines, and producing wines. This is noted by several growers and producers of wine: Hattingley Valley Wines Limited, Lympstone Manor Ltd, Gusbourne Estate Limited and Tanners Wines Limited. There is a perception among English growers of wine that this is an emerging industry, with high domestic and global demand.

> "The UK climate continues to evolve towards improved growing conditions for vines"
>
> –Hattingley Valley Wines Limited

But at the same time, a range of technological adaptations are being pursued. A number of agricultural organisations are involved in research to develop seeds, for instance, which are more resistant to changing climatic conditions. This includes using predictive modelling technologies and stress tests to select for drought resistance, temperature resistance and resilience in specific locations.

“Recent new product introductions... with greater climatic resilience to drought / stress conditions.”

Sakata UK Limited

Both Sakata UK Limited, a subsidiary of the global seed producer Sakata Seed Corporation, and Terradance Holdings describe investing in this kind of research and development activity to produce crops which can deal with harsh conditions – and suggest they have already brought such new seeds to market.

We can also see the emergence of demand for short-term intensive work to make up for unpredictable growing periods. For instance, T.H. Clements & Son Limited describes a rush with “almost round the clock teams to harvest crops”, aiming to get a late sprout harvest on shelves in time for Christmas.

With an increasing prevalence of hot and dry summers, we can see agricultural producers invest in crop protection of different kinds, including the construction of mesh houses, polytunnels, glasshouses and more novel approaches such as vertical farming. Firms describing such measures include W B C F Holdings Limited, Valefresco Limited, Littywood Farm Limited and Terradace Holdings Limited. Within this move towards more controlled growing environments, a smaller number of firms, including Terradace, are moving towards illuminated facilities which allow for your-round production of seasonal produce.

“The building of our stage 4 illuminated crop was completed in the period and will facilitate year-round production of UK strawberries”

Terradace Holdings Limited

For these producers, climate control strategies reduce the risk associated with growing food in the elements. But these controlled growing solutions can also themselves be sold as products. Terradace, for instance, describes its illuminated growing system in these terms: “This patented system could become the growing system of choice in areas of the planet where natural resources are increasingly under pressure.”

“continued change in the global climate is having an immediate and increasing impact on high-risk conventional agriculture. To this end, we are moving or have moved, all our outdoor nonorganic production to be farmed under some form of environmental protection”

Terradace Holdings Limited

But there are trade-offs to this strategy. For instance, polytunnels and glasshouses are highly vulnerable to storms – which are also becoming more likely. Several firms, including The New Forest Fruit Company Limited, Edward Vinson Plants Limited, and Camel Community Supported Agriculture CIC, a not-for-profit community growing scheme, all report damage to environmental protection infrastructure following winter storms. Meanwhile, some small producers complain that they are unable to obtain insurance for items like polytunnels.

In a parallel example, salmon farming group Bakkafrost Scotland Limited describe minimising the time fish spend in wild marine environments, "particularly during summer when higher seawater temperatures present challenges to salmon." On-land Recirculating Agricultural Systems (RASs) are considered more reliable and cost-efficient for production of commercial salmon, due to low quality seawater and increasing sea temperatures. Bakkafrost is currently constructing a massive RAS facility which will be capable of producing 4,000 tonnes of smolt (young salmon) a year.

In response to the growing prevalence of drought, a number of farms have invested in new irrigation infrastructure, including P.J. Lee & Sons Limited, Fex Farming Limited, Grovetree Limited and Tompsett Holdings Ltd who cite the UK weather as "A significant business risk". Rainwater harvesting is similarly being used by a number of firms to help combat a scarcity of water during droughts, a strategy described by Terradace Holdings Limited, Teign Greens CIC and S&A Holdings Limited.

And, as a direct corollary, a number of firms describe new investment in drainage to help deal with the growing prevalence of wet weather, including Terradace Holdings Limited. PBM Holdings Limited, a land drainage contractor, describes a positive upward trend through 2024 in their market. Some organisations, such as the Fferm Ifan project, are exploring ecological approaches to drainage: it describes planting hedges to prevent downstream flooding of the town of Llanrwst.

“Implementing climate-resilient farming practices, exploring drought-resistant crops, and investing in water management systems can help mitigate risks associated with climate variability.”

G.H. Dean & Co. Limited

One farm has taken advantage of a nitrate credits offset scheme to gain revenue from wetland restoration, and made this an important part of its business. H.N. Butler Farms has carried out extensive work on the Whitewool Stream Wetland Project in the South Downs, widening a fast narrow stream to establish a wetland as an ecosystem for wildlife and de-nitrifying microbes. The intention of the project is to stabilize the river’s flow and reduce nitrate levels in the water. Nitrate credits from the scheme can be sold to developers building in areas subject to ecological protections.

For many agricultural companies, information about the climate is becoming an important commodity and tool for effective adaptation. Climate monitoring is therefore being broadly experimented with, both by small growers and major producers or distributors. Wine producer Gusborne Estate Limited describes mobilising “temperature loggers and weather stations” to predict incoming frost and prevent damage to crops. Similarly, Lincolnshire grower T.H.Clements & Son, and its parent company, NG25, describe experimenting with “new methods and equipment to improve the data being used to better manage the impacts of changing weather conditions”.

“THC continues to research and trial new methods and equipment to improve the data being used to better manage the impacts of changing weather conditions”

T.H.Clements & Son Limited

Larger firms are leveraging their position to provide growers in their supply chains with information. This is the case for international brewer AB InBev and its Barley growers, for instance. Similarly, Terradace Holdings is in the process of formalising a risk register which will track extreme weather events and their impacts on people and products in real time to “capture the direct impacts of climate related events on supply.” Beyond this, Terradace describes investing in “predictive irrigation” and drone technology to address water scarcity.

Networks of buyers and consumers chat with one another sharing data before it is known to the public. Lamex Food Group Limited, an importer and exporter of frozen food, describes gathering intelligence “from a variety of sources, primarily from the traders being in constant contact with the suppliers and buyers of produce around the world.”

Among other things, climate information can be used to anticipate demand and manage stock. J.C. Peacock & Co. Limited, a large salt supplier for the de-icing market (which also supplies the food industry), describes utilising short and long-term weather forecasts to maintain timely stocks. Meanwhile, the firm Oliver Agriculture Limited, a supplier of agricultural machinery, describes monitoring the extreme weather to forecast seasonal stock levels.

More broadly, stockpiling is being utilised by a number of firms to offset the risk of supply shortages. Food Team International Limited, a broker and distributor of products for retailers, wholesalers and manufacturers, describes the emergence of a situation in which “all stake holders” are maintaining greater minimum stock levels. Similarly, Leda Properties Limited describes how holding onto stock from previous harvests can help mitigate the impact of future poor harvests, while Cannington Enterprises Limited (a bioenergy and waste-management firm) describes stockpiling as a successful measure for regulating supply to its plant.

Conclusion: the business of failure

Conclusion: the business of failure

Investigation of climate risk disclosures made by agricultural firms exposes two key trends:

- On the one hand, poor climatic conditions have caused significant disruption to both the domestic and global food systems in recent years, leading to food shortages – a trend that is only set to escalate.

- While some smaller agricultural firms are struggling to keep their head above water, for others (especially those operating across multiple climatic regions), food system failure has in many cases been good for business.

Company disclosures offer a remarkably candid view into how agricultural businesses are responding to failure in the food system. We can see the emergence of positive lessons for mitigation and adaptation. Among these is stockpiling, which a number of growers and producers are undertaking to smooth out the impact of poor yields or shortages. Similarly, we can see broad experimentation with measurement and climate information, as well as forecasting, which growers use to anticipate extreme weather events and establish appropriate protections. Long-term financing, where it is available, has clearly helped growers endure bad harvests and return to strong production.

In addition to these mitigations and adaptations, we also see the proliferation of strategies aimed at minimising financial losses and maximising profits during moments of crisis. Some agricultural firms have been making record profits despite experiencing very poor quality and yields of harvest.

This kind of strategy is of course only available to growers and producers with large or diverse enough holdings to weather local climatic events. If the whole harvest is ruined, it is not possible to profit from higher prices. Meanwhile, for growers that operate multiple farms across regions or even countries, poor harvests due to extreme weather in one area nonetheless increase the value of harvests elsewhere. In fact, food shortages create an opportunity, as we've seen, to drive prices up in excess of losses from poor harvests. Some of the inflation to food prices we've experienced in recent years can therefore be attributed to strategic financial mitigations deployed by agricultural firms in the face of climate related supply shortages.

By contrast, small farms are poorly suited to surviving an unpredictable climate without external support. If they cannot access financing, or if they become reliant on loans, these smaller farms become unsustainable as businesses. In parallel, we can see the growth of domestic and global speculation on the price of commodities like grain, which itself contributes to price volatility.

In short, big agricultural businesses might be profiting from climate shocks, but they are not maintaining a secure, reliable supply of food. All this points to the need to develop coordination across the food system adequate to maintain the viability of farms, even after successive difficult years. In other words, to engage with the food system as a

system. Currently, some coordination is occurring between larger firms and between companies with significant direct relationships. Most co-ordination is taking place via the market, however, and is experienced by consumers as price shocks.
One response would be the development of a National Plan for Food Security to expand positive mitigation lessons and sustainable agroecological methods in a coordinated manner across the food-system. Stockpiling is already taking place in some parts of the system, and a more coordinated form of this would help to blunt the inflationary impact of yield related price shocks.

Where adaptation is capital intensive, there will be infrastructural costs to improving food security. If we want reliable food production amid climate related market volatility, long term financing and more sustainable forms of management need to be promoted, as in proposals for running council farms as public common partnerships. In parallel, proposals for a basic income for farmers would remove the risk and precarity from growing work.

However, the success of large, geographically diversified companies also suggests that calls for so-called “food sovereignty” – for producing more British meat and veg – are inadequate as responses to an increasingly volatile climate. Developing greater domestic capacity for food production will insulate us from price shocks only until the UK experiences its own incidences of particularly bad extreme weather. A strategy focused on isolating our food system leaves us at risk of devastating supply shocks.

Instead, we might learn from those multinational agricultural companies that hedge risk across borders and climates. This means, alongside building up domestic capacity, developing reciprocal international agreements to minimise inflationary price shocks.

Currently failure is big business in the food system. Moving forward requires reorganising the system away from harmful outcomes like failed harvests, ecological deterioration and inflation to the cost of living, and towards reliable, sustainable and secure food production,

Recommendations

Recommendations

For the food system

Develop a National Plan for Food Security setting out clear steps to increase the climate resilience of food production in the UK, avoid shortages and keep prices down. This plan would:

- ↳ Anticipate shocks using cutting edge of meteorology, climate modelling, agricultural science and economic planning.
- ↳ Inform and coordinate growers to minimise the impact of extreme weather events on domestic supply.
- ↳ Promote sustainable practice, including agroecological methods and lessons in mitigation from across the sector.
- ↳ Support systems change by funding infrastructure when necessary, and trialling new approaches such as a basic income for farmers or public-common partnerships.
- ↳ Minimise inflationary impact through price controls and international collaboration.
- ↳ Require food-distributors to maintain buffer stocks of preservable stock to diminish the effect of price shocks during supply shortages and ensure the nation never goes hungry.

Build up domestic agricultural capacity to minimise the impact of shocks in the global food system to prices at home. This means improving the efficiency of land use (by, for instance, prioritizing arable crops when possible) and improving land quality.

Collaborate internationally via reciprocal agreements to ensure stability during domestic supply shocks, minimise regional inflation and crack down on climate profiteers.

Introduce price controls during extreme price shocks to limit the short-term inflationary impact and prevent profiteering.

For risk disclosure

- ↳ The UK system of financial risk disclosure already holds a number of specific strengths:
- ↳ All UK company annual reports are freely available.
- ↳ All UK companies must disclose annual reports.
- ↳ From April 2027, all UK annual reports will be machine-readable and adopt the iXBRL standard which allows key financial data to be easily extracted.

There is, however, also an opportunity to establish the UK as a leader in quantifying the financial impacts of physical climate change at high resolution, enabling more targeted

and efficient intervention. In order to achieve this, Companies House should:

Require reports to directly represent estimates of the physical costs of climate change, including insurance claims, damage to tangible assets and loss of business/sales. Currently, very few companies report costs directly attributed to extreme weather, for instance, instead focusing on the costs and risk associated with transition. This data is mostly held by companies, and shared with insurance firms or occasionally local or national government, but is not open to public scrutiny.

Improve usability, first of all by removing company limits in location searches, and by allowing searches by post-code. This would remove barriers to analysis of its data, strengthening public oversight.



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