Whatever Next
Risk Review - UK 2030

SEEDING OUR FUTURE

The Schumacher Institute

**Report commissioned by
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Executive Summary

This report uses the best available forecast data to highlight the specific impacts of eight key risks likely to affect the UK by the year 2030, and to outline practical responses to these issues. The aim of the report is to guide community leaders/groups, activists, and policymakers to identify priority issues and best response strategies.

The report covers eight risks, briefly described below. For each risk, the report gives specific forecast data, likely impacts, a best case/most likely/worst case outcome from these impacts, plus practical response options and resources for further information.

Headline findings for each of the eight risks are set out below.

Risk 1 – Extreme Weather: Severe weather events are already becoming more frequent and extreme, and the report gives forecasts for the future trends. We should expect much more frequent incidents where extreme weather exceeds the capacity of defences and response services. There are various ways local communities could anticipate this, e.g., local resilience action groups and partnerships.

Risk 2 – Energy: Various factors make disruption to electricity and gas supplies likely over the coming years and increased social and economic impact is probable. There are a range of positive responses which households and communities can take, some of them relatively easy to do.

Risk 3 – Water: Mains water shortages and restrictions are very likely in coming years. Droughts and water contamination have systemic consequences on other essential goods and services. Assuming pressures on the water infrastructure are likely to exceed demand, households and communities will need to be better prepared.

Risk 4 – Food Supply Constraints: Substantial increases in food prices and shortages in supply are already happening and are almost certain to increase substantially in future years. There are various ways that households and communities can respond, including dietary choices, community supported agriculture schemes, and adaptive cultivation methods and crops. Worst case scenarios may need considering, such as communal meal provision (soup kitchens).

Risk 5 – Pollution – Air, Water, Land and Oceans: Pollution creates a range of hazards, some specific and easily identified, some diffuse and hard to forecast or respond to. Pollution of many types is likely to continue presenting environmental challenges, and this issue calls for systemic health innovations, and the ability to improve measurement and responses to specific hazards.

Risk 6 – Health and Well-being Impacts – Physical and Mental Diseases: There is a high probability of physical and mental health issues increasing, partly driven by other risks described in the report. Current demand far exceeds current capacity in the NHS and other channels, and this overload is likely to increase substantially, implying significant social and economic impacts. While this issue clearly calls for a governmental response in expanding capacity and improving effectiveness, there are many opportunities for local communities and voluntary organisations to use approaches already available to address mental health and general stress arising from eco-anxiety and other factors.

Risk 7 – Social and Cultural Disorder: This is an increasing risk in the years ahead, partly driven by the impact of other risks. Trends already visible are likely to increase, e.g., increased militancy by activists, and restrictions on civil liberties by government. Constructive responses are most likely to arise from grassroots movements and local community groups, and this is a major need and opportunity.

Risk 8 – Information System Failure: Most systems in our society are now heavily dependent on cloud-based data storage and processing, and mobile phone/satellite communications. The risk of major disruption from cyber-attacks and other factors is high over the coming years, and could easily result in major disruption to basic services, such as banking, food, utilities and health. There is some scope to reduce these impacts through local community resilience networks and precautions at household level.

In summary, all these risks are interconnected, and there are other risks which could have been highlighted, such as biodiversity loss, rising inequalities, and mass migration. While the outlook can easily be seen as alarming, there is great scope for some adaptation and mitigation of most of these issues, especially by local community groups. In many cases, best practice processes or project exemplars are already available.

Introduction

This report is a brief review of the existing literature on the major environmental and related threats likely to affect the UK up to circa 2030. Where possible, the review includes estimates and opinions on the likelihood of these risks occurring as well as indications of timing and severity. Thinking about these risks can identify opportunities for positive action to reduce the severity of the changes and to adapt to them well. This work was carried out by The Schumacher Institute directors, Ian Roderick, and Dr Dharm Kapletia, Dr Roubie Naidu and Seeding our Future founder, Alan Heeks.

Outcome

"We want to engender hope and enthusiasm for an optimistic future while preparing for change"

Our purpose is to alert community leaders, activists, and policymakers to the threats to our society, motivating them to build a resilient, sustainable, and fair world within the constraints of resources. We wish to guide decision-making and behaviours for individuals, communities, businesses, and government. We want to engender hope and enthusiasm for an optimistic future while preparing for change
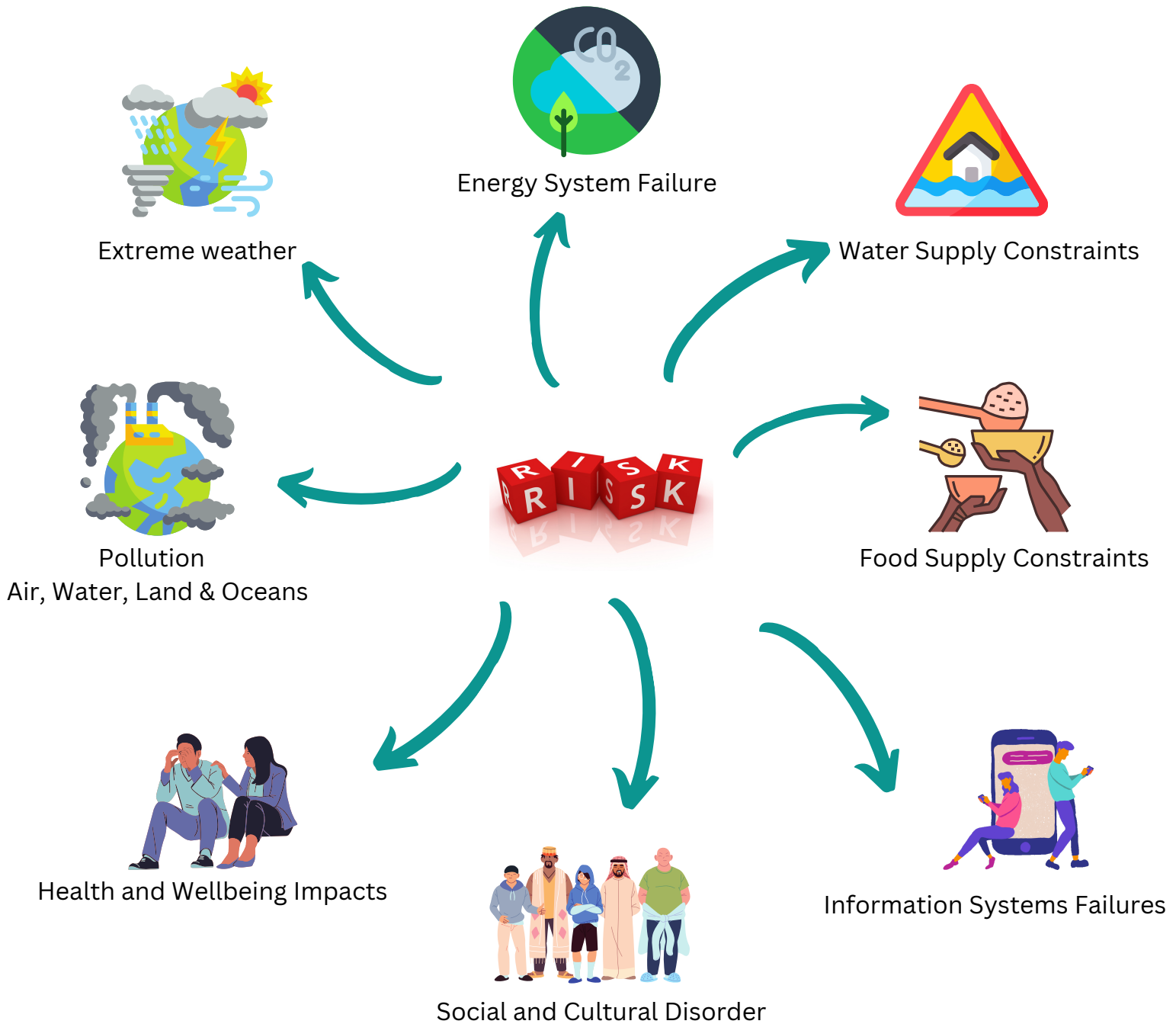
The Risks

There are many organisations and individuals exploring the threats and risks that the world faces in the coming years and decades. The list of these risks can run to many pages, some appear at the global level, affecting everyone in the world, while others are local and peculiar to a particular region or country.

A global risk is defined by the World Economic Forum (WEF) as 'an uncertain event or condition that, if it occurs, can cause significant negative impact for several countries or industries within the next 10 years' (Global Risks Review, 2020)

It is within this context of global threats and trends that we examine the risks faced by communities in the UK. We have selected eight that we think are worth exploring in detail as they would have direct impact on communities and individuals.

The Eight Risks

Energy System Failure

Extreme weather

Water Supply Constraints

Pollution
Air, Water, Land & Oceans

Food Supply Constraints

Health and Wellbeing Impacts

Social and Cultural Disorder

Information Systems Failures

Drivers behind these risks

The drivers of the hazards we face today are complex and multifaceted and include (not an exhaustive list) technological advances, global warming (rising levels of greenhouse gases), geopolitical shifts and conflicts, demographic changes (growing populations, ageing societies, migration), and biodiversity loss - these all interact and have consequences that are difficult to foresee. Our report is about the immediate future and given current concerns, the year 2030 is a convenient marker. [i]

Responses

The ability of individuals and communities to directly affect the drivers of these risks is constrained – however, if enough people do take small actions, then they add up to a large effect, actions and strong messages can be directed towards those who can affect change, and a greater understanding can raise awareness to shape change. Thinking beyond the UK government advice[ii] on general preparedness, we consider the specific impacts of the risks we cover, and this inevitably stimulates us to examine what might these responses be?

- Do nothing and hope for the best?
- We can change our individual behaviours
- We can support campaign groups
- Communities can act for larger scale adaptation
- Government decision making and rules can enable change - we can express our opinions, influence the debate, alter voting patterns.
- Business practices can change

There are a range of emerging tools and resources being developed by others all over the world, by individuals and groups who also recognise the need to take action (e.g., increasing democratic participation and implementation of potential solutions using tools like Decidim, or utilising specialist visual maps like <u>Coastal Risk Screening Tool.</u>

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i In 2013, John Beddington, England's chief scientific advisor at the time, warned that the world could be facing a "perfect storm" by the year 2030, unless more is done to address the challenges posed by climate change, population growth, and the rising demand for food, energy, and water.

ii https://www.gov.uk/government/publications/preparing-for-emergencies/preparing-for-emergencies

Likelihood, Timing, Severity

<u>When will things happen?</u>

For many years, even decades, the threat of climate change and extreme weather events was in the news but as theoretical and contested possibilities. The scientific process is never certain, it always questions evidence and is open to review and reinterpretation, so we must live with beliefs based on likelihood rather than certainty. The evidence for the threats and risks outlined in this report is growing in both volume and intensity. Patterns are emerging that show increases in the effects, and we are improving our estimates of damage to the environment and the depletion of resources. In the run up to 2030, just eight years away, we will see some of these risks materialise, we are likely to experience extreme weather events, to see food supplies disrupted, and energy shortages. The potential for social disorder, cyberattack, and further global diseases are all there.

It is impossible to predict when the next pandemic will occur as they are random events. They can begin anywhere in the world where animals and humans are in proximity as pandemics most often originate when a pathogen transfers from an animal in which it lives to a human never before infected with that pathogen.

Chatham House (https://www.chathamhouse.org/2022/02/next-pandemic-when-could-it-be)

In the same way that we cannot specify the likelihood or timing of when threats may happen, we are unable to give definitive answers to their severity. We can see patterns that suggest that the impacts are increasing in extent and in the amount of damage caused. The pattern of increasing maximum temperatures is seen in many countries, about 1.47 billion people, or 19% of the world population, are directly exposed to inundation depths of over 0.15 meters. The impression we gauge is of worsening conditions although with considerable variations.

Massive Response Today

Efforts to prepare for change are happening. The UK government maintains a National Risk Register and the National Risk Assessment (NRA) is a yearly process aimed at identifying, characterizing, and comparing all the major hazards and threats that may cause significant impacts in the UK, roughly on a five-year horizon. Eighty types of threat event have been identified and analysed through the NRAs over the last years. We observe that in the UK's climate risk assessment, the following areas have been prioritised: the viability and diversity of natural habitats and species, risks to soil health, loss of carbon stores and sequestration, damage to agriculture and trees, disruptions to vital supply chains, energy disruption, and negative impacts on human health, wellbeing and productivity.

Drawing on these risk assessments and our own analysis, we propose eight focal areas that we think are most pressing in the immediate term to support resilience building. Somehow the world must wake up to the reality that a massive response is needed to address climate change and loss of biodiversity, and that means tackling a spectrum of threats and risks that are damaging our environment and threatening humanity.

Risk 1: Extreme Weather

Our first risk covers all aspects of extreme weather.

Looking at global evidence over the past 20 years, the published literature is mainly focused on studies of **extreme heat** (30%), **rainfall or flooding** (25%) and **drought** (16%), and in most cases are more severe and more likely to occur in future, based on evidence collected to date [1].

1 . According to the UK Royal Meteorological Society, through decades of analysis and up-to-date observations, the 'State of the Climate' report argues that all top-ten warmest years have occurred from 2002, six of the wettest years have occurred from 1998 (datasets from 1884 and 1862 respectively) [2].

Forecasts

According to the 2020 UK National Risk Register, there are at least nine categories of extreme weather-related risks listed, with differing degrees of potential negative consequences in the immediate term. The most likely (1-5 in 500) are drought (Level C impact [iii]) and wildfires (Level B [iv]). Interestingly, the next most (5-25-500) likely include coastal flooding and river flooding, which are considered to have a higher (Level D [v]) economic and human cost impact than drought and wildfires. In the same category of likelihood is surface water flooding, severe space weather but at Level C. Lastly are (25-125 in 500) are storms, low temperatures, heatwaves (all at Level C).

With drought and wildfires in mind, having reached a record high of just above 40 degrees in the UK's summer of 2022 and observing this phenomenon across Europe, this has raised alarm bells of more to come in the immediate term.

Hazards associated with extreme weather risks

Current issues facing the UK include but are not limited to the following:

- Heatwaves impairing the health of vulnerable groups and the proper functioning of emergency services, hospitals and care homes.

- Droughts impact on availability of water for domestic use and critically for agricultural production, which in-turn affect the food and animal feed supply chains (national and export) resulting in higher costs and farm closures

- Extreme flooding impacts can result in sudden loss of life, homes and ecosystems, interruptions to power supplies which have knock-on consequences, and can leave regions inaccessible for a time – such events can be coastal, near rivers/estuaries, and also surface rainfall in high-risk areas

- Extreme flooding can also result in increased pollution, risks to human health from exposure to contaminated water and cost pressures on local authorities and firms, with long-running effects on demographics and investment

[iii] Level C = £100m-£1bn economic impact, circa 41-200 fatalities, 5k evacuated over 3 days, and over 100k citizens feeling more vulnerable, environmental damage/contamination for 1 year, lack of health and social care affecting 10% of population for 12 hours, 300k face electricity disruption longer than 18h
[iv] Level B = £10m-£100m economic impact, circa 9-40 fatalities, 200-1k evacuated over 3 days, and tens of thousands of citizens feeling more vulnerable, environmental damage/contamination for 1 month, lack of health and social care affecting 2% of population for 12 hours, 100k face electricity disruption longer than 18h
[v] Level D = £1bn-£10bn economic impact, circa 201-1k fatalities, 20k evacuated over 3 days, and millions of citizens feeling more vulnerable, environmental damage/contamination for 1 year, lack of health and social care affecting 20% of population for 7 days, 1m face electricity disruption longer than 18h

Best case - most likely – worst case

After record breaking daily rainfall in Oct 2020, the latest research estimates a 10-fold increase in the chances of such extreme rainfall events by the end of this century[3]. According to current projections, the UK is likely to face sea level rises between 0.27 and 1.12 metres by the end of the century, with 1.9 million people already living in areas at significant risk from either river, coastal or surface water flooding (a figure which could double by 2050)[4].

Our best case for the UK, as suggested by research and analysis[2] points out a mixed picture in the UK due to the unpredictability of weather systems. For example, the number and intensity of widespread and substantial snow events have generally declined since the 1960s. Extreme events may not appear every year and when they do, we may get lucky - they may not be as bad as the storms in 2013 with thousands evacuated from homes, and environmental devastation from Storm Arwen in 2021.

The most likely scenario over the next 10 years is that there will be ongoing regional instability in vulnerable hot spots across the UK, which will directly affect households, businesses and public services in those specific areas. These are likely to involve a combination of local and national responses to build resilience accordingly.

The worst case is that the UK is continually caught off-guard, for 'known-unknowns' – in other words, we are aware of specific extreme weather risks but cannot comprehend the extent of our exposure or where to direct mitigation efforts. In this scenario, we are almost entirely reactive, potentially under-resourced and will have to deal with extreme heat, flood, drought and related hazards on a case-by-case basis.

Options available to address risk

The following options may depend on geographic and demographic factors.

1) Formation of local resilience action groups, targeting known thematic challenges in the area and maintain local knowledge on risks and actions – utilising online community platforms

2) Strengthening citizen and business engagement in <u>local resilience partnerships</u>, which may include for instance, feedback on highways and transport [5] risk management plans/actions, and novel asset sharing arrangements for faster responsiveness to emergencies

3) Action group consultations with local environmental and ecologist experts to co-design and implement nature-based solutions (i.e., restoring and creating peatlands and wetland, sustainable urban drainage systems, tree canopies) [7]

4) Creation of new not-for-profit enterprises with a clear remit to engage local citizens, and attract funding for the construction and maintenance of extreme weather defences Unlike other risks, efforts and investments for extreme weather events that may not occur, should ideally be linked to other systemic social and environmental benefits.

Resources Available

UK Government Flood Risk Tool

The UK Government portal provides a static map of the UK illustrating the extent of flooding from rivers or the sea, providing a visual spectrum from high to very low. You can also search for flood risk by reservoirs. You can use the post code entry or go direct to the map to scroll over areas of the UK. You can also check for live flood alerts and more specific river, sea, groundwater and rainfall levels.

Climate Central – Coastal Risk Screening Tool

Climate Central is an independent group of scientists and communicators who provide compelling visuals (maps) related to extreme weather and related topics. This online tool illustrates high risk areas of the UK over time, which can be adjusted for different scenarios (i.e., differences in water levels above the high tide line). Related researchers provide further reading on projected threats to cities from multi-century sea-level rise.

GeoIKP – Platform for Nature-based Solutions

EU-funded Horizon 2020 project which offers guidance to citizens on Nature-based Solutions (NBS) that can help defend against extreme weather and other risks. NBS are "actions to protect, restore or sustainably manage landscapes, seascapes, watersheds and urban areas so they can tackle challenges such as food and water security, climate change, disaster risks and human health" (WWF, 2023). The platform offers an NBS catalogue of over 600 cases globally to learn from. The platform also provides a visual map of NBS projects, which covers regions in the UK.

UK Resilience Innovation Grants and Funding

The UK government has introduced dedicated innovation funding towards improving flood and coastal resilience. Between 2021-2027 the Environment Agency will allocate funds to 25 local areas, dedicated to flooding and coastal erosion. Furthermore, a coastal transition accelerator provides support to communities and businesses, and an adaptation pathways programme will focus on the Thames and Humber estuaries, the Severn Valley and Yorkshire.

Farming Resilience Funding and Payments

A range of options are available to farmers facing challenges, including advice on business changes towards more sustainable practices as well as one-off and ongoing payment schemes, which cover environmental interventions. There is a list of trusted organisations (by county) providing free advice on farming resilience.

Local Government Association – Severe Weather Plans

The LGA is a cross-party national membership body for 315 local authorities in England and 22 in Wales. The LGA has published an Adverse Weather and Health Plan in 2023, and provides publications and updates on resilience and emergency planning related to extreme weather.

Extreme Heat Checker Tool

Using heat hazard data and scoring by 4EI, this map provided by the BBC, illustrates areas vulnerable to extreme heat. For live updates, you can sign up to the met office alerts and follow best practice guidance from the UK Health Security Agency. The met office also provides a Fire Severity Index map for England and Wales.

Risk 2: Energy

Energy is the vital ingredient for any society and one that is undergoing a major transition. There are many drivers of change ranging from the need for carbon emission reductions, to geopolitical conflict, and through to the inevitability that fossil fuels will run out. The transition to renewable energy faces a multitude of hurdles and barriers. It is underway for sure, but it will be expensive and there are uncertainties around access to required raw materials (i.e., precious metals). Transitional periods are full of risks. The main risks for communities are sudden unplanned shortages, or rationed supplies, and the consequences that follow.

Forecasts

The coming few years hold the prospect of shortages. The Office of Gas and Electricity Markets (OFGEM) have said (Oct, 2022) that a gas supply emergency could impose "load shedding" on the largest consumers, forcing gas-fired power stations to close leading to power cuts. In the National Risk Register, 'widespread electricity failures' is cited as a real threat (5-25 in 500 likelihood) and with the potential for major consequences (Level DV). The National Grid Energy Supply Organisation (ESO) has modelled several scenarios, amongst these is Scenario 1 - the cessation of energy supplies from France, Belgium and the Netherlands (due to the war in Ukraine), which will result in deployment of contingency coal contracts and a newly commissioned Demand Flexibility Service to take on the burden of maintaining weather corrected peak demand forecasts. However, recent media posts and market confidence continue to question the viability of contingency measures in the short-term, particularly if energy imports are halted.

Hazards associated with energy risks

Some of the risks and consequences are:

• Vital equipment ceases to function – medical needs, water purification, sewage pumping
• Refrigeration failures – food spoilage
• Communication systems failures – supply issues develop, emergency service disrupted
• Gas shortages (and domestic oil) affecting heating and cooking
• Transport fuel shortages – society grinds to a halt, food supplies are hit
• Loss of heating (possibly cooling in heatwaves) may be exacerbated by extreme weather and can threaten life.

As this last item mentions, some of these risks are life threatening or harmful to health. Prolonged energy blackouts may require evacuation if localised, while national scale events will force people onto their own resources. The National Grid Energy Supply Organisation (ESO) has published considerable guidance on power cuts.

Best case – most likely – worst case

Our best case would be that the UK squeezes through this tight period for energy supplies and that renewable sources and storage pick up to meet demand – and all assuming the geopolitical conflict subsides (i.e., peace for Ukraine). However, the impact/timing on energy costs and supplies are complex and unpredictable to forecast.

The most likely outcomes running up to 2030 is a continuation of a fragile situation with hikes in energy prices, increased fuel poverty, and blackouts and shortages do occuring unpredictably. Communities will adapt but hardships and distress will occur, some people facing the dilemma of 'heat or eat' in winter months.

The worst case would happen if the conflict between Russia and Ukraine spills over to other countries and/or persists with gas and oil supplies to Europe are severely disrupted, resulting in knock-on effect to the UK. This would create severe hardships in all the areas mentioned above. If adapting to this 'new normal' proves difficult then social unrest increases, and states of emergency are declared.

Options available to address risk

Whilst most of these options are fairly practical in nature, they can vary in terms of expertise and planning required, as well as level of costs involved. Recommendations on how to navigate some of these options can be found in the resources section.

- Retrofit and insulation of homes and workplaces
- Installation of alternative and renewable energy systems – worth noting that most gas and oil central heating requires electricity to function!
- Decentralised energy - setting up a community-based renewable energy system
- Safely store emergency supplies of fuel – caution on this [vi]
- Backup generators and uninterrupted power supply units
- For essential medical equipment - register with energy suppliers for priority assistance during any power outage or consider a battery backup
- Emergency good practice – set-up or identify local support (warm/cool banks) groups, keep emergency telephone numbers and torches nearby, spare battery and solar charging for mobiles, and check-in on elderly/vulnerable neighbours
- Working from home as much as possible – due to fuel shortages or rationing

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[vi] Fuel should never be stored in your home, or any living space, and away from combustible material

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Resources Available

Retrofitting Your Home

TrustMark is not-for-profit social enterprise which licenses and audits a range of businesses involved in building and improvements to domestic homes and gardens. TrustMark provides independent guidance on renovations that will improve energy efficiency in the home. They also help with finding local TrustMark Traders.

Guidance on Community Energy

The UK Government provides a guide aimed at local groups who are interested in setting up a community energy project (covering the scope of collective action to reduce, purchase, manage and generate energy). There are guides for instance on setting-up community buying groups, and financial support for urban communities across England seeking to set up a green energy project. Further information on this topic is available from the Centre for Sustainable Energy.

Guidance on Power Cuts

The Met Office provides a useful guidance on power cuts, providing useful contact points, taking precautions and assistance for older and disabled people. You can also search, track and report power cuts via the national grid website, which provides a useful visual map. The regulator energy regulator ofgem also provides guidance on securing assistance through the Priority Services Register. The UK's main utility companies offer useful advice and contact information on electrical emergencies, and gas emergencies.

Generating Renewable Electricity

The Energy Saving Trust is a profit for purpose organisation, which provides independent advice on energy savings and reduction of carbon emissions. Their guidance covers solar panels, wind turbines, hydroelectricity and micro combined heat and power. There is further guidance on storing and installing renewable energy and living off-grid and blogs offering practical advice.

UK Map of Community Energy Projects

Community Energy England is a membership body with over 300 community energy and stakeholder organisations, supporting its members to thrive and innovate through green energy. Their national map for the sector is based on data from Community Energy England membership and the annual State of the Sector reports but is not exhaustive, and provides locations by region, constituencies, local authority and energy operator boundaries – all using Google maps.

Risk 3: Water

Water is something we take for granted, yet is essential for life and for hygiene. Too much water or too little water can threaten life. At the global scale, diseases from dirty water kill more people every year than all forms of violence, including war. But even in the most advanced countries we can see occasions of persistently unsafe and unreliable drinking water and "*massive gaps in the access to safe drinking water are intolerable in any modern society*" – resident of Jackson, Mississippi, Sept 2022. Water-related hazards like floods, droughts, pollution, and related issues, are increasing in frequency and intensity almost everywhere around the globe due to population growth and effects of climate change.

Forecasts

The UK experienced a prolonged period of dry weather in 2022, which culminated in a severe summer heatwave and record-breaking temperatures. This posed challenges for water resources. The National Drought Group (convened by the Environment Agency) projections suggest average rainfall over winter will not be enough to prevent drought conditions in some areas next year. This pattern may repeat in years to come as there are trends towards warmer, drier weather, which could impact water security, particularly in the south-east. Yet, there is also a high likelihood of more extreme weather, meaning a greater risk of floods and droughts.

Water UK, which represents the water companies, suggest that in the timeframe of 2020-2050, we are twice as likely to have a year with water restrictions due to droughts when compared to 1997-2004. The chance of a serious drought between now and 2050 that results in water deficits and requires supply restrictions is between 1-in-7 and 1-in-4.

The UK population could grow by up to 10 million people over the next 20 to 30 years. Most are expected to live in the most water stressed areas, particularly the South-East of England.

Hazards associated with water risks

Water risks pose hazards in four aspects:

- Too much – flooding causes considerable damage and disruption
- Too little – drought stresses agriculture and drinking water supplies
- Contaminated drinking water – see also Risk 5 on pollution
- Failure of wastewater/sewage systems – consequent danger of diseases

The first two hazards are connected to Risk 1 - Extreme weather, and these are predicted to increase in regularity and severity over the rest of the century. Even in the timeframe up to 2030 we are likely to witness floods and droughts that break previous records. River, surface water and coastal flooding are covered in the National Risk Register.

The effects of flooding may lead to water contamination - biological and chemical - from industrial sites and from agriculture, storm water may overwhelm sewage systems. Knock on effects on biodiversity may also occur. Contamination from toxic algal blooms may affect drinking water supplies. Sewage system failures are likely to be part of cascading problems involving power supplies, transport, or information control system disruptions or malicious attacks. However, reliability of waste systems, under increasing volumes in urban areas, is of concern given the age of the network.

Best case – most likely – worst case

This best case would assume that water system management is robust and sufficient investment maintains a high quality of water storage, distribution, and quality management. Environmental management and land regeneration schemes for managed flooding are part of the mix towards a secure and safe water supply to all and these are geared toward managing emergencies due to flooding or drought.

The most likely case is that the rising number of extreme weather events stretch our water management systems and these sometimes fail. We have several flooding events that cause significant problems and periods of drought that do likewise. Water quality issues will arise, and we continue to operate in a reactive mode. Coastal flooding due to sea level rise is manageable in the short term.

The worst case for the immediate future is one of high probabilities of major flooding or drought and the water management systems are overwhelmed – causing cascade effects such as knocking out a power station, disrupting agriculture and food supplies, and threatening water borne diseases (incl. instances of Legionnaire disease).

Options available to address risk

The Environment Agency has set out a strategic steer to the water industry regarding their technical obligations for water management and <u>building resilience</u>.

Communities can play their part also following the potential options:

- Register to join an online community resilience hub (i.e., <u>Communities Prepared</u> who train flood wardens, and <u>Dry Project</u> for drought preparation)
- Consider emergency supplies of fresh water - see <u>Water Direct</u>
- Identify local at-risk areas that would benefit from sandbags and request these from your local authority
- Establish evacuation procedures – planned escape routes and safe shelter areas
- Decontamination processes – water purification, although drinking water in the UK normally is of high quality (see the <u>Drinking Water Inspectorate</u>) , in states of emergency we may need to ensure purity – there are many products available such as Life Systems
- Adopt good practices, such as local campaigns to reduce water usage and provide garden water butts etc. - see <u>Friends of the Earth</u>

Resources Available

Water performance dashboard

A dashboard provided by Water UK (a membership body for the water industry) provides the latest statistics and information through their one page dashboard. They also provide a range of resources for consumers including finding a supplier and an approved contractor. You can also learn more about their 2030 Routemap towards achieving a net zero carbon future.

Tips to save water at home

The Energy Saving Trust provides a number of useful tips to save water at home, which are related to energy use and environmental impact. These relate to good practice for water usage either through human activity or through appliances. More detailed research and information related to water planning and management in domestic and business contexts is available from the Water Wise database.

Citizen science and volunteer monitoring – for water quality

The Catchment Based Approach (CaBA) is a civil society-led initiative working with key water stakeholders to support the UK Government's 25 year environment plan, working across all 100+ river catchments. The CaBA provides guidance on citizen participation to help with the collection of UK river quality samples, which are vital for environmental monitoring.

Associated Programme on Flood Management Tool Series

The World Meteorological Organization and Global Water Partnership provide a programme on flood management, consolidating expertise and capacity building across the world to provide valuable lessons learned. The Toolkit provides guidance on a range of key themes, such as community participation, flood emergency planning, flood management for climate change mitigation, dealing with flash flooding, and flood proofing.

Risk 4: Food Supply Constraints

Our current myriad of globally interconnected supply chains appears not to be as resilient we expected. Recent events include significant failures of lower cost minimum inventory and just-in-time practices – affecting all sectors, but notably foodstuffs and quite publicly with gaps on supermarket shelves. According to the Office of National Statistics, between 20-31 Oct 2021, an average of 1 in 6 adults in Great Britain experienced shortages of essential food items. Whilst such events are relatively short-lived, current affairs and events related to other risks are driving up the costs of production and transport of food – thus affecting availability and price to end-consumers. Whilst official sources [8] state that the UK produces around 60% of its domestic food consumption, other sources argue up to 80% is imported [9] (which counts raw foods for processing), which would make the UK highly vulnerable.

Forecasts

The UK is a significant player in global food manufacturing. Issues affecting the global supply chain in terms of upstream supply of ingredients may provide an early warning barometer of immediate risks building up over the next 10 years. Issues affecting international supplies due to scarcity of water are likely to put pressure on domestic supplies as manufacturers seek to switch (at scale) to local reliable sources.

According to DEFRA the UK is self-sufficient in seed potatoes, rapeseed, barley and wheat, yet if food supplies are constrained in the near term, there are likely to be shortages of fruit, vegetables and poultry – much of which is imported. Animal diseases are cited in the National Risk Register as being quite likely (1-5 in 500), and in an October 2022 press release DEFRA confirmed a payment scheme to deal with an outbreak of bird flu.

The global food system is vulnerable to production shocks caused by extreme weather, and that this risk is growing. Global Food Security suggest that the risk of a 1-in-100 year production shock is likely to increase to 1-in-30 or more by 2040.

Hazards associated with food supply constraints

The UK arguably has the ability to be more self-sufficient, yet this is not easily reconfigurable in the short-term, which may result in a multitude of issues including:

- Sharp increase in food banks and individuals/families highly dependent on local authorities and charities
- International and/or domestic societal breakdown and conflict over access to food (contributor to Risk 7 – Social and Cultural Disorder)
- Deterioration in long-term human health and well-being (Risk 6), resulting in increases in disease and strains on emergency, hospital and social care services
- Draconian domestic policies, policing food choice and limits on consumption

Not all food is equal. Depletion of fresh water for agricultural use, soil health, rainfall and speed of transport all have a bearing on a food quality and quantity (thus dependent on other Risks 1, 2, 3, 5) – everything is connected.

Best case – most likely – worst case

The best case assumes local and global supply chains will adapt and recover in the weeks and months following shortages. Consumers switch to more available and lower cost products (albeit possibly lower quality) and more agile suppliers – the market plays out. Current efforts to stimulate increasing security of supply   pay off and deliver stability during the peaks and dips over the next 10 years.

The most likely case is an increasingly divided society, between those who can afford the higher food prices and those who cannot. The middle classes are likely to be squeezed harder if wages continue to stagnate, debt accumulates and inflation in combination with other issues affect the cost of living. The collapse of global biophysical systems and ecosystem services[10] is likely to have unforeseen increasing pressures on food production, which affect the UK indirectly over the next 10 years (price fluctuations, starvation prompting sudden migrations to Europe, further conflict over natural resources and societal assets). Systemic conflicts become more visible in the public media, between the demand for productive agricultural land and habitable spaces to accommodate human population growth.

The worst case is that the most serious scenarios associated with Risk 1 and 2, in combination with other factors such as labour shortages in food harvesting, processing, and transport create a multiplier effect on UK food security. This is not an unrealistic prospect given the systemic uncertainties we currently face. Also, political disputes between nations, and competition between neighbouring states for control of food resources (i.e., marine food from international waters) are more likely when food stocks run low.

During the pandemic, we observed nations prioritise stocks of medical supplies for their own use, enacting emergency laws – similarly, we can expect international law and multi-lateral agreements between nations to fail again and the rise of populist movements who promise greater food security through new nationalistic policies.

Options available to address risk

Unlike other risks, there is more that can be done here by local communities to improve food resilience and reduce dependency on complex supply chains, including:

- Supporting existing (or creating new) community supported agriculture partnerships and agricultural land trusts, to ensure local continuity of supply and affordable access to land for new tenant farmers
- Immediately switch consumption to sustainable locally produced organic products and support agricultural entrepreneurs and start-ups, particularly those involved in regenerative agriculture (higher quality and better for the environment) who are less dependent on external inputs (chemicals, etc.)
- Support institutions[11] and charities championing sustainable food security
- Switch to growth and consumption of more diverse native crop types that make us less dependent on higher-scale mass production techniques
- Changes to consumption habits and dietary changes, such as avoiding ultra-processed foods which rely on unsustainable production, poor utilisation of crops, and wasteful practices; and sourcing meat and dairy only from diverse agroecological systems but in substantively reduced volumes.
- Make use of allotments to grow food and nurture more plants for pollinators
- Lobby local councils and institutional decision-makers to plant more fruit trees[12] [13] where there is space to do so
- In the worst case, ensure individuals/communities have access to emergency supplies of long-life food stores and the means to prepare basic meals

Resources Available

Organic Research Centre – Popular Resources

The Organic Research Centre (ORC) is an independent research organisation for agroecological farming approaches such as organic and agroforestry, advancing a research agenda that supports local and community-based solutions. More details are available on their projects, research tools, and their resource library.

Food Safety for Community Cooking and Food Banks

The UK Food Standards Agency provides a useful guide covering food safety, ranging from hygiene, allergy and distribution.

Donate and/or Support Land Trusts with their Aims

There are various ways individuals and communities can help to protect and support land for agricultural use, including donating funds or land in trust, and involvement in specific farm projects/initiatives. The National Farmland Trust takes a broad approach and works with wildlife, whereas the Biodynamic Land Trust focuses more on organic and regenerative agriculture methods.

Access to Land - Resources

The Access to Land organisation is a European network of grassroots organisations also concerned with securing agricultural land (and related ecosystems) and addressing the socio-economic pressures facing food security. You can participate by supporting their work or publicising your own related work. You can find organisations using their map directory, and learn from case studies (includes UK) and reports.

Guidance and resources to support food security

The Global Food Security (GFS) programme works across UK Government departments providing thought-leadership and horizon scanning for emerging challenges, and facilitates new interdisciplinary research and systems approaches. GFS offers a range of helpful publications and reports to support learning across a range of issues, including climate, nutrition and health, and resilience. The UN also provides a useful checklist to reduce food loss and waste by changing social habits.

Risk 5: Pollution
Air, Water, Land and Oceans

The scope of Risk 5 covers pollution of the atmosphere, watercourses, land, and seas – these can be pervasive or 'point source' like a sudden, large release of noxious substances. Apart from greenhouse gas emissions that pose a long-term threat to the world the other types of air pollution of concern in the near term are: (I) industries – rule breaking and accidental releases; (II) vehicle emissions – concentrated in urban areas – causing lung diseases and breathing difficulties; (III) smoke from fires and burning waste; and (IV) use of pesticides affecting human health and wildlife.

Rivers and lakes are largely impacted by pollution from agriculture, vehicle emissions, industry, and products used in the homes every day. In our seas, we observe discarded fishing gear, pollutions (chemical, plastic, drugs, suntan lotion), and garbage dumping – some pollutants found in fish are being consumed by humans.

Runoff from soils can settle in waterways and create hazardous conditions for humans and wildlife. In 2022, we have had sewage discharges into rivers and seas brought to public attention, but some of the hidden issues come from plastics and nanoparticles from household waste entering the sewage systems. Significant and large failures may overwhelm water treatment plants and domestic drinking water may become unsafe.

Other forms of pollution such as light and noise can adversely affect our health and well-being.

Forecasts

According to the State of the Environment report on Soil, around 4 million hectares in England and Wales are at risk of compaction, over 300,000 hectares are contaminated, and microplastics widespread. Another related report estimated that the proportion of England's urban areas made up of green space declined from 63% in 2001 to 55% in 2018, which at this rate has negative consequences for air quality in the coming years. According to a Public Health England report, in 2016 alone, 5.3% of total mortality was attributable to particulate pollution (over 8% in some London boroughs).

There is correlation between greenhouse gas emissions and air pollution, if we continue to reduce burning fossil fuels the air pollution may lessen particularly in urban environments, however, there are many aggravating factors such as wildfires and industrial chemical gas releases.

Water quality presents a mixed picture. In many rivers downstream of urban centres quality has improved in sanitary terms but not with respect to emerging contaminants (pharmaceuticals, novel substances), while river quality in catchments with intensive agriculture is likely to remain worse now than before the 1960s. Water quality is still unacceptably poor in some water bodies.

All other types of pollution are likely to increase unless significant action is taken by regulators. At present rates, plastic production is expected to double by 2040 unless we change how we make and use plastics. The Ellen MacArthur Foundation suggest that by 2050 there will be more plastic in the oceans than fish by weight.

·Hazards associated with pollution

Current and aspirational lifestyle patterns are creating unsustainable levels of pollution and in-turn create negative health consequences, locally and elsewhere across the globe. The stress impacts from diffuse pollutions are not often apparent but they can slowly weaken human health and increase the vulnerability of the environment, affecting wildlife and crops – reaching tipping points.

Novel entities in the environment pose an unknown threat. We have created and released thousands of new chemical compounds that are not found naturally in nature. Those we recognise (DDT, asbestos as airborne fibres, ozone depleting compounds, etc.) are subject to international co-operation to eliminate threats.

Radiation release - although in normal times this is a low probability, there may be occasions when other risks (cyberattack, conflict, flooding ...) have a cascade effect. The jury is out with regards to increasing exposure to increasingly powerful radio frequency radiation [14] and linkages to cancer or other ill health effects, as well as disturbances to the natural environment.

Best case – most likely – worst case

Our best case is that pollution is high on the agenda and the regulatory frameworks improve. At the same time, we transform our industrial and agricultural systems to become circular in nature so that waste streams become inputs again, new technologies find ways to substitute dangerous materials and processes. Vehicle emissions reduce dramatically (switch to electric, hydrogen).

Agricultural practices improve eliminating pervasive leaching of fertilizers into water courses. The most like scenario running up to 2030 is some progress on pollution control but not as rapid as needed – serious failures could still occur.

The worst case would see a fallback in regulatory control, cost pressures on industry and agriculture leading to lower standards and failures to maintain equipment, poor progress on plastic waste reduction, increased reliance of fertilizers to improve food production. The extreme worst case might be a nuclear power station failure.

Options available to address risk

Much of what can be realistically delivered here would be mitigation against likely local impacts and reducing pollutants that end up elsewhere in the world.

- Maintaining well provisioned emergency tools (first aid kits and stations) and alternative supplies of safe water
- Working alongside emergency/resilience services to establish good practice, evacuation procedures and training in how to manage pollution hazards
- Education, training and research through local colleges and universities to increase their awareness of pervasive pollution risks and establish monitoring so that there is evidence to present to authorities or to take community action within guidelines from experts.
- Look at exemplars around the world and what we can learn (e.g., how Barcelona is transforming its polluted city and addressing social justice)
- Set-up or join a local Climate Action Network and help advocate change
- Following emergency planning good practice such as maintaining well provisioned emergency tools (first aid kits and stations) and alternative supplies of food and safe water
- Working alongside emergency/resilience services to follow or establish good practice, evacuation procedures and training in how to mitigate or how to manage pollution hazards

Resources Available

Global Burden of Disease Study and Datasets

The Institute for Health Metrics and Evaluation (IHME) at the University of Washington School of Medicine provides a comprehensive scientific evidence base on causes and risk factors affecting health globally. The dataset covers a profile of the UK, which includes top causes of mortality (total and under 5's) and disability (over time, by location) and related risk factors (includes pollution).

WHO Factsheet on Air Pollution

The World Health Organisation approved resolution A68.8 which focuses on supporting efforts to reduce air pollution levels. The Factsheet provides a useful simple summary of key statistics, current policies, key air-based pollutants, air quality guidelines, and actions being taken.

Citizen Science – Participate in Air Quality Mapping

University College London have developed a visual community maps tool. Individuals and groups can participate in existing projects or by adding comments, which includes providing air quality readings by location. This resource also offers a UK Climate and Community Action Map. These maps have around 8 years of data to date

Tools for visualising the measurement and monitoring of pollution

Human health is dependent on the sustainability of the natural world. The Air Pollution Information Systems (APIS) is a collaboration between the UK Centre for Ecology and Hydrology and a group of UK pollution and conservation agencies across England, Wales, Scotland and Northern Ireland. They have funded a visual map support tool for assessing the potential effects of air pollutants on habitats and species. Training videos provide the background of APIS, models and datasets, levels of pollution impact, and the basics of source attribution data.

The Department for Environment Food & Rural Affairs also provides a powerful visual map of the UK, focusing on largely anthropogenic derived pollutants (e.g., nitrogen dioxide, carbon monoxide, benzene, lead, etc.), which can be viewed by year and location.
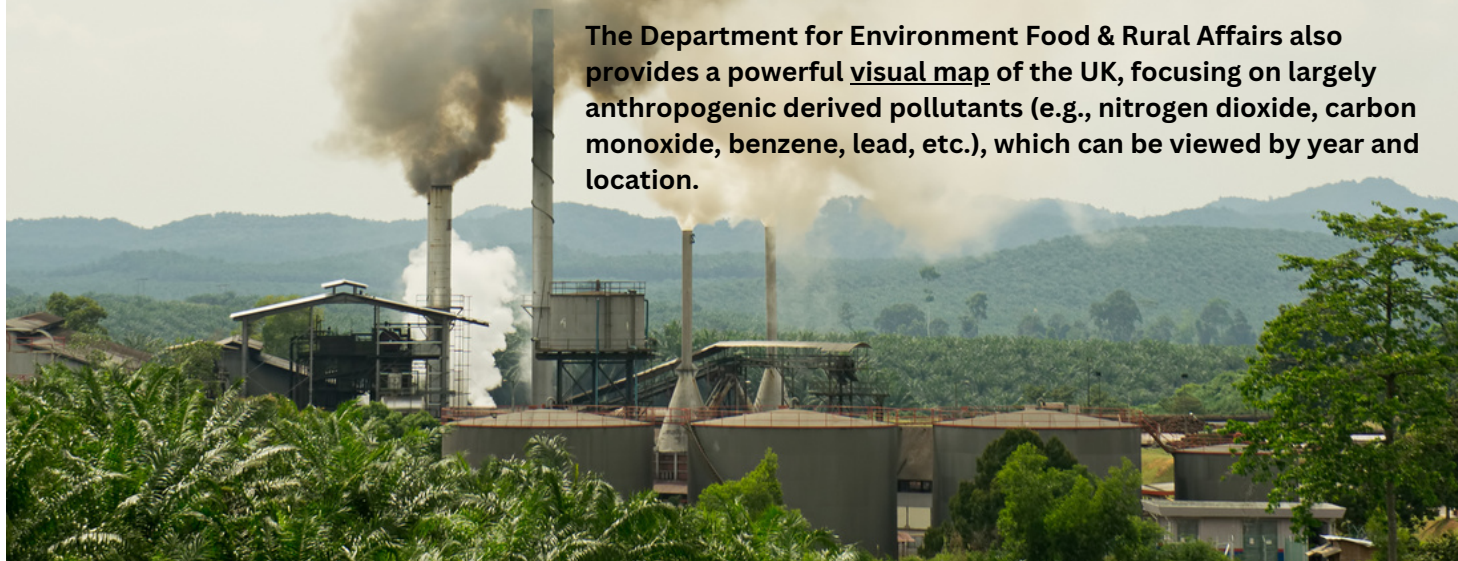
Risk 6: Health and Well-Being Impacts
Physical and Mental Diseases

As the UK grapples with the crisis of climate change and environmental degradation, there is growing concern about the impact of these crises on both the physical and mental health of its population. In the third UK Climate Change Risk Assessment [15] (CCRA3) report to Parliament published in January 2022, the UK Government has highlighted the risks to human health and wellbeing as one of its top priority risk areas that require the most urgent UK-wide action. A major issue identified was the increased exposure to heat in homes and other buildings. But as we will discuss below, the risks to physical health and mental health of people from our changing climate are more far-reaching and are already being felt here in the UK and on a global scale.

Forecasts

According to the Lancet Countdown report, in 2021 there were 1,600 excess deaths recorded during heatwave conditions in the UK, mainly in the over 65s category – and this is expected to rise considerably over time. Young children are less able than adults to regulate their temperature, thus medical experts argue they too will be affected.

Not surprisingly according to recent studies [16] [17], looking at the long-term impact of flooding in the UK, discovered psychological morbidity persisted years after the incidents. Extrapolated to wider perceived or actual environmental threats and hazards, we expect to see a rising trend in associated physical and mental disease.

Robust data and forecasts directly linking physical and mental health to specific climate and environmental risks affecting the UK are challenging to obtain [18]. Yet, according to perceptions in 2021, the Royal College of Psychiatrists reports that *"More than four-fifths (84%) of the UK public think the climate and ecological emergencies will affect mental health in a decade at least as much as unemployment (83%) and Covid 19 (84%)."*

Public Health England suggest that as the population ages, the number of people with chronic conditions is expected to increase. For example, the number of people with diabetes, is expected to increase from 3.9 million people to 4.9 million by 2035.

Hazards associated with health and well-being impacts

Increased demand and/or disruption to the health and social care delivery due to extreme weather (Risk 1) or other such risks, on hospitals and care settings, may have a detrimental effect on people's health and wellbeing. Concerns about the climate crisis are also exacerbating mental distress, particularly among the young and children including eco-anxiety and ecological grief [19]. In the context of an expected warmer climate in the UK, the following observations can be considered:

- Analyses of hospital admissions show that hot days are associated with an increase in heat-related illnesses including cardiovascular and respiratory complications, kidney stones, negative impacts on pregnant women and foetal health, including increasing the risk of preterm birth [20].
- Temperature changes in the body as a result of overheating may also affect blood flow and the central nervous system which can in turn lead to cognitive and emotional changes, impacting mental health and emotional wellbeing
- Hot summers have already affected transmission dynamics for vector borne disease, with the mosquito vector of dengue having been found in the UK for the first time. Due to an extended transmission season and increases in person-tick contact, Lyme disease cases may increase with climate change

Best case – most likely – worst case

The best case is that the negative impacts of climate change on health and well-being are offset by some of the positives, such as less severe winters – and healthcare systems are able to rebalance resources accordingly. New green investments and initiatives, along with nature-based solutions are widely adopted and provide substantive cost-effective benefits to human health and well-being.

Most likely, over the next 10 years, the UK will need to remain vigilant for pockets of negative impacts on health, particularly in places of high health inequality and poor health outcomes under normal conditions – where the ability to adapt is lower. As mental health issues become more severe and more widespread, it is likely that the capacity to provide support will be overwhelmed, potentially leading to economic and even social disruption.

In the worst case, under-funding of health and awareness, in combination with the near-term deregulation or lowering of environmental standards results in a multiplier effect, which is hard to quantify yet likely to result in much worse health consequences. Pressures on global health systems [21] as outlined by the World Health Organisation also have a knock-on impact for UK health provisioning in ways we cannot predict (likely to involve a combination of Risks in this report).

Options available to address risk

Human health and well-being are a one of the more complex areas to tackle, given the variables at play and importance of other indirect factors such as politics, culture and values, which have a bearing on where attention and interventions are directed. Amongst the range available, here are a few diverse options:

- Adopting heat adaptations for passive cooling which have been tested for buildings to reduce overheating risks such as improved ventilation; external shading and shutters, internal blinds or curtains.
- Implementing guidance for enhancing green space and urban cooling measures, including examples of nature-based solutions, has the potential to reduce urban heat islands and moderate outdoor temperatures
- Learn and participate in vector monitoring and disease surveillance, which are important strategies for addressing the risk from vector-borne diseases (see relevant Resource links below)
- Much wider availability of simple methods to live with eco-anxiety and other stresses, for example Deep Adaptation, Community Resilience Model, Transformational Resilience.
- Increase the capacity to provide mental health support through selective recruitment and training of volunteers through non-profit (mental health, health and social care) organisations, as well as resources to be used on a self-help or support group basis.
- Give young people hope, follow health guidance and make them aware of all the good work that is taking place to address the challenges, and also future career pathways in ecology, environment and other related vocations to make them feel more empowered.
- Adopting heat adaptations for passive cooling which have been tested for buildings to reduce overheating risks such as improved ventilation; external shading and shutters, internal blinds or curtains.
- Implementing guidance for enhancing green space and urban cooling measures, including examples of nature-based solutions, has the potential to reduce urban heat islands and moderate outdoor temperatures
- Learn and participate in vector monitoring and disease surveillance, which are important strategies for addressing the risk from vector-borne diseases (see relevant Resource links below)

Resources Available

NHS Forest – Green Space for Health

The UK National Health Service (NHS) has created a network of over 330 healthcare sites consisting of occupational therapy gardens, staff allotments, productive orchards and wide range of other nature-based environments to encourage. There are a number of ways to get involved in planning, sponsoring, implementation or through projects.

European Centre for Disease Prevention and Control (ECDPC)

The ECDPC is an agency of the European Union (EU), This agency provides surveillance and disease data for disease vectors, including maps for mosquitos, ticks, phlebotomine, and midges. There are also guidelines to support the surveillance of invasive mosquito species.

Zoonotic diseases: surveillance of laboratory confirmed cases

Similar to the ECDPC, the UK Government has a surveillance system for the identification of laboratory confirmed human infection cases, for thousands of species, subspecies and subtypes of microbial pathogens. Guidance on surveillance is provided. The UK Health Security Agency also provides a range of updates, current and historic.

WHO Quantitative risk assessment on selected causes of death

In 2014, the World Health Organization provided a dedicated analysis of the effects of climate change on selected causes of death with a predicted horizon of the 2030s and 2050s. The report covers heat, coastal flood and others global risks, and also provides future scenarios – utilising quantitative data.

Risk 7: Social and Cultural Disorder

Climate change and environmental challenges are creating complex risks for societies, in terms of its resilience on one hand, and on the other hand how it mitigates and adapts to those risks. Much has been said in recent years about ensuring a "fair way, leaving no one behind", what is referred to as a "just transition", not only at a global level but at the fabric of our society and its cultural diversity.

Changes in the frequency and intensity of climate impacts both at home and abroad may lead to disruption to our food supply, hence creating panic buying and social disruption. Events abroad such as the 2010 heatwave in Russia resulted in a ban on wheat exports, which had a cascading effect on poverty and political unrest in countries such as Egypt, Tunisia and Mozambique (one of many factors contributing to the Arab Spring). Multiple crop supply failures across Europe could post systematic risks, bringing down entire systems and long-held cultural norms in the UK that have held society together.

In addition, extreme rises in energy costs, high inflation, the leadership turmoil of late 2022 and other factors mean that there is a very high level of stress and uncertainty in the UK, which may lead to serious social and cultural disorder in the near future.

Forecasts

The National Risk Register includes widespread public disorder as having 5-25 in 500 likelihoods of occurring, causing medium grade Level C impact. Linked to this risk are other potential triggers such as undermining the democratic process (5-25 in 500), and systemic financial crisis (1-5 in 500), which has a higher likelihood of occurring.

The EU Institute for Security Studies predicts that "…the cyber sphere is likely to become an arena of conflict and tension between states of all political stripes…", aiming to destabilise and subvert civil society from within (scapegoating, extremism, etc.).

The European Centre for Populism helpfully illustrates the global phenomenon of extreme political agendas with their visual populism map, which is leading to democratic decay and increasing authoritarianism. Over the next decade, as leaders and governments seek to prevent mass violence using their defence and security apparatus, they may also invertedly exacerbate tensions by excessive securitisation and use of force, further fuelling division, crisis and violence.

Hazards associated with social and cultural disorder

Although it is difficult to establish a direct causal relationship between climate change and migration, associated hazards may exacerbate societal tensions[22]. For the UK, sudden migrant inflows to a community may lead to resource pressures on housing and services causing heightened cultural tensions and threatening social cohesion.

- As the UK transitions to a net-zero economy, mitigation and adaption policies are likely to impact society disproportionately [23] (e.g., job losses in the legacy economy, communities left behind, higher demand on social security).
- Behavioural changes required to meet the net-zero targets might also be met with resistance - some of the mitigation policies might be too costly (e.g., penalising those who can't transition to EV's - social injustice).
- Despair and mistrust lead to shifts in political power towards anti-environmental ideological positions, arguing for improved growth, better economic conditions, and job security – resulting in a cascading effect in other risks (i.e., Risk 5 – Pollution) and tensions with environmental advocates (demonstrations, arrests, disruption).
- Ongoing generally high levels of mistrust and uncertainty lead to an increase in prejudice, scapegoating and extremism, and the exploitation by hard right and hard left activist and political groups.
- Mistrust among government, society, and legal entities, resulting in national security emergencies and long-lasting divisions, are hard to recover from.
- Internal and external third-party actors leverage the breakdown of society and culture to pursue their own political interests (extremism, fascism, profiteering).

Best case – most likely – worst case

The best case is that things continue as they are and do not deteriorate any further in the short-term, despite the political and economic turmoil associated with climate and environmental challenges as well as business-as-usual.

The most likely situation is that the political structures and situation over the next 10 years will elicit few opportunities to steer society and culture in any substantive [high-level] alternative pathway(s). Any major improvements will likely derive from local breakthroughs in grassroots movements and citizen engagement in political change and in practical adaptation at community level.

Worst case, over the next 10 years, the real possibility of a combination of events may occur simultaneously, these include the largest-scale human displacement from the Middle East and/or Sub-Saharan Africa towards Europe and the UK, and a major shift towards strict border enforcement and geopolitical shifts towards hard nationalist policies. These would create the conditions for serious division and societal conflict (exploitation, riots, persecution, discrimination, new draconian laws).

Options available to address risk

In the face of current challenges, steps can be taken to strengthen community ties and co-create a common vision amongst diverse individuals and groups. These include:

- Form new or support existing Citizen Assemblies to debate complex issues.
- Identify funding sources to support your ideas for community resilience.
- Learn from experts and cases of how others have built community resilience.
- Supporting community and social housing, alleviating pressure on the system.
- Lobbying educational institutes to support skills development for green jobs.

Resources available

Citizen participation toolkit for climate resilience

Researchers at Utrecht University have developed a comprehensive toolkit on citizen participation for climate resilience, based on lessons learned from several international research programmes, in the form of practical exercises and advice on how to apply them. It is designed for municipalities and governments, NGOs and community leaders/organizers, and third parties (e.g., consultants), who want to engage citizens in preparation and action phases of resilience planning.

Community-oriented business support resources

Power to change provides a range of resources to support the creation and sustainment of community businesses. This includes cases on how community businesses dedicated to climate action and supporting people experiencing marginalisation.

The Prince's Responsible Business Network provides a range of useful toolkits, covering for instance, Climate Action Routemaps, Race Equality, age equality, integrating climate into supply chains, and how harness nature for employee wellbeing.

Plunkett Foundation Resources

The Plunkett Foundation is a national charity that supports rural communities to address challenges through community business. They have helped over 600 such organisations to reach trading stage, providing mostly free practical advice, support and training – and in some cases small grants. They offer a useful visual map providing the location of community businesses across the entire UK.

Involve - Community Cohesion and Participation, A Practical Framework

Since 2003, Involve have been working with governments, parliaments, civil society, academics and the public to create and deliver new forms of public participation that re-vitalise democracy.

London Government Association – Community Cohesion – An Action Guide

A useful guide on community cohesion was produced in partnership between the Local Government Association, Audit Commission, Commission for Racial Equality, Home Office, Improvement and Development Agency, The Inter Faith Network and the Office of the Deputy Prime Minister. Whilst aimed at local authorities, the definitions, concepts and methods are helpful to individuals and community groups lobbying the public sector for change and adoption of best practices.

Seeding our Future: How can we raise our resilience?

Seeding our Future (SOF) is a non-profit initiative, which started in 2017 and works to support individuals and communities to pioneer and catalyse societal resilience. Based on the results of a project delivered by Reos Partners, this short blog provides an overview of nine key insights to improve community resilience.

Risk 8: Information Systems Failure

Much of current planning around information system failure is focussed on temporary problems (cybersecurity, malfunction, costs of repair/maintenance) and the ability to cope with incremental changes and upgrades in technology. These are expected to be easily managed in the short-term, yet they suggest a blind spot in current thinking. The increasing trend towards holding substantive data in the cloud has shifted responsibility to data centres and global service providers. Should we really depend on this model – where no one knows who has control?

We are also witnessing a proliferation of digital, smart interconnected devices that provide easy access to money, homes and appliances, transport, energy, work, as well as family and friends. Our domestic policing, security and defence services all rely on information systems of increasing complexity and sophistication to keep up with new threats and breakthroughs in technology (i.e., quantum computing, artificial intelligence).

Extreme weather events can wipe out communication lines or damage physical infrastructure responsible for the control and monitoring of essential utilities and services, which could have a devastating effect on water, energy, and food supplies.
Space weather events, such as solar flares, are low risk but high impact possibilities posing significant risks to electrical power supplies and disruption to satellite communications. The UK Met Office provide a forecasting service for space weather.

Forecast

According to the National Cyber Security Centre Annual Review 2021, the UK is working closely with global partners to detect and disrupt shared threats, primarily emanating from Russia and China. The report states that organised crime gangs from Russia have been launching ransomware attacks against Western targets and Chinese attacks have a proven interest in the UK's commercial secrets. Furthermore, *"how China evolves in the next decade will probably be the single biggest driver of the UK's future cyber security"*, which suggests major uncertainties over the next few years.

As the Bank of England considers its role in future digital currencies, a recent article [24] that has surveyed 65 executives responsible for risk management or treasury functions, citing cyberattacks as the top risk factor for the financial sector in October 2022. Furthermore, 72% of respondents believe that in the next three years, the likelihood of a high impact cyberattack is high, an increase of 26% on last year's perception.

Where environmental risks in this report materialise as being extreme, there will be a higher risk to disruption of power, with knock-on effects to digital-dependent devices. Similarly, risks to essential services also come from the *best of intentions* from within, with repeated experiments and major failures [25] in government-driven digital transformation programmes, disrupting the proper functioning of the police, the NHS and other essential services.

Hazards associated with information systems failure

There several assumptions associated with threats and vulnerabilities that were rarely questioned but now seem most reasonable to revisit. These include:

- Loss of emergency services due to temporary or ongoing disruption to communication and information systems technologies, including those that increasingly rely on Geographical Information Systems (GIS) – digital maps.
- Green technologies run the risk of overreliance on information technology, making them expensive, unreliable, and potentially inoperable in the long-term.
- Direct or indirect climate related impacts on equipment that rely on information systems could impact on businesses (job security) and essential services, resulting in disruptions to our way of life or worse.
- Loss of electronic communications, even to a small degree has substantive financial costs and may result in social disorder (Risk 7).
- External attacks on our information systems can result in loss of national security, or manipulation by actors working against peace and stability.

Best case – most likely – worst case

The best case is that the UK can leverage its science and technology R&D, and international cybersecurity partnerships to keep ahead of the potential disaster curve and mitigate accordingly. A major incident does occur over the next few years, which delivers serious damage to digital assets and infrastructure but the UK recovers within weeks or months and changes strategy to invest in more resilient systems.

Most likely, the UK and at least one close ally that it shares digital capabilities with, will face more than one major incident over the next 10 years, resulting in the loss of strategic infrastructure. Essential services may be targeted, such as major power network failure, loss of banking or National Health Service (NHS) systems failure.

Worst case, we encounter a 'black swan' or unthinkable yet realistic event such as the destruction of transoceanic fibre-optic cables and/or space systems, which are cited by the defence community horizon scanning as possible future threats. This is likely to originate from an escalation of global conflict (i.e., Russia or China) or competition for increasingly scarce natural resources and precious metals.

Options available to address risk

Like some of the other risks, information systems failure is complex and challenging for communities and individuals to take meaningful mitigation actions against. In the coming years, we will need to think about the case against the inevitability of so-called digital transformation on all aspects of human life. Some options to consider include:

- Avoiding digital interfaces and network-controlled devices and equipment that do not have manual override functionality or easy repairability [26].
- Maintain duplicate hand-written or printed backups of important information.
- Set-up, invest-in or subscribe to local community energy resilience initiatives, or appropriate retrofit/renewable energy modifications to your home/business.
- Maintaining analogue phone systems for emergencies and other non-digital or traditional methods for ensuring emergency lighting, heat and cooking.
- Join or form a local makerspace lab, or other such open workshop network, creating greater local resilience to manufacture, repair, reuse and recycle.
- Lobby and support local training and education providers to provide curricula aimed at resilient [intermediate] appropriate [low] technology engineering skills.
- Support and lobby local politicians and legal bodies to contest policies and strategies that have not fully considered the range of risks associated with digital transformation on essential services over the next 10 years

Resources available

Low Technology Solutions Guide

Low-tech Magazine presents past and often forgotten technologies and how they can inform sustainable energy practices, with the aim of addressing the ongoing dependence on technological progress. They offer a range of "how to" guides for <u>low tech solutions</u>, covering renewable energy, domestic heating and repurposing materials. They offer a <u>full list</u> of useful articles over time.

Low Tech Lab

The Low Tech Lab offers a range of useful tutorials ranging from how to set up a low-tech lab, to building household devices that are not dependent on sophisticated information systems. The site is in French and the link provided offers a translation. Further reading is recommended on this topic – <u>The Age of Low Tech</u>: Towards a Technologically Sustainable Civilisation by Philippe Bihouix.

Centre for Alternative Technology (CAT)

The CAT is based in Powys, Wales and is a provider of <u>educational courses and degrees</u> in sustainability. CAT offer a free service providing <u>independent advice</u> on a wide array of topics relating to sustainability covering for instance: renewable energy, green building and renovation, water and sewage treatment, and organic growing.

List of open-source hardware projects

Shifting towards 'open source' in computer-based systems means ensuring the original software source code or hardware design is made freely available and may be redistributed and modified. Through shared ownership, know-how, problem solving and ongoing upgrades become available to all with minimal barriers. Wikipedia provides a useful list of open-source <u>projects</u> and <u>hardware</u>.

NCSC – <u>Report a cyber incident</u>

The UK National Cyber Security Centre (NCSC) provides the facility to report a cyber incident, where it affects organisational data, computer firmware, software or hardware, and any personal data of the UK, Channel Islands or Isle of Man.

NCSC – <u>Small charity guide</u>

The NCSC also offer guidance to small charities on how to improve cyber security, quickly, easily and at low cost. A <u>report</u> on the current threat to the UK charity sector was launched in Jan 2023. A number of <u>resources</u> is also provided online, covering training, infographics and the cyber essential readiness tool.

Conclusion
What's Next?

In this brief review of risks that the UK faces in the next few years we chose eight to look at: extreme weather, energy system failure, water supply constraints, food supply constraints, pollution – air, water, land, and oceans, health, and well-being impacts - physical and mental diseases, social and cultural disorder, and information system failures. And for each of these, we have briefly explored potential best-case, most likely, and worst-case scenarios, informed by evidence and our own expertise.

We could easily have continued with other emerging risks, such as economic insecurity, rising inequalities, biodiversity loss, or migration in the age of climate change. The National Risk Register catalogues ten times the number we have considered.

All these risks are interconnected and the way that our society addresses them will either tend towards the best case for all or the worst case for all. That is, we accept the need to increase our resilience to shocks and stresses and we adapt across the board, or we put our heads in the sand and continue down the 'highway to climate hell' as António Guterres the UN secretary general has warned at COP 27 – "the fight for a liveable planet will be won or lost in this decade".

Assessing the chances of these risk materialising is not easy, the authors are all many times bitten, many times shy of forecasting. However, there are some discernible trends and patterns that are most likely to continue for the next few years – population growth, increases in greenhouse gas levels in the atmosphere, water stress, pollutions, health and social care demands, the energy transition to renewables.

The options to adapt that we have presented are illustrative and each individual and community will have local conditions and opportunities to add to these. Although individuals and communities can do their bit, all these risks require systemic changes in governance, which is a big ask, and can never be achieved unless we appreciate the need for political change. However, we are not alone – we have provided pointers to a growing reservoir of useful links, networks, and resources.

Risk likelihood/severity table

(roughly derived from the National Risk Register, 2021)

	Risk	Likelihood	Severity
1	**Extreme weather**	**1 in 5**	**Level C - £100m - £1bn damages, evacuations and major disruptions to localised electricity supply**
2	**Energy system failure**	**1 in 20**	**Level D - black outs affecting > 1m people, essential services affected**
3	**Water supply constraints**	**1 in 100**	**Level C - £100m - £1bn damages, contaminations, affects lasting > 1 year**
4	**Food supply constraints (not covered explicitly)**	**1 in 5**	**Level B/C – economic impacts, health and care affected, social disorder**
5	**Pollution – air, water, land, and oceans**	**1 in 20**	**Level C - £100m - £1bn damages, contaminations, affect lasting > 1 year**
6	**Health and well-being impacts – physical and mental diseases**	**1 in 20**	**Level C and E – perhaps millions of people affected, essential services disrupted**
7	**Social and cultural disorder**	**1 in 20**	**Level C – hundreds of thousands affected, loss of incomes, essential services disrupted**
8	**Information system failures**	**1 in 5**	**Level A and B – up to £100m impacts, essential services / electricity disruptions**

Likelihood: the reasonable worst-case scenario of the risk occurring **in the next year**.
Severity levels A to E: A is limited local impact through to E extreme, widespread and prolonged impact.

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