

PUBLIC HEALTH ANNUAL REPORT

2024

**HEALTH,
SUSTAINABILITY
AND CLIMATE
RESILIENCE**

FORWARD



**Helen Atkinson,
Director of Public
Health**

Climate change stands out as one of the most significant threats to our population locally and globally, and will continue to grow in importance in years to come. Addressing climate change's health and wellbeing impacts is crucial for protecting public health now and in the future.

This year's annual report takes the theme of health, sustainability and climate resilience, focusing on four areas in particular – extreme heat, flooding, air pollution and insect transmitters of disease (vectors). It examines the current and projected data on the likely impacts for our population in these areas.

We are already seeing the impact of extreme heat and flooding on our residents. Case studies throughout the report explore residents' experiences of climate

change, and what measures are being put in place to improve climate resilience and adaptation.

Importantly, the actions we need to take to reduce climate change and improve our resilience to it, also produce a range of co-benefits for the health of our residents in Portsmouth, and the local environment. They benefit improvements in health, society and the economy and ecosystems. This approach is both nationally and internationally recognised, leading to the first declaration on climate and health at the United Nations Climate Change Conference in 2023 (COP 28).

This report celebrates the great work already underway in Portsmouth, and highlights that we urgently need to do more by making recommendations for all of us. This work cannot be done in isolation, we all have an important role to play. It encourages individuals to make positive behaviour changes and partners across the system to prioritise actions that will deliver. We must act now for the benefit of the health and wellbeing of Portsmouth.

ACKNOWLEDGEMENTS

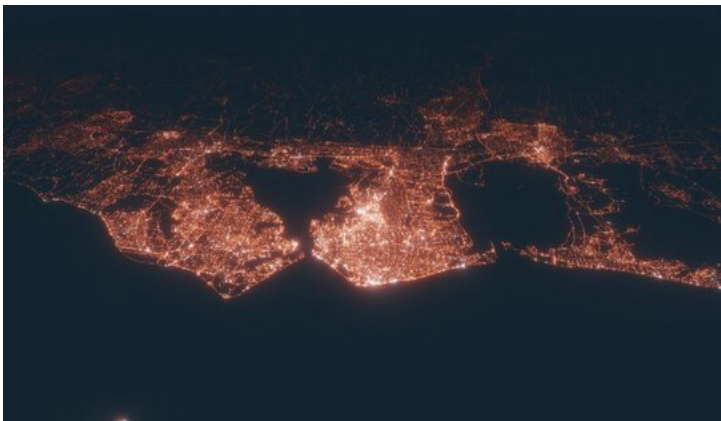
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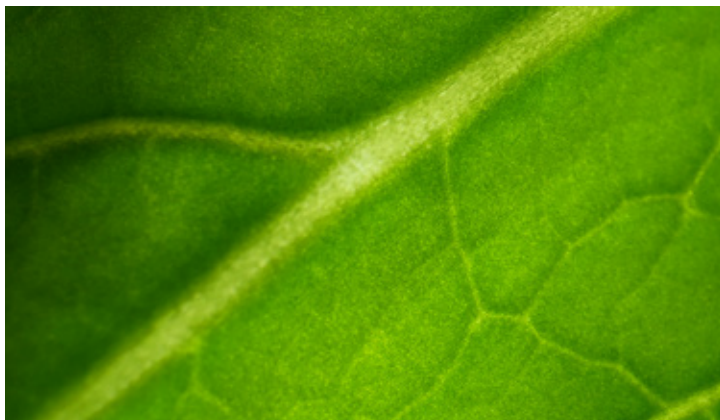
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CHAPTER 1: **WHY HEALTH, SUSTAINABILITY AND CLIMATE RESILIENCE?**

The environment has long been understood to have a big impact on our mental and physical health.



The World Health Organization has estimated that around a quarter (25%) of deaths worldwide are attributable to environmental factors.

The climate emergency is one of the most significant threats to our residents locally and globally.

Current climate change is primarily caused by human emissions of greenhouse gases. This warming can drive large changes in sea level, sea ice and glacier balances, rainfall patterns, and extreme temperatures. This has potentially devastating impacts on human health as well as farming systems, the stability of societies, and other species. To limit and stop climate change, we need to greatly reduce global emissions of greenhouse gases, and make massive shifts in our energy use towards renewable sources and our food systems away from energy intensive farming.¹

The COP28 UAE Declaration On Climate And Health² committed signatories to working towards

transformation of health systems to be climate-resilient, low-carbon, sustainable and equitable, and to better prepare communities and the most vulnerable populations for the impacts of climate change.

Climate change is already adversely affecting human health all over the world through:

- **direct impacts** – including health impacts of rising temperatures and extreme weather events
- **indirect impacts via ecosystems** – such as impacts on global food supplies and changes in vector-borne disease transmission
- **indirect impacts via socioeconomic systems** – including increased poverty, migration and intensification of existing inequalities, through loss of livelihoods (for example due to crop failure) and reductions in habitable land (eg due to flooding or extreme temperatures).

The UKHSA Health Effects of Climate Change report, published in 2023,³ outlined the growing evidence on the health threats posed by climate change. Based on that evidence it highlighted several key areas of public health concern for UK: heatwaves, increased risk of infectious vector-borne diseases, flooding and food security.

In Portsmouth, it is estimated⁴ that around 17% of ischaemic heart disease and stroke deaths and 28% of deaths due to Chronic Obstructive Pulmonary Disorder and lower respiratory infections can be attributed to environmental and occupational risks.⁵

Addressing climate change's health impacts is crucial for protecting public health now and in the future. This year's Director of Public Health report takes the theme of health, sustainability and climate resilience and the positive co-benefits of climate action for the health of our residents in Portsmouth.

This report looks at the health impacts of four key areas of the climate emergency for Portsmouth:

 **Extreme heat**

 **Flooding**

 **Air pollution**

 **Insect-borne disease**

It examines the current and projected data on the likely impacts for our population in these areas. It also explores case studies on each theme and the way climate change is already influencing lives in Portsmouth, and ways we are supporting climate adaptation.

There are some important topics that it wasn't possible to cover in this short report but will undoubtedly impact on health and inequality in years to come—for example food security and water quality in the UK and global droughts and famine leading to increased migration.

SYNERGIES AND CO-BENEFITS

The importance of our living environment to our health is well documented, with recent UK increases in health inequalities being linked to worsening social and economic conditions.⁶

Exposure early in life to environmental factors such as cigarette smoke or dietary stress can even influence our gene controls and predisposition to disease.⁷ Emerging evidence suggests that pre-natal climate change stress in pregnant women (for example from extreme heat, storms, flood risk and so on), is related to adverse birth outcomes, increased risk of disease later in life and negative mental health outcomes for unborn children.

Environmental factors, such as air pollution, which itself interacts with climate change, can worsen disease interactions and amplify their impact. For example, air pollution has been shown to increase susceptibility to respiratory infections, including COVID-19.⁸

The way that the climate crisis interacts with, and exacerbates, other environmental and socio-economic challenges such as inequality, existing chronic diseases and animal and ecosystem health has been described by some as a 'syndemic' or 'synergistic epidemic'.

Correspondingly, however, this inter-relatedness also means that **actions to reduce and improve resilience to climate change, also produce a wide range of co-benefits, for human and planetary health.**

'No-regrets', and 'win-win-win' approaches to policy and intervention are precautionary measures with either no or limited hard trade-offs, or contribute to climate adaptation whilst producing other benefits for health, socioeconomic policy and ecosystems.

Forming a golden thread throughout our report, three key themes support a no-regrets approach to realising those co-benefits:

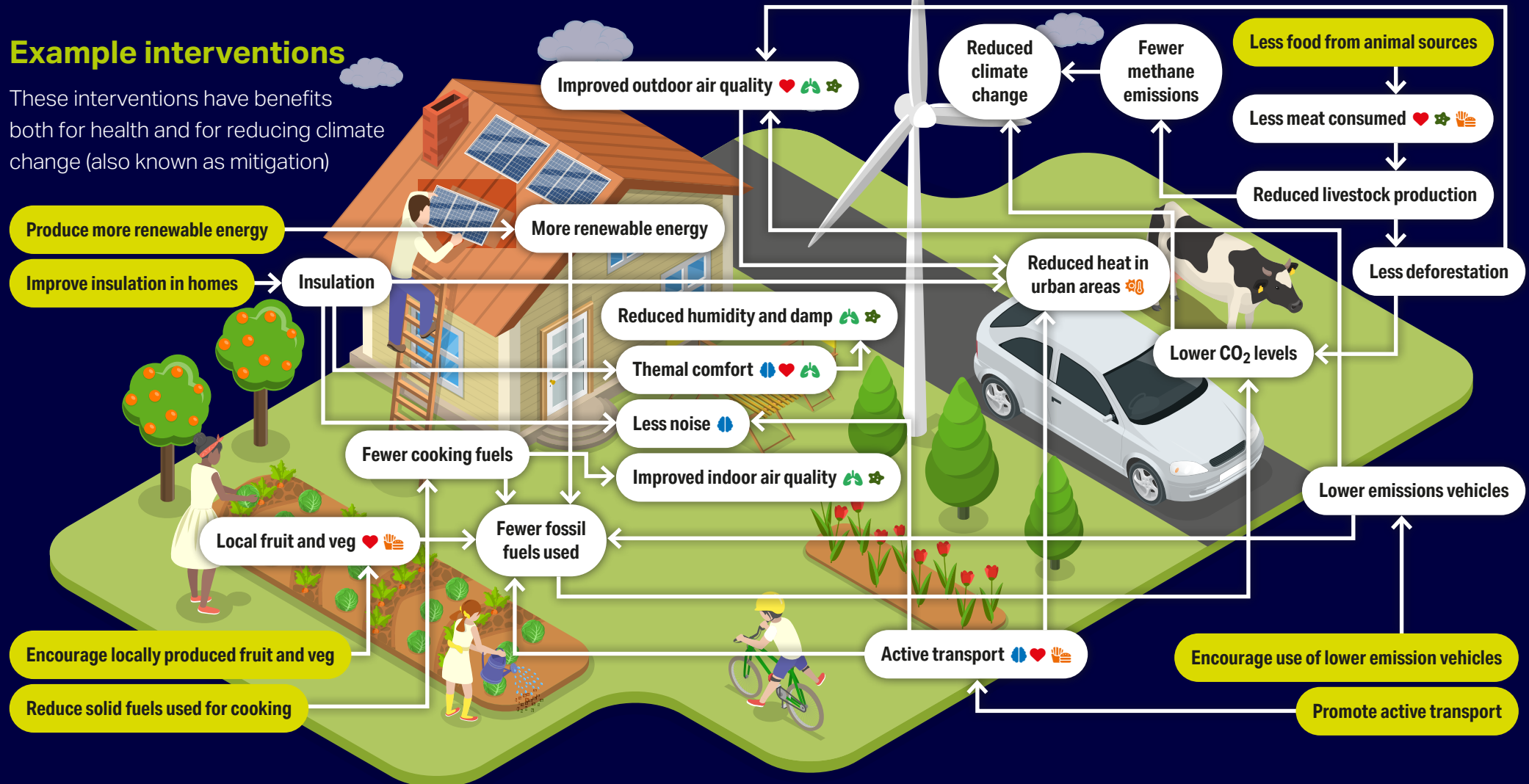
1. addressing inequality
2. One Health
3. nature-based solutions.

Figure 1: Health and Climate: co-benefits

Source: <https://sandpit.bmj.com/graphics/2016/cobenefits-v40.png>

Example interventions

These interventions have benefits both for health and for reducing climate change (also known as mitigation)



Health benefits

- Better mental health
- Fewer deaths from extreme heat
- Less cardiovascular disease
- Less respiratory disease
- Lower rates of cancer
- Lower rates of obesity

Reduced climate change

- Indirect benefits: Reducing climate change also leads to further benefits downstream
- Fewer deaths and injuries from extreme weather events
- Less skin cancer from UV radiation
- Reduced spread of vector-borne diseases to new areas

ADDRESSING INEQUALITY

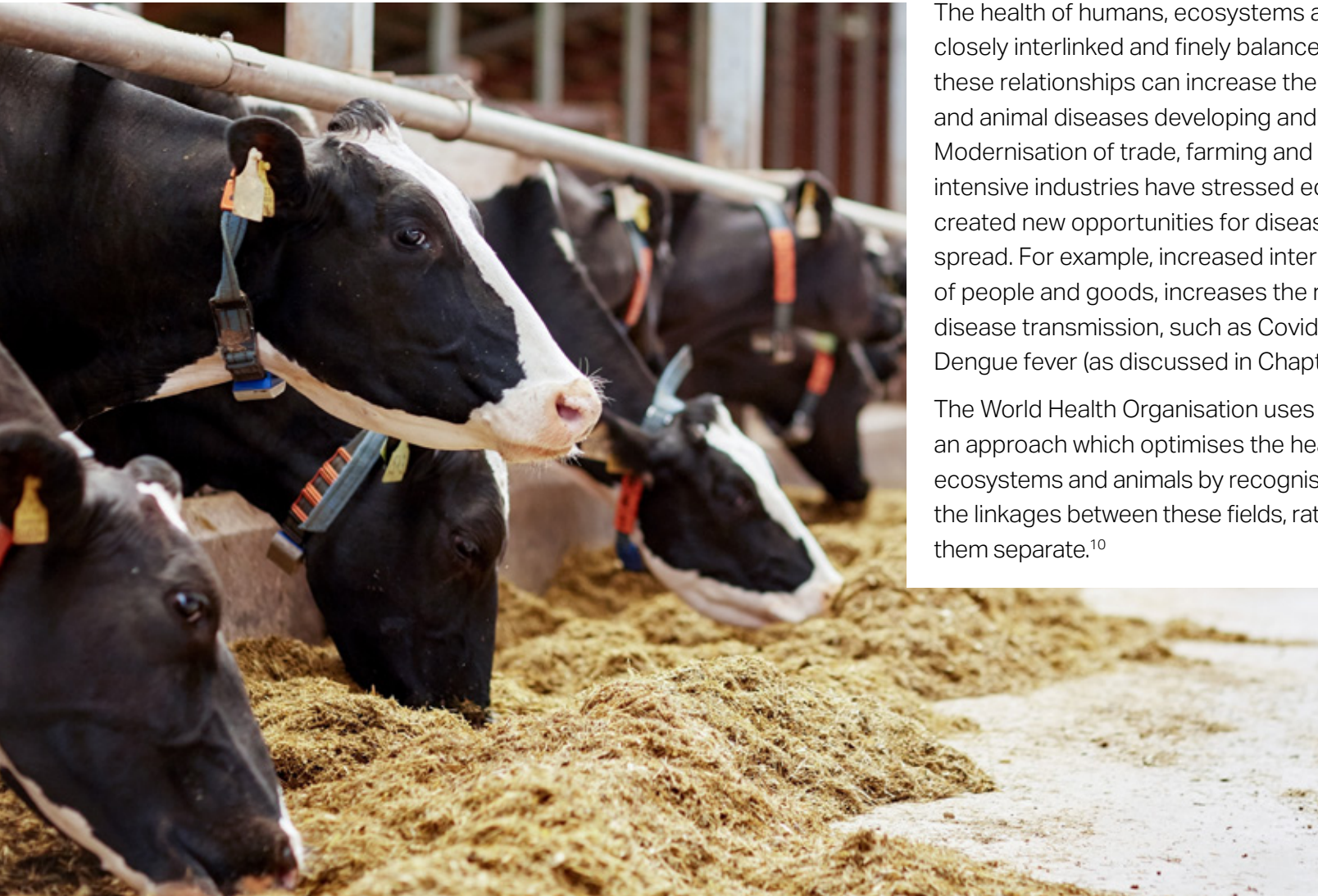
Vulnerable residents, including those with pre-existing conditions, the elderly, the very young and disadvantaged communities, are worst affected by climate change. An increasingly changing climate will exacerbate inequalities, deprivation and therefore magnify health impacts.

Differential health impacts can also be caused by the impact of climate change and climate change solutions on the wider determinants of health, such as housing and livelihoods. In combination, these differential health impacts between resident groups can lead to new and widening health inequities.⁹

This report emphasises the need to prioritise those most vulnerable and disadvantaged as we consider resilience to climate change to avoid widening health inequalities.



ONE HEALTH



The health of humans, ecosystems and animals are closely interlinked and finely balanced. Changes in these relationships can increase the risk of new human and animal diseases developing and spreading. Modernisation of trade, farming and other fossil fuel intensive industries have stressed ecosystems and created new opportunities for diseases to emerge and spread. For example, increased international movement of people and goods, increases the risk of infectious disease transmission, such as Covid-19, Avian Flu and Dengue fever (as discussed in Chapter 5).

The World Health Organisation uses 'One Health' as an approach which optimises the health of humans, ecosystems and animals by recognising and addressing the linkages between these fields, rather than keeping them separate.¹⁰

NATURE-BASED SOLUTIONS

Taking a One Health approach, this report places nature-based solutions at the forefront of our local response to the health challenges posed by climate change

Nature-based solutions **protect or enhance nature in a way that helps tackle climate change and other challenges, while benefitting biodiversity and improving human wellbeing**,¹¹ and can include tree planting, green screens to trap air pollution and Sustainable Drainage Systems (SuDS) that include rain gardens and bio-swales.

Nature based solutions in urban areas have great potential for climate adaptation and mitigation, complementing structural and material climate adaptation measures, such as insulation and ventilation. They also bring substantial co-benefits such as the enhancement of place attractiveness, of health and quality of life, and creation of green jobs. Evidence also shows that designing cities and buildings which reflect characteristics of nature (so called 'biophilic design') has calculable direct and indirect benefits. Features such as increased green infrastructure, views of nature and natural light have been shown to improve economic, health, community, education and healthcare outcomes.¹²



HOPE IN ACTION

While we make every effort to continue to decarbonise, we must also begin to adapt. Climate change is here. The year of 2023 was the warmest on record,¹³ and recent measurements of global sea temperatures also indicate warming oceans.¹⁴

The UKHSA Health Effects of Climate Change report¹⁵ emphasises that many risks to health are preventable through adaptation at low levels of climate warming. Ensuring we adapt our built environment to minimise heat, pollution, vector transmission and other climate impacts, will protect us all and particularly the most vulnerable in our communities.

Taking an integrated approach like One Health also means aligning and maximising the co-benefits of climate action. Substantial health benefits can be made if health goals are aligned with the decarbonisation agenda. If health considerations are embedded in decarbonisation strategies (such as through prioritisation and planning), there is the potential to generate a range of health benefits, particularly through air quality, food, housing, transport, green space, vector control, improved mental and physical health and reducing health inequalities.

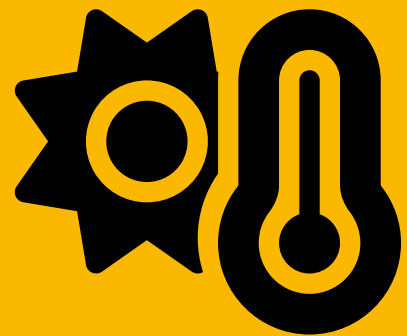
So lastly and perhaps most importantly, this report, in addition to outlining the threats that climate change poses to the health of residents, also gives hope; highlighting the ways we can provide win, win, win solutions that benefit health, ecosystems and socio-economic wellbeing for Portsmouth, and gives examples of how this is already happening in our city, for the benefit of all – children, adults and older people.

“The feeling of ‘it’s too late’ just leads to inaction and paralysis. The science is very clear that it’s never too late.”

Climate Scientist Hannah Ritchie¹⁶



CHAPTER 2: **EXTREME HEAT**



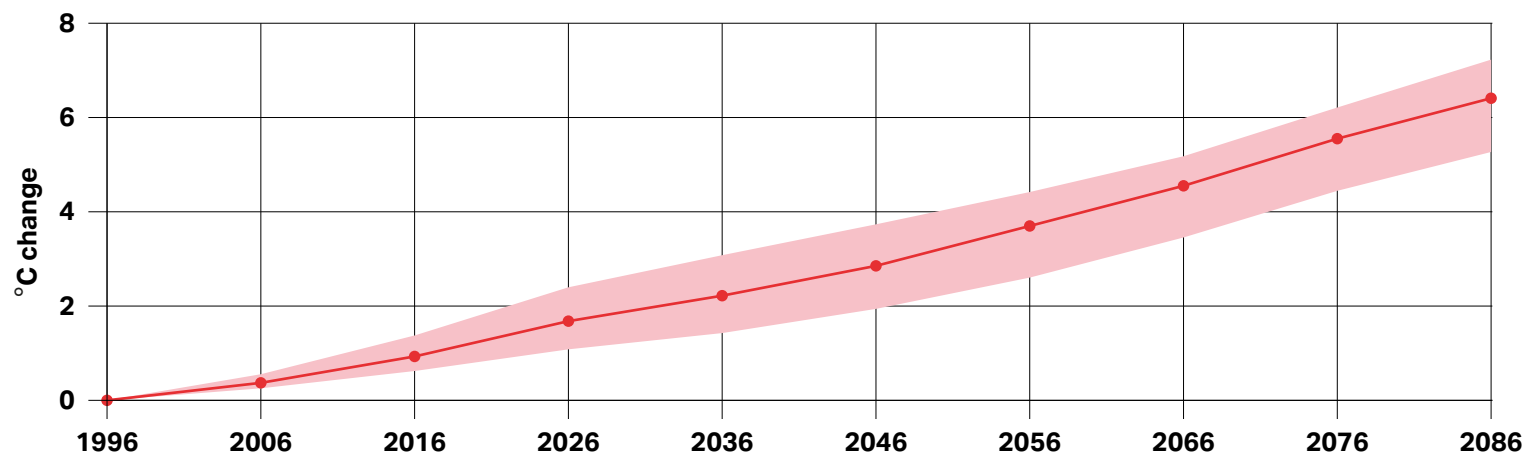
INTRODUCTION

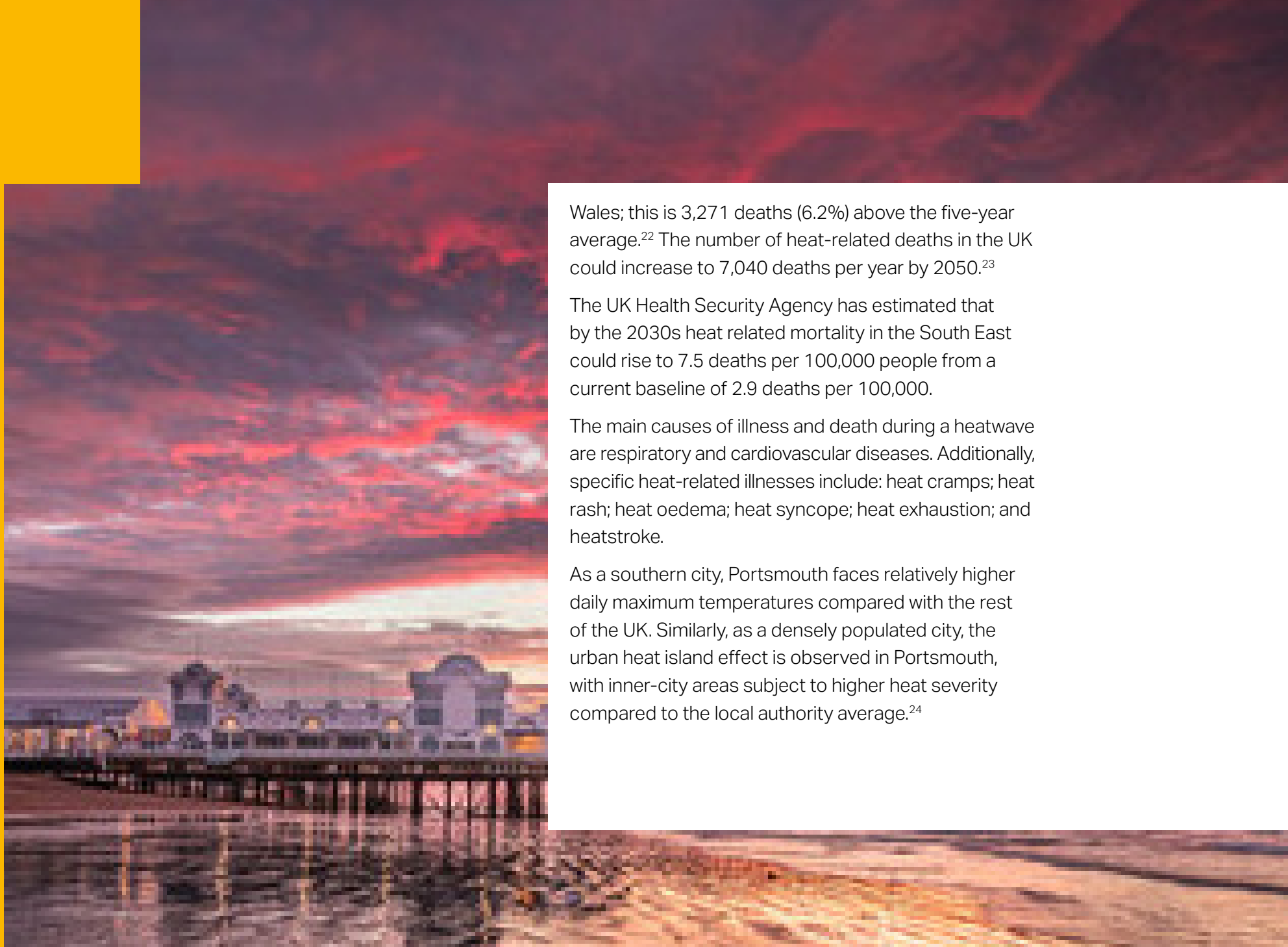
The Intergovernmental Panel on Climate Change (IPCC) predicts that as a result of climate change, it is very likely that heatwaves will increase in frequency, duration and intensity around the world.¹⁷ The Met Office has published data illustrating the mean daily maximum temperature across the UK, showing the variation per geographical area (*Figure 2*). The top 10 warmest years for the UK since 1884 have occurred since 2002¹⁸ and the UK's 2022 heatwave was more intense and widespread than previous comparable heatwaves and the first time that 40°C has been recorded in the UK.¹⁹

Predictions for temperature change in Portsmouth should greenhouse gas emissions continue to grow unmitigated (very high emissions) by 2036, the average summer annual temperature is expected to increase by 2.22°C (compared to 1996 baseline). Summer rainfall for the city is predicted to fall by 20% in 2036 (compared to the 1996 baseline), resulting in heatwaves that are more severe, more frequent and longer.²⁰

Temperatures over 25°C are associated with increased deaths. During five heat-periods between June and August 2022,²¹ 56,303 deaths occurred in England and

Figure 2: Temperature change modelling for Portsmouth (1996–2086)





Wales; this is 3,271 deaths (6.2%) above the five-year average.²² The number of heat-related deaths in the UK could increase to 7,040 deaths per year by 2050.²³

The UK Health Security Agency has estimated that by the 2030s heat related mortality in the South East could rise to 7.5 deaths per 100,000 people from a current baseline of 2.9 deaths per 100,000.

The main causes of illness and death during a heatwave are respiratory and cardiovascular diseases. Additionally, specific heat-related illnesses include: heat cramps; heat rash; heat oedema; heat syncope; heat exhaustion; and heatstroke.

As a southern city, Portsmouth faces relatively higher daily maximum temperatures compared with the rest of the UK. Similarly, as a densely populated city, the urban heat island effect is observed in Portsmouth, with inner-city areas subject to higher heat severity compared to the local authority average.²⁴

WHO IS AT RISK?

There is a significant risk to population health resulting from heatwaves; excessive exposure to high temperatures can be fatal. In a moderate heatwave it is mainly high-risk groups who come to harm, however, during an extreme heatwave, fit and healthy people can also be affected.



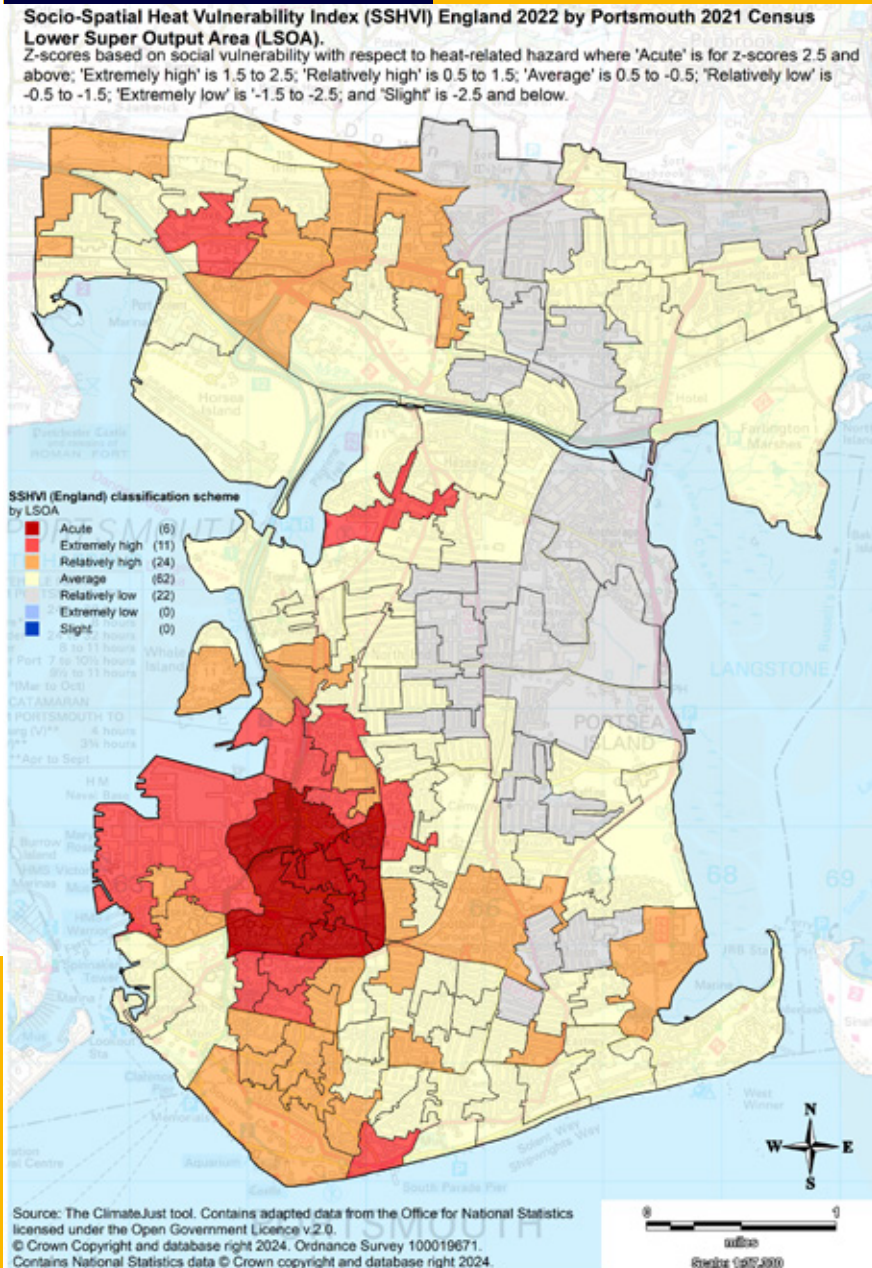
There are certain factors which increase an individual's risk during a heatwave, including:^{25, 26}

- people who are over 65 years, babies and young children (aged 5 and under),
- those with certain underlying health conditions or taking certain medications,
- are already ill or dehydrated,
- pregnant women,
- people experiencing alcohol or drug dependence, or homelessness (including those unable to make adaptations to their living environment),
- people who may be living on their own and isolated or unable to care for themselves,
- people who are housebound or have otherwise low mobility,
- people living in deprived circumstances,
- and people who are physically active and spend a lot of time outside (for work or leisure)

Of these groups, those aged over 65 are at particular risk as they experience multiple risk factors. An ageing population will increase the effects of heat related mortality. Modelled heat-related mortality in the 2070s is nearly three times higher when population projections are included.²⁷

The Socio-Spatial Heat Vulnerability Index (SSHVI) (Figure 3) demonstrates where negative social impacts from heat are more likely. The SSHVI combines of scores at neighbourhood level for socio-spatial vulnerability to heat combined with the impact of age and health to indicate how easy it would be for people living in these areas to prepare and respond to extreme heat. The figure shows the greatest areas of vulnerability in some of the poorest areas of the city.

Figure 3: Heat Vulnerability for Portsmouth



PREPARING AND RESPONDING TO EXTREME HEAT

The UK's heatwave plan²⁸ is underpinned by a system of heatwave alerts, developed with the Met Office. From the 1 June to the 15 September each year, the Met Office is able to forecast heatwaves defined by the forecasts of day and nighttime temperatures and their duration. The health alert system comprises of five main levels (Levels 0 to 4), ranging from long-term planning for severe heat up to a major emergency response as shown in Figure 4.

Depending on the level of alert a response will be triggered to communicate the risk to the NHS, government, and public health systems. Advice and information is provided to residents and health and social care professionals, particularly those working with at-risk groups. This includes both general preparation for hot weather and more specific advice when a severe heatwave has been forecast. The rise in mortality due to hot weather occurs very sharply, usually within one or two days of temperatures rising. As a result, by the time heatwaves begin, the window of opportunity for effective action is very short, therefore advanced planning and preparedness is essential.

The Portsmouth City Council heatwave plan outlines the management structures and procedures used by Portsmouth City Council during a heatwave, largely



drawn from the UK Health Security Agency (UKHSA) Heatwave Plan.²⁹

At a local level, emergency planning arrangements are brought together in the Local Resilience Forum and the Local Health Resilience Partnership. The Portsmouth Health Protection Forum is also used to inform member planning and policy through shared information on the identification, monitoring and escalation of risks through surveillance data on environmental threats.

Since a climate change emergency was declared in March 2019, and in addition to following the immediate actions required during levels 1–4 of the Heatwave Plan, Portsmouth City Council has undertaken several projects targeting level 0. The Portsmouth Climate Change Strategy and Portsmouth Greening Strategy include aims to increase green infrastructure in order to reduce urban heating.³⁰

Figure 4. UK heatwave alerts

Level	Description
0	Year-round planning All year
1	Heatwave and summer preparedness and action programme 1 June to 15 September
2	Heatwave is forecast – Alert and readiness 60% or greater risk of heatwave in the next 2 to 3 days
3	Heatwave action Temperature reached in one or more Met Office National Severe Weather Warning Service regions
4	Major incident – Emergency response Central Government will declare a Level 4 alert in the event of severe or prolonged heatwave affecting sectors other than health.

CASE STUDY:

EXTREME HEAT AT THE ROYAL ALBERT DAY CENTRE

The Royal Albert Day Centre provides a safe and secure environment for older people with a diagnosis of dementia to allow them to maintain a valued and rewarding lifestyle. Older people with dementia are a high-risk group for excess heat.

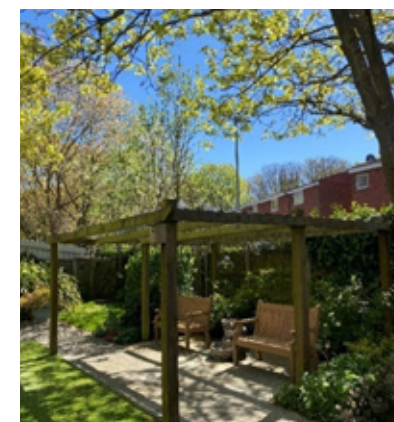
Yvonne Collins, manager of the Royal Albert Day Centre, is taking steps to manage excess heat and keep service users safe while at the day centre, after clients and staff struggled during the 2022 heatwaves.

There is a largely exposed south-facing garden with few areas of shade. Yvonne said,

"It is just really hot. There are only certain times of the day we can take people outside when the sun has moved over. The front garden is beautiful, but it is a



Figure 5. South-facing front garden with greenery but minimal shade (above and top right). Well-shaded side garden with few amenities (right).



sun trap, and it gets so hot. We have an area that is so much cooler but there is nothing in it... it looks so uninviting to take people out there."

Yvonne also emphasised the importance of being able to take service users outside, saying,

"The more we can get people outside in the summer, the better for them as they may live in flats and never go outside, or even if they live in houses that may have a garden, they may not be able to go out on their own."



It helps their general health to be exposed to sunshine and fresh air."

The centre has completed a risk assessment using information from public health, adult social care and the Met Office. This includes plans to reduce the generation of heat, increase ventilation, improve cooling of outdoor areas and create cooler areas for service users at particularly high risk.

As part of plans to create a green and healthy city, in line with the greening strategy, Portsmouth City Council were able to provide funding to the Royal Albert Day Centre to implement nature-based solutions to reduce excess heat. A team from the Local Authority have developed plans to incorporate more plants and trees into the garden to create additional areas of shade and make shaded areas more inviting so outdoor space can be fully utilised at the centre. This project will shortly be underway, with architectural plans shown in *figure 6*.



Figure 6. Architectural plans for greening including planting of additional trees and plants to provide cover over the pergola.

WHAT ELSE CAN WE DO?

A number of initiatives and plans are in place to tackle extreme heat in Portsmouth, particularly the most vulnerable. Developing climate-resilient spaces in the city will ensure that all high-risk groups are given the support they need.

There is good evidence that interventions and adaptations can minimise the health harms due to heat. The UKHSA HECC Report³¹ highlights the importance of protecting older adults and those with chronic health conditions from even small increases in heat, as populations particularly susceptible to temperature-related health risk. Those living in densely populated areas more susceptible to heat island effects, in accommodation that is poorly ventilated, insulated or overcrowded are also more likely to be adversely affected by extreme temperatures.

It makes sense therefore to focus interventions and adaptations on those groups.

Mitigation measures already underway in the city include behavioural change messaging, good use of national heat alert systems, sharing alerts with health and social care sites and energy efficiency measures for housing through work in Housing, Neighbourhood and Building Services via the Switched On and social housing improvement programmes.

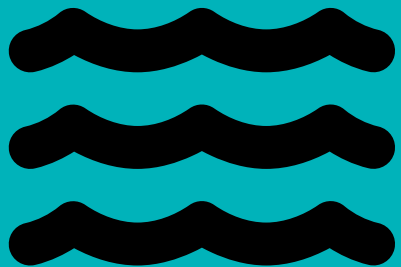
Heat mitigation measures also need to become standard in the planning and development process, for buildings and public space. New homes should adhere to building regulations, Decent Homes Standards, National Design Guide and National Model Design Codes to ensure thermal comfort.³²

A programme of increased shading and increasing availability of greenspace is underway through the Greening Strategy. The model at Royal Albert Day Centre is part of broader work to assess heat risk in care homes, schools and play areas in the city.

In the future, this work could be expanded to provide improved awareness of protective behaviours and interventions, including improved response mechanisms and networks between public health, emergency planning, health and social care and the voluntary sector to provide safety netting in extreme heat for vulnerable individuals.



CHAPTER 3: **FLOODING**



INTRODUCTION

As an island city, Portsmouth is particularly exposed to flooding, storms, rainfall and rises in sea level. It is also heavily urbanised, with substantial hard landscaping, increasing surface water flood risk. The impacts of climate change are expected to further increase flood risk in Portsmouth, as sea levels rise and winters become wetter with more intense rainfall events.

The third UK Climate Change Risk Assessment (CCRA3) (2022) identified flooding as one of the most important climate change adaptation challenges facing the UK. In all future climate change scenarios, direct and indirect flood risks are projected to rise over the 21st Century.³³

Flooding can pose a direct threat to health and wellbeing in terms of injuries, infections, exposure to chemical hazards and disruption to health services.³⁴ It can also have significant impacts on mental health. A longitudinal study found that the prevalence of probable depression among those whose homes were flooded was 20.1%, anxiety 28.3% and PTSD 36.2% one year after the flood, with elevated risk of those conditions for those whose lives were disrupted. The odds of having these mental health issues were approximately six times higher in this group than in

those who were unaffected by flooding. The increase in mental health problems persisted for three years after the flood.³⁵

The HECC in the UK report 2023 details the current and future modelled impacts of flood events on the UK's population. The current burden of flooding has been estimated as 18 deaths per year and 360 injuries per year in England. By the 2050's this is projected to increase to annual additional impacts of 6 to 34 deaths, and 120 to 680 injuries with the baseline population, or 8 to 49 deaths, 160 to 980 injuries, assuming population growth.³⁶

Environment Agency flood risk maps for rivers, sea and surface water indicate the probability of flooding from Flood Zones 1 (low risk, less than 1 in 1000 annual probability) to 3 (high risk, over 1 in 100 annual probability). Most of Portsmouth, is designated as Flood Zone 3, with high probability of flooding from rivers and the sea. The Environment Agency data does take into account the existing (and yet to be completed) flood defences, but notes that flood defences reduce, but do not completely stop the chance of flooding because they can be overtopped or fail.³⁷

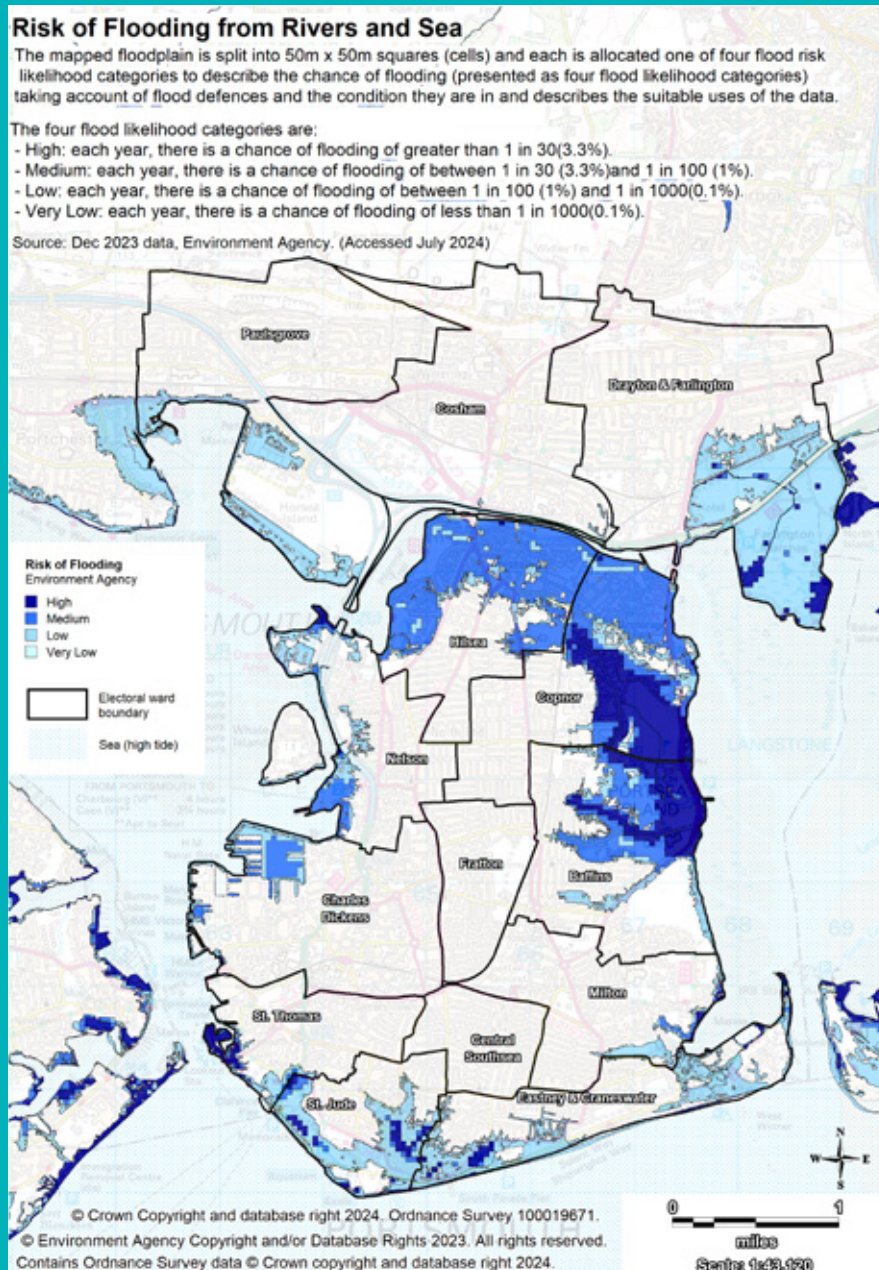
COASTAL FLOODING IN PORTSMOUTH

Significant activity is underway in the city to limit flood risk.³⁸ Coastal Partners³⁹ is a partnership of five councils across Hampshire and West Sussex that manages coastal flood and erosion risk and coastal defence schemes, aiming to improve community resilience and enhance the natural environment in the process. Large schemes underway in Portsmouth include the Southsea Coastal Scheme and the North Portsea Island Scheme:

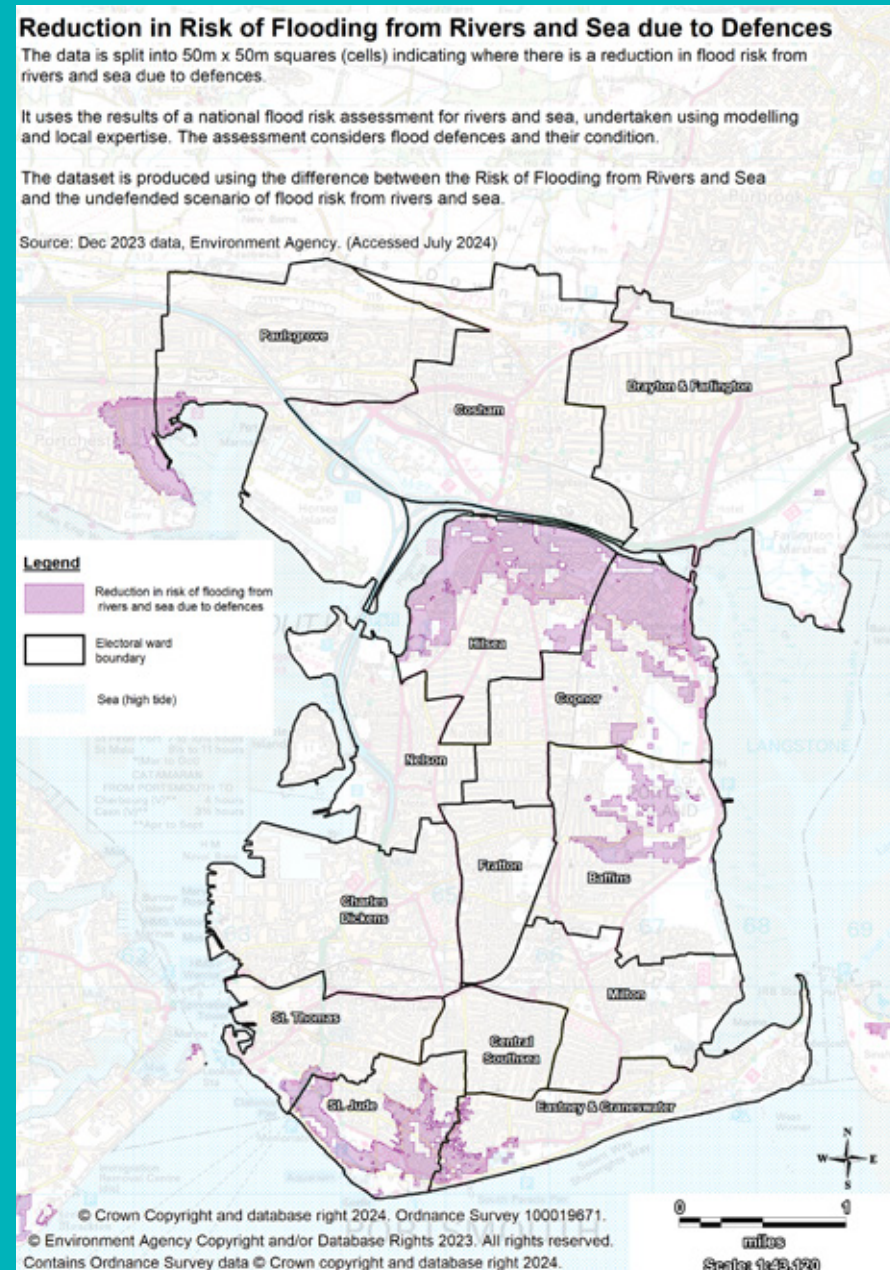
The Southsea Coastal Scheme is delivering new flood defences along 4.5km of seafront, from Old Portsmouth to Eastney, aiming to reduce the risk of flooding to over 8,000 homes and 700 businesses in Southsea for the next century. However, these flood defences are designed on the basis that long-term global CO₂e emissions do not continue to increase in excess of 2°C, which would lead to corresponding additional sea level rise.

The North Portsea Island Scheme covers 8.4km of coastline from Tipner in the north to Milton in the south-east of the city. It is upgrading protection to reduce the risk of coastal flooding to one of the highest risk low-lying areas in the country, helping to protect 4,200 properties and 500 businesses.





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SURFACE WATER FLOODING IN PORTSMOUTH

Surface water flooding occurs when flow exceeds what can be absorbed either by drainage systems (sewers) or open ground. In heavily paved and densely populated areas such as Portsmouth, opportunities for rainwater to be absorbed are reduced. This risk is exacerbated by the intense rainfall associated with climate change related extreme weather.

The Portsmouth Surface Water Management Plan details surface water flooding issues on a local level, primarily concerning the health, safety and wellbeing of Portsmouth residents and businesses and prioritises areas at greatest risk.

Increasingly, smaller scale infrastructure and nature-based solutions are being sought to minimise surface water flood risk in urban areas. Sustainable Drainage Systems (SuDS) absorb rainwater and surface water run-off, slowing down the run-off rate and reducing the risk of flooding.

In Portsmouth, multi-directorate plans are underway to routinely use green infrastructure in Highways Improvements schemes, as a method for combatting surface water flooding as has been done elsewhere.⁴⁰ Following a review by the Department for Environment, Food and Rural Affairs (DEFRA) in 2023,⁴¹ SuDS are expected to become mandatory for all new developments.



Multiple co-benefits have been identified from SuDS in addition to reducing surface water flooding:⁴²

- Preventing flooding (by reducing surface water flows)
- Improving water quality by managing pollution
- Providing additional green space
- Improving local air quality through planting
- Improving biodiversity

PREPARING AND RESPONDING TO FLOODING

Data from Partnership for South Hampshire (PUSH) Strategic Flood Risk Assessment⁴³ has informed the Local Plan for Portsmouth, which requires site-specific Flood Risk Assessments ahead of new development and should include climate change projections.

The UKHSA Adverse Weather and Health Plan (AWHP) outlines the important areas where the public sector, independent sector, voluntary sector, health and social care organisations and local communities can work together to maintain and improve integrated arrangements for planning and response to deliver the best outcomes possible during flood events, and other adverse weather events.

Agencies can also support communities to prepare for flooding, in particular by providing targeted advice for those at high risk.

The AWHP includes health protection advice to manage flood impacts once a flood has occurred and to inform health professionals' response to flood warnings (which are issued by the Environment Agency). UKHSA has also published guidance for specifically addressing the mental health impacts of flooding,⁴⁴ including raising awareness and allowing people to prepare and respond appropriately.

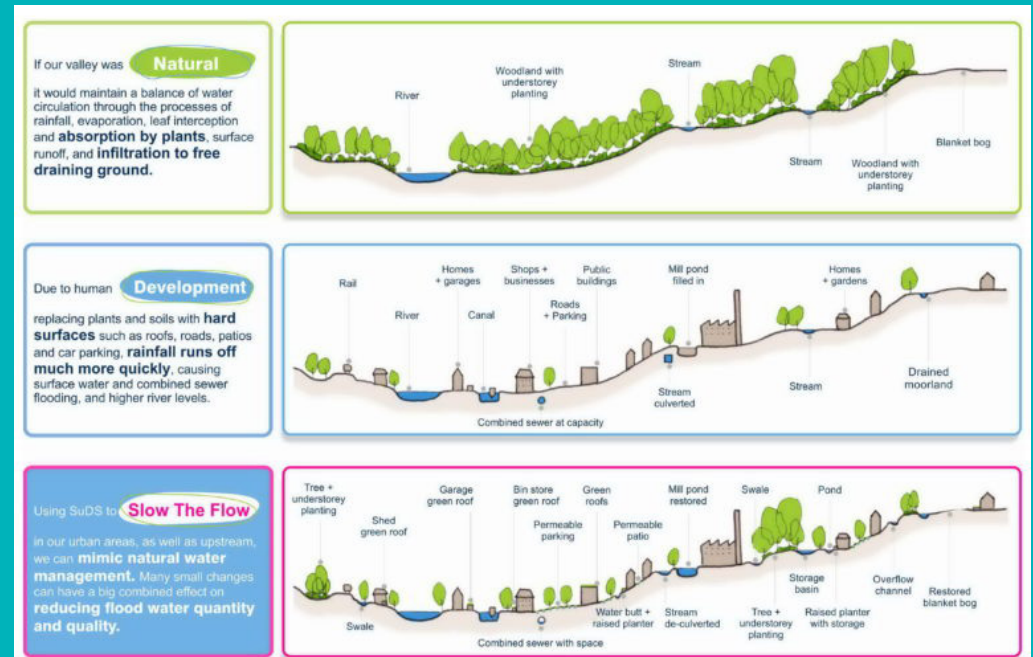


Figure 8: Sustainable Drainage Systems

Image credit: Slow the Flow

The Portsmouth Flood Response Plan⁴⁵ is a specific hazard plan for Category 1 responders under the Civil Contingencies Act 2004. It outlines the Council's response to a major flood event that threatens life or property. It is produced in line with the requirements of the Multi-Agency Flood Plan (MAFP) guidance for Local Resilience Forums and Emergency Planners (2008) and is part of the council's Emergency Response Plan and supporting plans and service procedures.



CASE STUDY:

PREVENTING FLOODING AT ARUNDEL COURT PRIMARY ACADEMY

Children in the Arundel Court Primary Academy Eco-Club noticed that parts of their school grounds were frequently flooding. Flooding restricted play on the field and the playground, and often meant the entrance was flooded, meaning children arrived at school with wet feet.

WATCH THE
VIDEO



Children worked with Portsmouth City Council to create a bio-swale or rain garden on the field to limit flooding and also enhance biodiversity on the site.

In discussions with the school, it also emerged that more consideration could have been given to climate adaptation in the recent re-building of the school and grounds. It highlights the co-benefits of taking these





considerations at the build and planning stages of new developments.

"I think more consideration could have been given to the position and planning of the school building to allow for climate change. Consideration given at the beginning would save money in the future.

"Many of the classrooms get the full morning sun sending the temperatures rocketing and they then remain hot for the rest of the day. If the school had

been built on a different angle turned 45 degrees these problems could have been alleviated.

"Tanks for collecting rainwater could have been installed on the roof, this water could then have been used to flush the toilets, solar panels could have provided us with energy, or a green roof could have been made to encourage more biodiversity."

Bex Miller, Deputy Head Teacher,
Arundel Court Primary School

WHAT ELSE CAN WE DO?

The HECC in the UK report 2023 includes information on research gaps and priorities, interventions to improve public and infrastructural resilience from flooding such as protection measures and spatial planning.⁴⁶ There are further actions we can take for homes, public space, businesses and institutions to further mitigate flood risk and limit the negative health impacts of flooding.

Many small changes can have a big impact on flood water quantity and quality.

As a city we should continue to realise the co-benefits of flood risk management. For example, nature-based solutions such as implementing green infrastructure also has potential positive benefits for physical and mental health. We should continue to support plans already underway to expand the use of SuDS to limit surface water flooding, prioritising areas and populations at greatest risk.



In addition to supporting existing emergency plans in response to flooding, we should continue to work on identifying those at greatest risk, and promote measures to ensure the continuity of health and care service delivery, including residential care homes, during flood events, for example using the NHS Green Plan and the Local Health Resilience Partnership to support this.



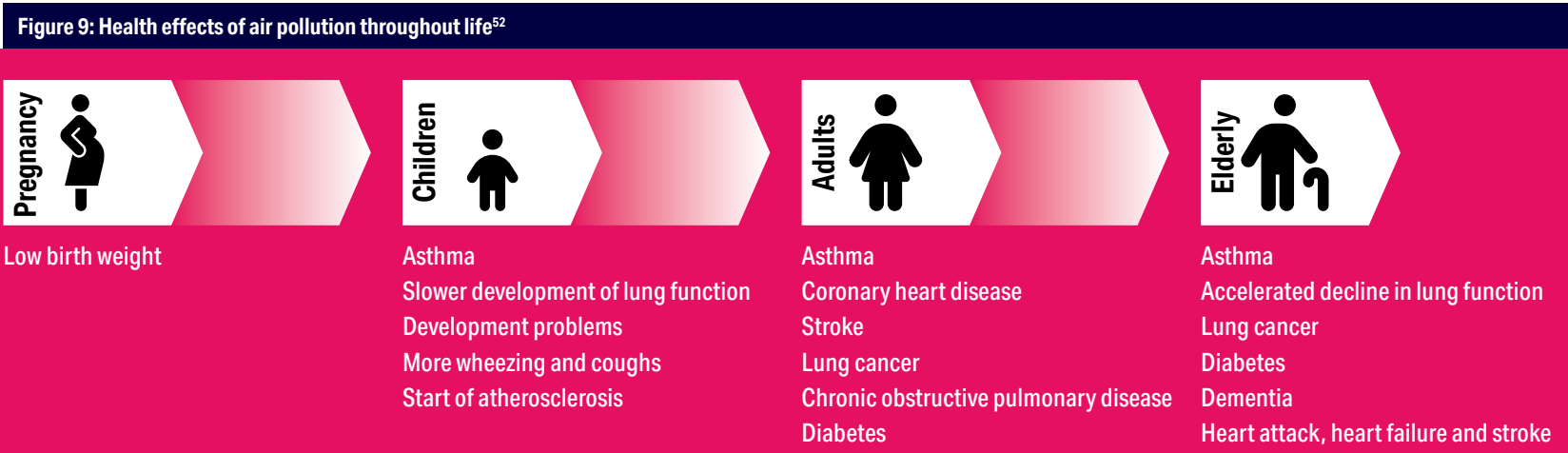
CHAPTER 4: **AIR QUALITY**



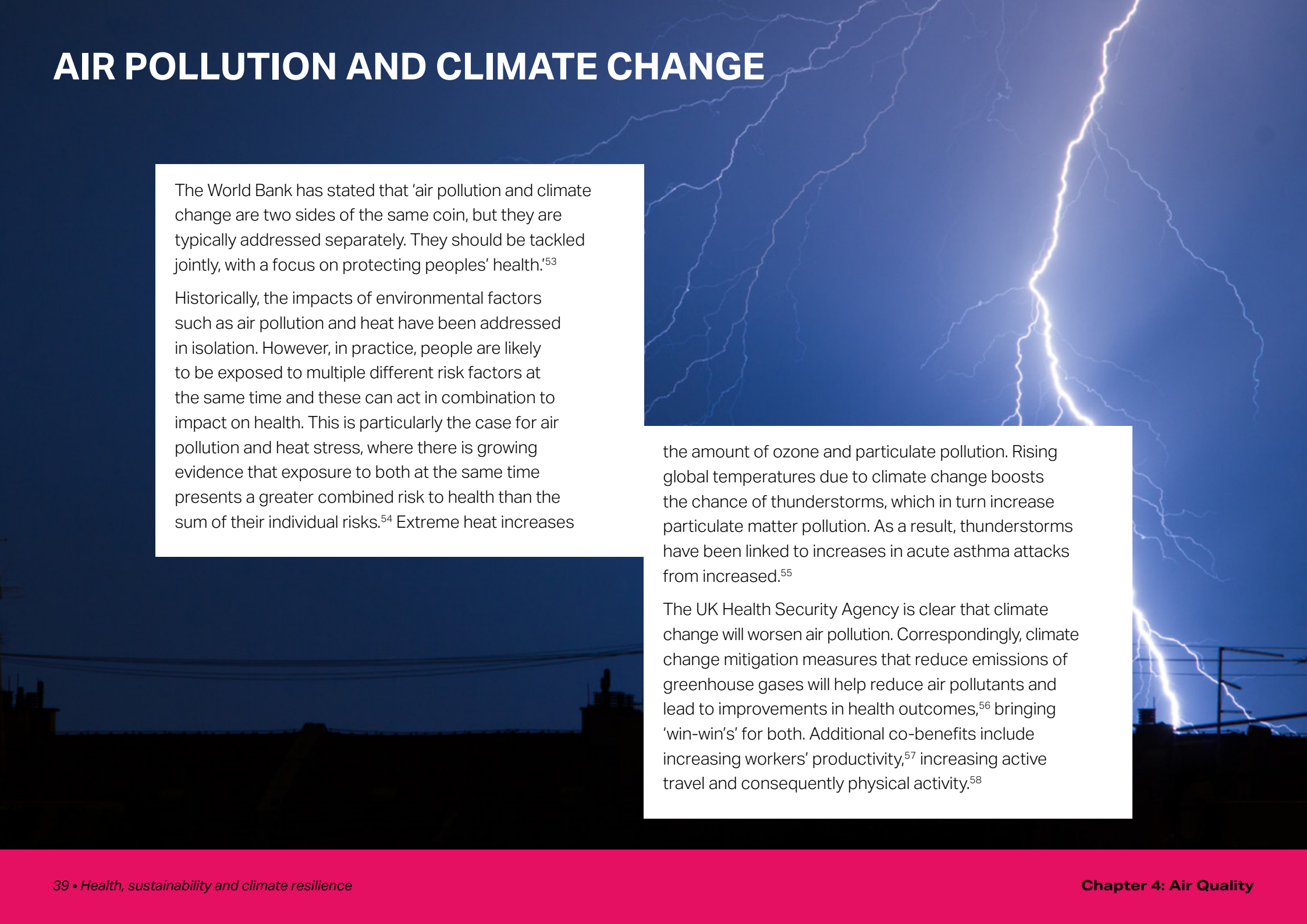
INTRODUCTION

Air pollution is the largest environmental risk to the public’s health in the UK.⁴⁷ Research suggests that air pollution has negative effects on human health throughout the course of people’s lives, from before birth to old age (as summarised in Figure 9). There is strong evidence that air pollution causes the development of coronary heart disease, stroke, respiratory disease and lung cancer, exacerbates asthma, and has a contributory role in mortality.⁴⁸ It is estimated that long-term exposure to air pollution in the UK has an annual effect equivalent to between 28,000 to 36,000 deaths,⁴⁹ and an associated 328,000 to 416,000 life years lost.⁵⁰

Air pollutants of concern to health include particulate matter, nitrogen dioxide and ozone, among others. Currently, the pollutants causing the most significant health impacts in the UK are emissions of nitrogen dioxide and particulate matter (NO₂, PM_{2.5}, and PM₁₀). Increasingly it is recognised that indoor air pollution can affect health as much as outdoor emissions, particularly as air quality outside improves. It is estimated that people spend 80–90% of their time indoors (homes, schools workplaces, other public spaces and transport).⁵¹



AIR POLLUTION AND CLIMATE CHANGE



The World Bank has stated that 'air pollution and climate change are two sides of the same coin, but they are typically addressed separately. They should be tackled jointly, with a focus on protecting peoples' health.'⁵³

Historically, the impacts of environmental factors such as air pollution and heat have been addressed in isolation. However, in practice, people are likely to be exposed to multiple different risk factors at the same time and these can act in combination to impact on health. This is particularly the case for air pollution and heat stress, where there is growing evidence that exposure to both at the same time presents a greater combined risk to health than the sum of their individual risks.⁵⁴ Extreme heat increases

the amount of ozone and particulate pollution. Rising global temperatures due to climate change boosts the chance of thunderstorms, which in turn increase particulate matter pollution. As a result, thunderstorms have been linked to increases in acute asthma attacks from increased.⁵⁵

The UK Health Security Agency is clear that climate change will worsen air pollution. Correspondingly, climate change mitigation measures that reduce emissions of greenhouse gases will help reduce air pollutants and lead to improvements in health outcomes,⁵⁶ bringing 'win-win's' for both. Additional co-benefits include increasing workers' productivity,⁵⁷ increasing active travel and consequently physical activity.⁵⁸

AIR QUALITY IN PORTSMOUTH

In 2022, the proportion of adult deaths attributable to long-term exposure to particulate air pollution in Portsmouth was 6.2% (over 1 in 20 deaths), compared to an England value of 5.8%.⁵⁹

The UK and WHO recommend annual average limits for nitrogen dioxide and particulate matter. The UK sets legal limits for nitrogen dioxide at 40 µg/m³ (micrograms per cubic metre of air). WHO guidelines state that annual average concentrations of nitrogen dioxide should not exceed 10 µg/m³.⁶⁰ However, the World Health Organisation is clear that 'there is no evidence of a safe level of exposure or a threshold below which no adverse health effects occur.'⁶¹

In 2023, nitrogen dioxide annual mean levels in Portsmouth were 42 µg/m³ and above at three locations in the city, all along major road links.⁶²

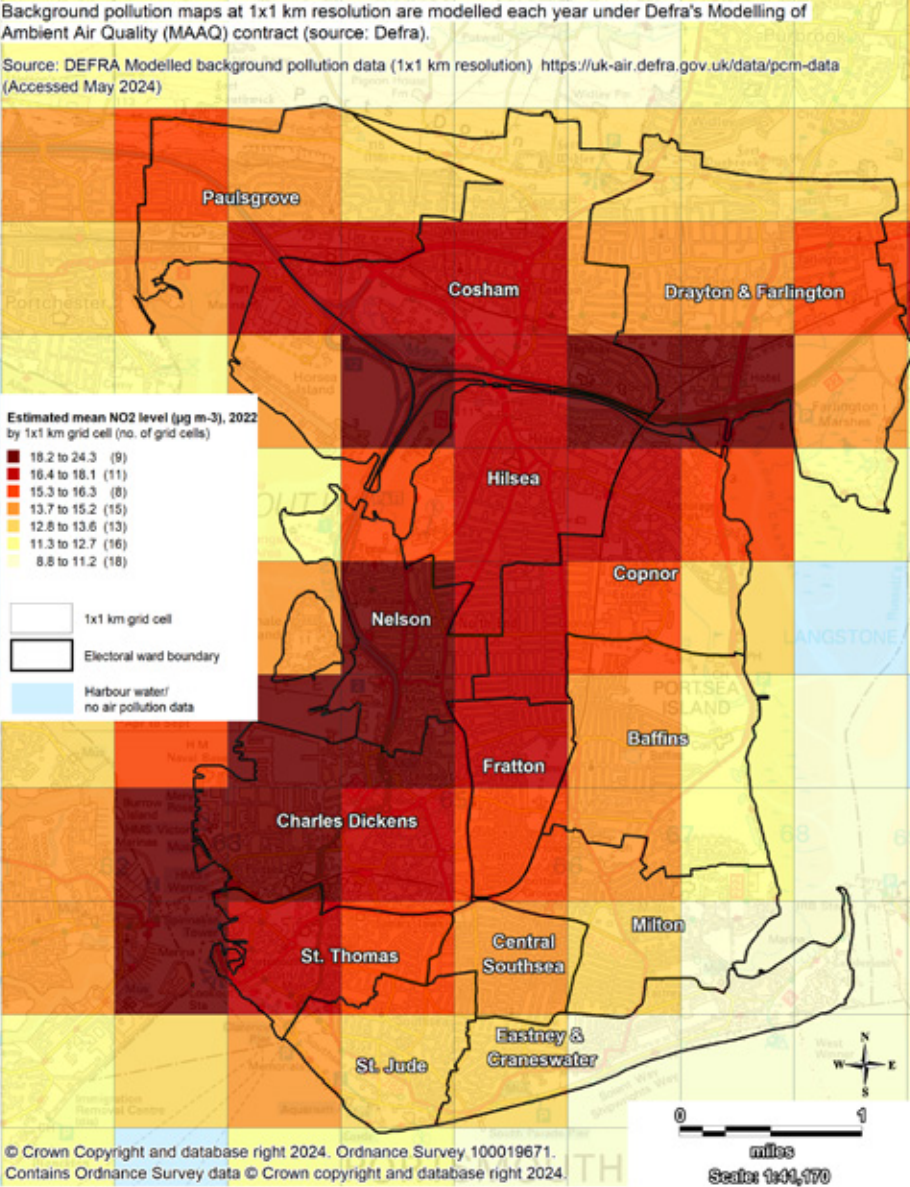
The main source of nitrogen dioxide air pollution in Portsmouth is road traffic, which accounts for around half of the air pollution in the city. Other sources are industrial, commercial, domestic, and background and trans-boundary pollution (unavoidably brought into the city via weather systems). Maps 10a and 10b show concentrations of nitrogen dioxide and particulate matter respectively. The areas with the highest concentrations correspond to major transport routes,

and are also the areas with the highest population density, which are therefore have the highest human exposure to air pollution.

Local authorities have a duty to address air pollution in their area which exceeds legal limits. This includes declaring Air Quality Management Areas (AQMA's) and publishing Air Quality Action Plans (AQAPs) setting out the measures they will take to reduce pollution. There are five AQMA's in Portsmouth. In 2017 around 3% of the Portsmouth population lived within an Air Quality Management Area.

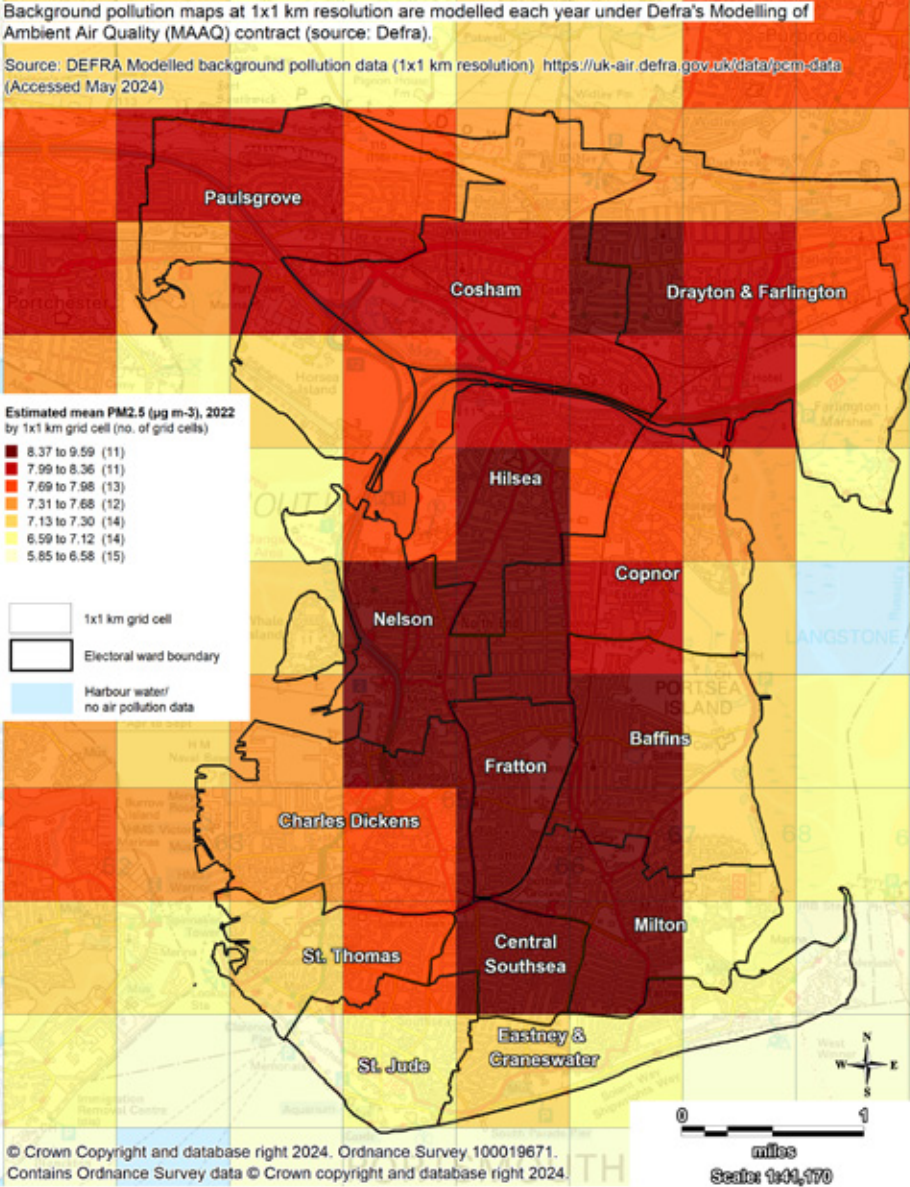
Portsmouth has been identified as a city that needs to reduce air pollution levels as quickly as possible.⁶³ The council is working closely with Government's Joint Air Quality Unit (JAQU) to develop an Air Quality Local Plan to reduce levels of nitrogen dioxide in the city to below legal limits in the shortest possible time.

Annual mean air pollution concentrations (modelled): Nitrogen dioxide (NO2) relative concentrations (µg m-3) within Portsmouth by 1x1 km grid, 2022 data



Source: Defra

Annual mean air pollution concentrations (modelled): Particulate Matter (PM2.5) relative concentrations (µg m-3) within Portsmouth by 1x1 km grid, 2022 data



Source: Defra

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WHO IS AT RISK?

The negative impacts of poor air quality are unequally distributed. Air pollution particularly affects the most vulnerable in society, children, the elderly, and those with existing heart and lung conditions.⁶⁴

Those who are already socially disadvantaged and living in less affluent areas tend to be exposed to higher levels of pollutants, and therefore experience more severe consequences. For example, areas of deprivation tend to be located closer to heavy road traffic, where air quality is worse. Those of lower socioeconomic status are also more likely to be living with pre-existing factors, such as obesity and heart disease, which exacerbate the effects of air pollution, while also being more likely to smoke.⁶⁵ Portsmouth's five Air Quality Management Areas (AQMAs) largely sit in the most deprived and densely populated areas of the city.

The UK Health Security Agency has estimated air pollution vulnerability for Portsmouth, shown in *Figures 11a and 11b*:

- 51% of the Portsmouth population are estimated to be in the most vulnerable deciles for air pollution, scoring 9 and 10 (around 110,022 people)
- Around 82% of the population were in the top 4 deciles of vulnerability.⁶⁶

Those with the greatest exposure are also the lowest emitters. Despite being one of the most polluted areas of the city, in the most deprived areas in Charles Dickens (our most deprived ward), the majority of households don't have access to a car.⁶⁷

The maps in figures 11a and 11b clearly show that those areas of greatest pollution largely correspond to those areas of higher socioeconomic deprivation.

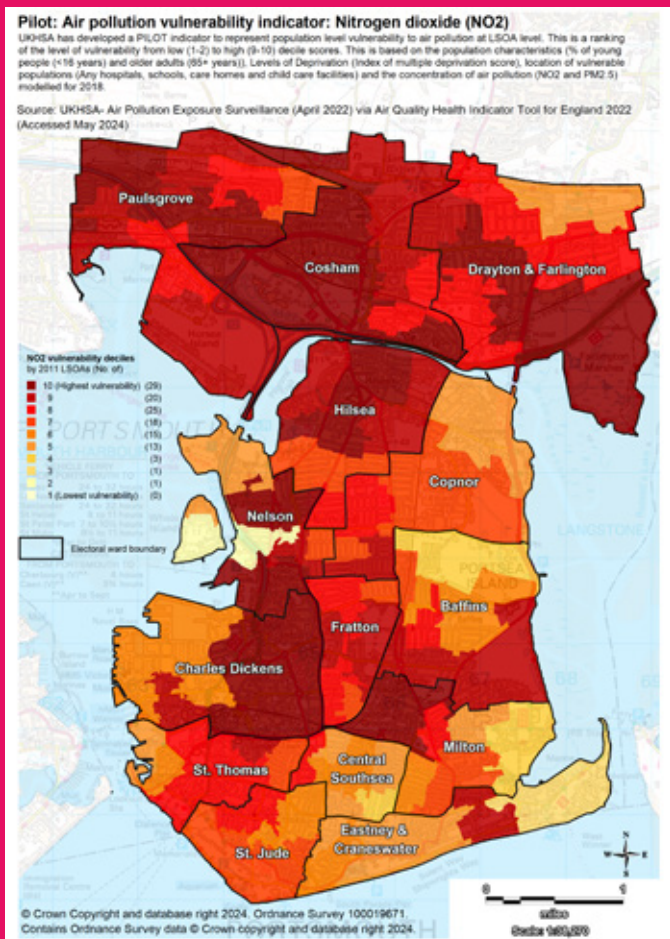


Figure 11a: Air pollution vulnerability indicators for nitrogen dioxide (NO2)
Source: UKHSA

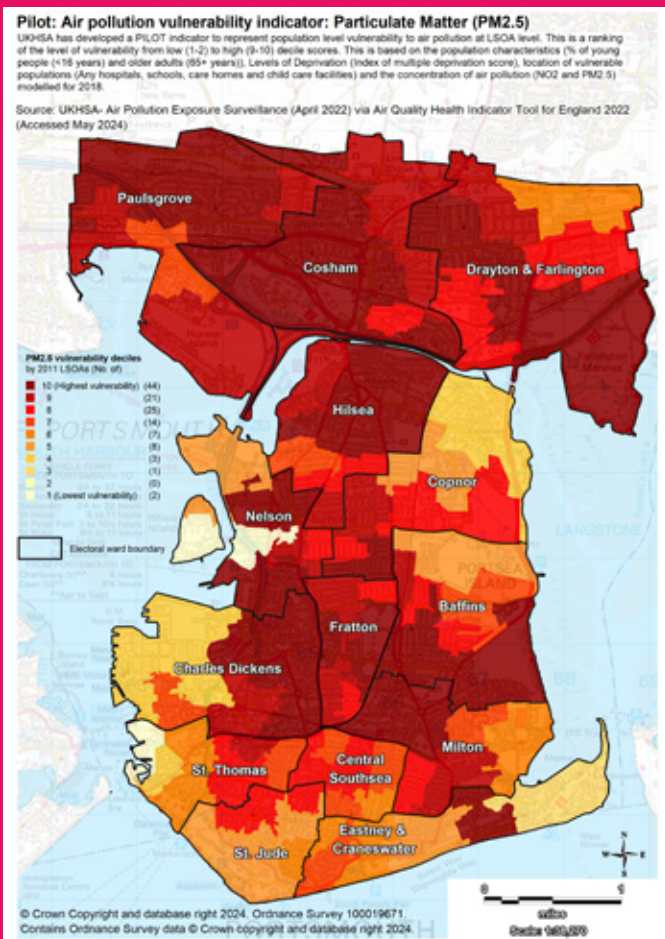


Figure 11b: Air pollution vulnerability indicators for particulate matter (PM2.5)
Source: UKHSA

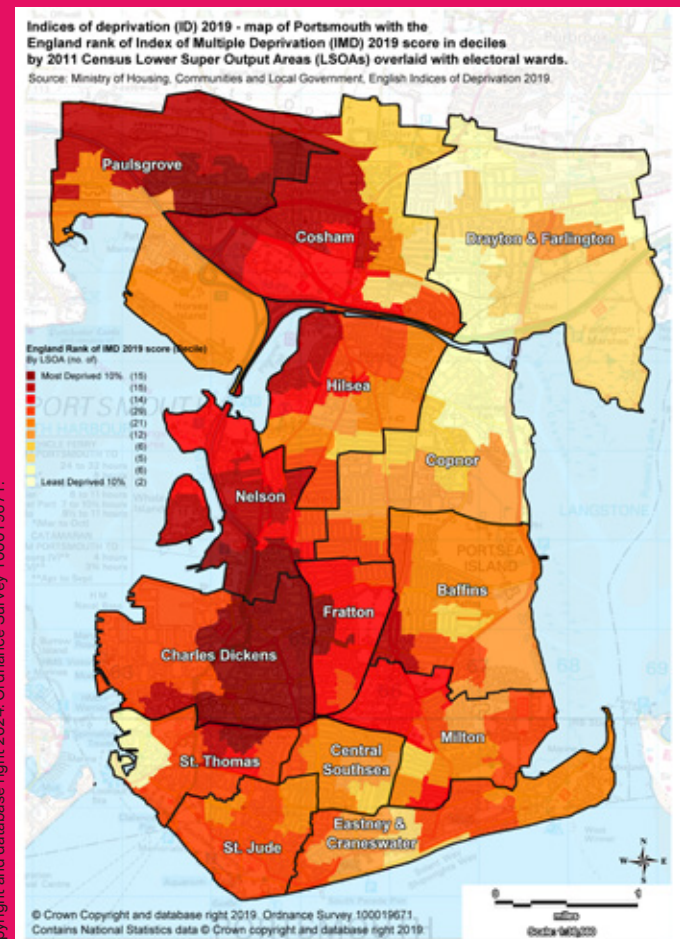


Figure 12: Indices of multiple deprivation, 2019

CASE STUDY:

CLEAN AIR CHAMPIONS

Working with the charity Global Action Plan, we adapted their Clean Air Champions project, which enables healthcare professionals to have more conversations with patients about air pollution.

One hour training sessions have been undertaken in person and online with over 50 health professionals working in acute and primary care across the city.

"Air pollution is a problem for people in Portsmouth with chronic lung disease.

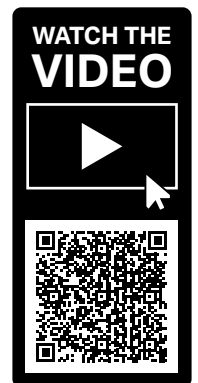
"Exposure to air pollution plays an important role in the development of lung diseases and leads to poorly controlled symptoms with more frequent flare ups.

"It is really important to discuss air pollution with our patients. There is a mistaken belief that there is nothing we can do about poor air quality. However, with training and an understanding of local air pollution issues, healthcare professions can give patients advice on how to reduce their risk.

"Most healthcare professionals are aware that air pollution leads to ill health. Training can increase awareness of ways we can give our patients individualised, pragmatic advice to reduce their exposure and signpost patients to resources where they can find out more.

"The Clean Air Champion training offered by Portsmouth City Council Public Health team can improve the way we incorporate discussions about air pollution into consultations and reduce risk for our patients."

Ben Green, Consultant Respiratory Physician and Clean Air Champion, Portsmouth Hospitals University NHS Trust



IMPROVING AIR QUALITY

One way in which the council is tackling air pollution and reduce carbon emissions in the city is through the charging Clean Air Zone (CAZ). Currently non-compliant vehicles like older Heavy Goods Vehicles (including some larger motorhomes), buses and coaches, taxis and private hire vehicles are subject to a daily charge. A range of measures support active travel including Active Pompey Neighbourhoods to reduce speeding and traffic congestion and School Streets, closing roads at school pick up and drop off times. Investment to increase bus use will support delivery of the National Bus Strategy and the South East Hampshire Rapid Transit system. Increased electric vehicle charging points and anti-idling campaigns aim to reduce pollutants from vehicles.

At the Port, the pioneering Sea Change project will design, build and operate a shore power system allowing visiting ferry or cruise ships to turn off their engines when in the port, and 'plug-in' to use green electricity to run onboard systems.



A smoke control area in place in the south-west corner of the city limits fuel usage to smokeless fuels (except where approved combustion equipment is used).

Focused behaviour change programmes for the public and health care workers in the city aim to improve knowledge of the dangers of air pollution, particularly for the most vulnerable and ways to limit exposure.

WHAT ELSE CAN WE DO?

Air pollution is a modifiable risk factor for disease.⁶⁸ Strategies to achieve clean air generally have three main objectives:

- Reduce sources of pollution (Protect)
- Limit exposure to pollution (Mitigate)
- Focus on the most vulnerable (elderly, youngest, sickest) (Avoid)

We can have a greater positive effect on both health and the environment if we more closely align the two agendas of air pollution and climate. Air pollutants and greenhouse gases often come from the same sources, such as diesel-fuelled vehicles.

Emerging evidence (in press⁶⁹) suggests that it is potentially more cost-effective for local authorities to integrate air quality and climate change policy. Integrating policy helps to manage any trade-off and justifies measures.

The council is currently refreshing its air quality strategy which will outline work already underway on this issue. The new overarching strategy will be supported by an action plan delivered by partners across the city.





A recent evidence review conducted by the public health team found that no single intervention to improve air quality is most effective on its own. A combined set of interventions tailored to the location achieves the maximum reductions in air pollution, many of which are underway in the city including active travel, electrification of transport, comprehensive air quality monitoring, clean energy through the Switched On programme and building efficiency.

However, more can be done in the city to improve air quality; in particular, doubling our efforts on:

- Promoting a hierarchy approach as standard – prevent, mitigate, avoid air pollution
- Routinely prioritising and promoting active travel over other forms of transport in policy, and adhere to NICE guidance on air pollution and Physical Activity: walking and cycling⁷⁰ for active travel. The Association of Directors of Public Health recommends that at least 10% of the local transport budget is dedicated to active travel,⁷¹ which Portsmouth currently adheres to.
- More effectively using urban planning and policy to reduce emissions and concentrations of air pollution, making a commitment to improving air quality in strategy documents that guide planning decisions. For example, expanding low emissions zones and low traffic neighbourhoods; promoting clean construction; increased use of green infrastructure to capture pollutants; further reducing waste and landfill emissions.



CHAPTER 5: **VECTOR (INSECT) BORNE DISEASE**



INTRODUCTION

Vectors are living organisms, often insects, that have the potential to transmit infectious pathogens between humans, or from animals to humans. Many are biting insects, which transmit disease from the blood of an infected human or animal, into a new human or animal (also known as the 'host'). An insect carrying disease can spread infection throughout its lifetime with each subsequent bite (*Figure 13*). Vector-Borne Diseases or VBDs are human illnesses caused by parasites, viruses, and bacteria and transmitted by vectors such as mosquitoes and ticks.

Vector borne diseases (such as Malaria, Dengue, Schistosomiasis, Leishmaniasis, Chagas disease, and Yellow Fever) account for more than 17% of all infectious disease globally and so represent a substantial public health burden. Amongst vectors, mosquitoes cause more deaths and illnesses than any other animal globally.

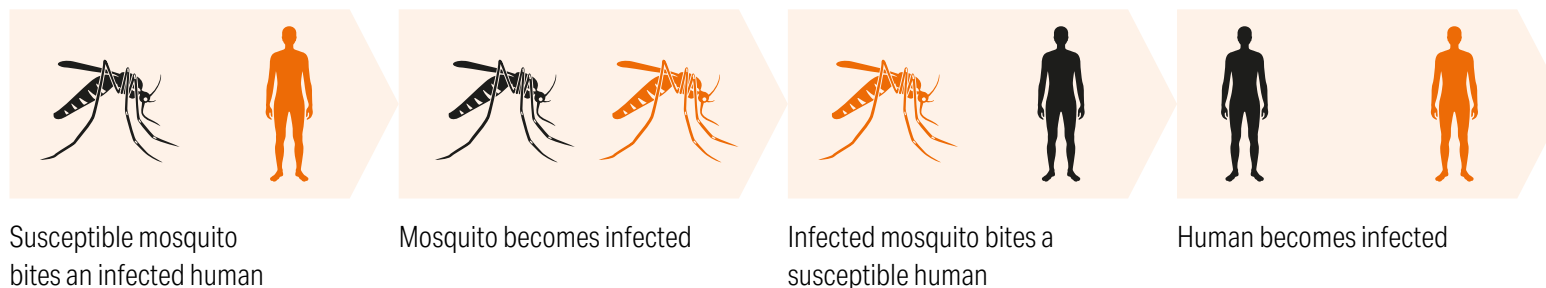
Mosquitoes spread of a number of diseases including malaria, Lymphatic filariasis, Chikungunya, Dengue, Rift Valley fever, Yellow fever, Zika, Japanese encephalitis and West Nile fever. Mosquito-borne diseases account for greater than 1 million deaths, and affect up to 700 million individuals annually, approximately impacting one in ten people worldwide.

Internationally, mosquitoes are common in urban environments, where they breed in small bodies of water (such as puddles and rivers) and feed almost exclusively on humans.

Mosquitoes are becoming an increasing concern in Europe with approximately 10 invasive mosquito types becoming newly established in Europe each year. The U.K. spends around £1.7 billion annually to mitigate the potential population impacts caused by these new species.

Figure 13: Mosquito vector to human host receptor transmission pathway

Source: Chathurangika, P & K De Silva (2024)¹²



CLIMATE CHANGE, GLOBALISATION, VECTORS AND VBD

The threat of VBDs has risen in recent decades due to rapid urbanisation, progression of climate change, and a rise in globalisation and international travel. As the planet warms and climate change lengthens the mosquito season, mosquitoes are expanding their geographical range to new regions and re-emerging in areas where mosquito numbers had previously reduced. Rising humidity may also lead to increased water availability, impacting on mosquito breeding levels. Predictive modelling suggests that an average 1°C rise in mean temperature over the next 20 years will lead to a 1-to-2-week extension of mosquito development and activity in southern England.

An invasive mosquito species already in Europe and at risk of spreading further to the UK, is the *Aedes Albopictus*, also known as the Asian tiger mosquito. *Aedes albopictus* is an aggressive daytime biting mosquito species that can transmit several viruses including Dengue, Chikungunya and Zika.

Aedes albopictus and *Aedes aegypti* have been found to colonise new areas via main highway routes, having moved across regions in vehicles. It is therefore considered likely that these species may be increasingly found in the UK, particularly close to ports., introduced via road, water and rail links with continental Europe.

Within Europe, *Aedes Albopictus* is established in 13 countries including France, and has been observed in 7 more, including the Netherlands (*Figure 14a*). *Aedes aegypti* is established in Cyprus and several European outermost regions (*Figure 14b*).

West Nile virus (WNV) is carried by *Culex* mosquitoes, including *Culex modestus*, which is now established in coastal parts of south-east England. To date there have been no cases of this infection acquired in the UK.

The UK Health Security Agency 'Health effects of climate change' report, highlights that with the establishment of Asian tiger mosquito *aedes albopictus* and the spread of *Culex* mosquitoes, the biggest disease threats to the UK would be Chikungunya, Dengue and West Nile viruses.

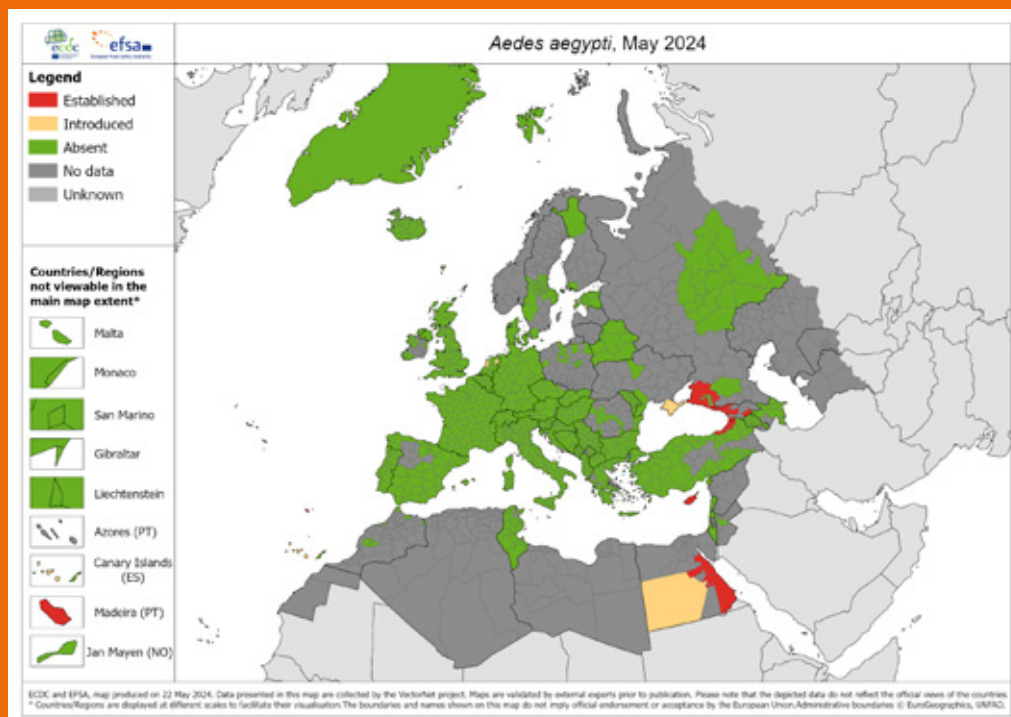


Figure 14a: Current known distribution maps of invasive mosquito vectors (May 2024) – *Aedes aegypti*⁷³

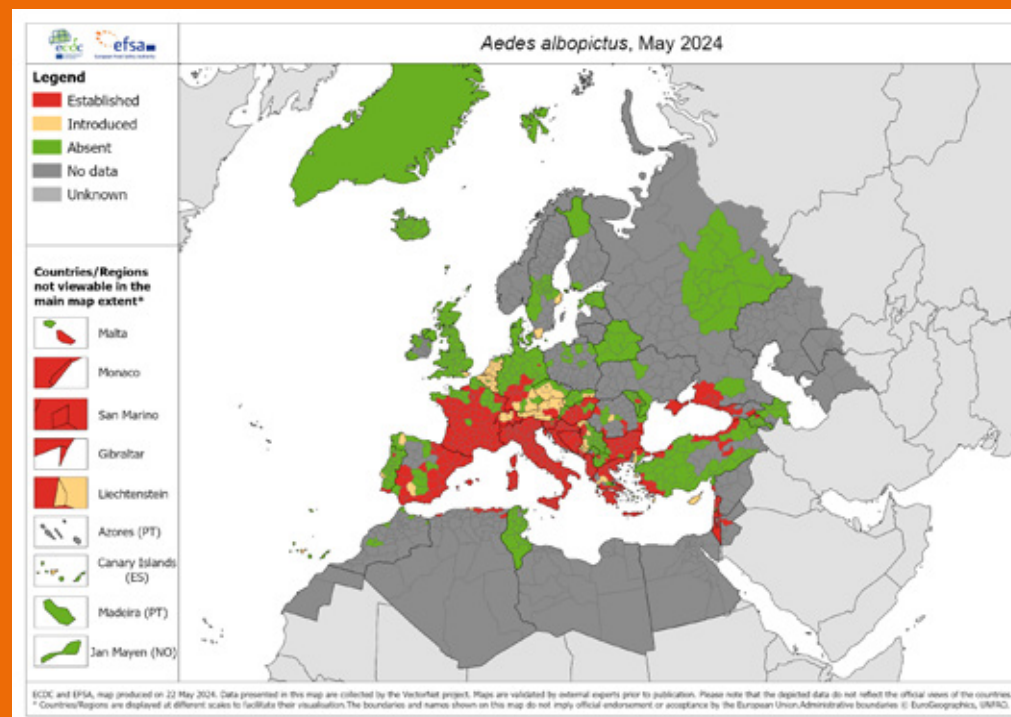
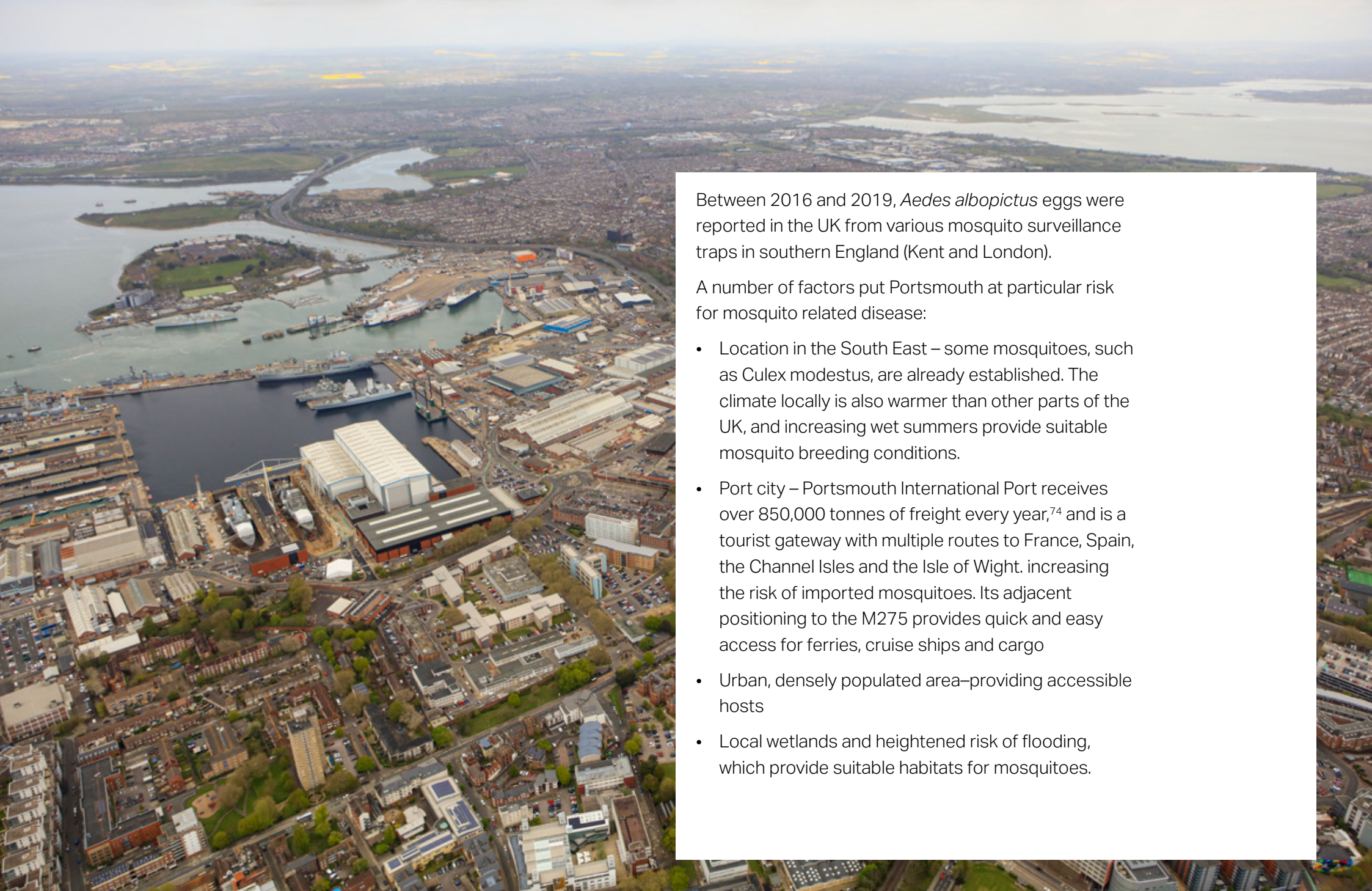


Figure 14b: Current known distribution maps of invasive mosquito vectors (May 2024) – *Aedes albopictus*



Between 2016 and 2019, *Aedes albopictus* eggs were reported in the UK from various mosquito surveillance traps in southern England (Kent and London).

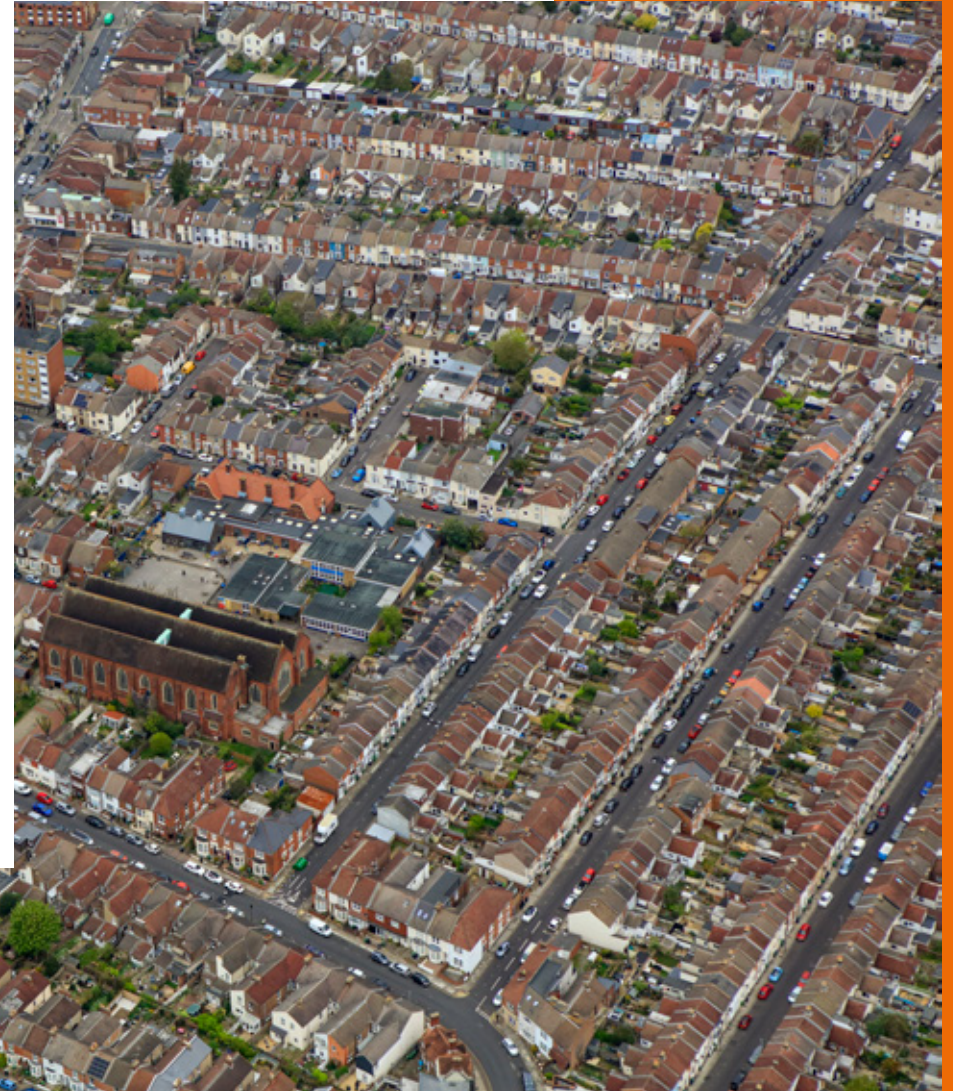
A number of factors put Portsmouth at particular risk for mosquito related disease:

- Location in the South East – some mosquitoes, such as *Culex modestus*, are already established. The climate locally is also warmer than other parts of the UK, and increasing wet summers provide suitable mosquito breeding conditions.
- Port city – Portsmouth International Port receives over 850,000 tonnes of freight every year,⁷⁴ and is a tourist gateway with multiple routes to France, Spain, the Channel Isles and the Isle of Wight. increasing the risk of imported mosquitoes. Its adjacent positioning to the M275 provides quick and easy access for ferries, cruise ships and cargo
- Urban, densely populated area—providing accessible hosts
- Local wetlands and heightened risk of flooding, which provide suitable habitats for mosquitoes.

VBDS AND HEALTH INEQUALITIES

Previous evidence has demonstrated that the most disadvantaged populations are disproportionately affected by VBDs. Poverty enhances vulnerability to VBDs in multiple ways, primarily by removing the capacity for people to cope with and address health risks.

Fifteen of Portsmouth's 125 small areas (12%) are within the most deprived 10% of small areas in England – and of these, half (8) are in Charles Dickens ward, next to the International Port. Outside Greater London, Portsmouth also has one of the most densely populated cities in the UK, with 13,370 individuals per square mile. The multiple disadvantage posed by increased population density in deprived areas and the warming effect of urban heat islands could create an ideal breeding environment for invasive vector species and increase the potential for VBD-associated health inequalities in Portsmouth.



DENGUE FEVER

	<i>Aedes aegypti</i> and <i>Aedes albopictus</i> mosquitoes transmit Dengue.			
	Most people have no symptoms. Where symptoms do occur, these include high grade fever, severe headaches, muscle ache, nausea and vomiting and swollen lymph nodes. Rarely, Dengue fever can be severe and result in death. No specific treatment – patients need hospital care.			
	Cases contracted in Europe are increasing:	2010–2020	2022	2023
		73	71	130
	No cases have yet been contracted in the UK. All current cases in UK travel related. Between 2012 to 2016 there were a total of 2,127 Dengue cases imported to the UK.			

CHIKUNGUNYA VIRUS



Aedes aegypti and *Aedes albopictus* mosquitoes transmit Chikungunya.



Rapid onset fever, and severe joint pain, which usually lasts for a few days but can last for weeks, months or even years. Other common signs and symptoms: joint swelling, muscle ache, headache, nausea, fatigue and rash.

The very old and very young are at higher risk for severe illness, which can increase the risk of death.



Aedes albopictus has been responsible for several outbreaks in Europe

No cases have yet been contracted in the UK.

Between 2012 and 2016 – 588 imported Chikungunya cases reported in the UK.

ZIKA VIRUS

	Zika virus is a newly emerging virus. <i>Aedes aegypti</i> and other vectors, including <i>Aedes albopictus</i> transmit Zika.			
	Most people have no symptoms. But can also cause an illness similar to Dengue fever. In its severe form, Zika virus infection is associated with neurological symptoms including Guillain-Barré syndrome (also known as 'locked-in syndrome').			
	Infection during pregnancy can cause:	infants to be born with disabilities	increased risk of miscarriage	risk of preterm birth
	Cases are currently travel related. Since the global outbreak in 2016, which included large numbers of Zika syndrome passed from pregnant mothers to infants, the number of Zika virus infections in travellers has declined.			

VECTOR AND VBD SURVEILLANCE AND CONTROL

The national Government has a multifaceted range of short- and long-term measures to address invasive mosquitoes, including enhanced surveillance and monitoring to inform ongoing policy; immunisation (where available); and a range of vector control measures. Mitigating climate change effects are also crucial to alleviate the burgeoning problem.

The UK Health Security Agency (UKHSA) oversees a mosquito reporting system, working closely with Local Authorities and other government agencies, including the Animal and Plant Health Agency, to coordinate national vector surveillance programmes and conduct research on the impact of climate and environmental change on vectors and their pathogens. Invasive mosquito traps are mostly based in southern England where the risk of these mosquitoes entering and establishing is greater, including ports of entry.

Mosquito surveillance takes place in Portsmouth Port over the summer months, undertaken by Portsmouth City Council Regulatory Services working in conjunction with the UK Health Security Agency. Traps are set up in strategic locations and routinely checked. If mosquito populations are identified, standing water can be treated with larvicides by the Regulatory Team.

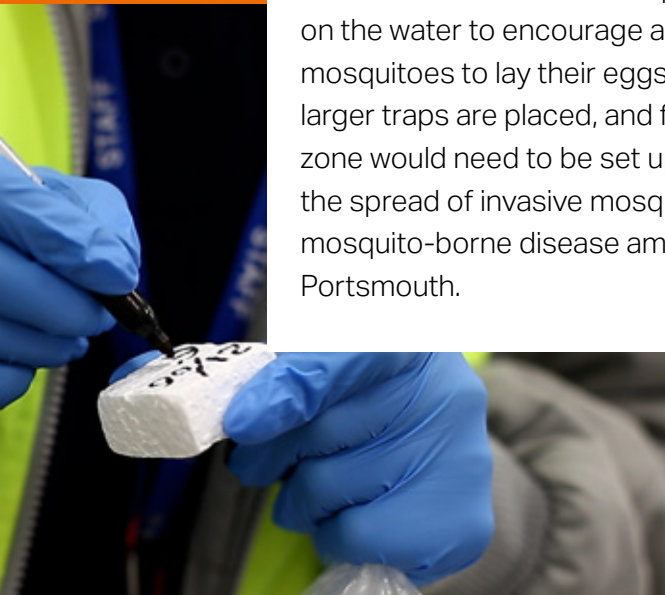
To date, no species of invasive mosquito has been identified in Portsmouth.

Elsewhere in the country, mosquito vectors have been detected through active surveillance programmes six times and controlled successfully by Local Authority teams working with the UKHSA.



CASE STUDY: MOSQUITO TRAPS AT PORTSMOUTH PORT

Mosquito traps are placed in 15 different strategic locations around Portsmouth International Port (PIP). These are gathered and sent to UKHSA via post for analysis for mosquito eggs on a fortnightly basis throughout summer and early autumn. The traps consist of a black pot, to mimic tree trunks where invasive mosquitoes are known to breed. They are filled with water and have a white polystyrene cube floating on the water to encourage any trapped invasive mosquitoes to lay their eggs. If eggs are discovered, larger traps are placed, and following this, an exclusion zone would need to be set up around the Port to limit the spread of invasive mosquitoes and reduce risk of mosquito-borne disease amongst the residents of Portsmouth.



Invasive mosquito surveillance has been in place at PIP since 2021. This was in response to the spread invasive mosquito species and mosquito-borne diseases, such as Dengue fever and Zika virus, in mainland Europe which the Port has close links to. Greater international travel trends amongst the general public and lack of available vaccinations for these mosquito-borne diseases were additional factors considered in setting up this surveillance programme. To date, we haven't found invasive mosquito eggs through this process.

WATCH THE
VIDEO



WHAT ELSE CAN WE DO?

Currently, the risk to the local population from invasive mosquito borne disease is very low. However, the UKHSA have stated that under warming temperatures, we can expect the introduction and establishment of invasive mosquito species in the UK, with the area around London already suitable for *Ae. Albopictus* survival.⁷⁵ Therefore, it is important to continue regular mosquito surveillance to limit this risk to the Portsmouth population.

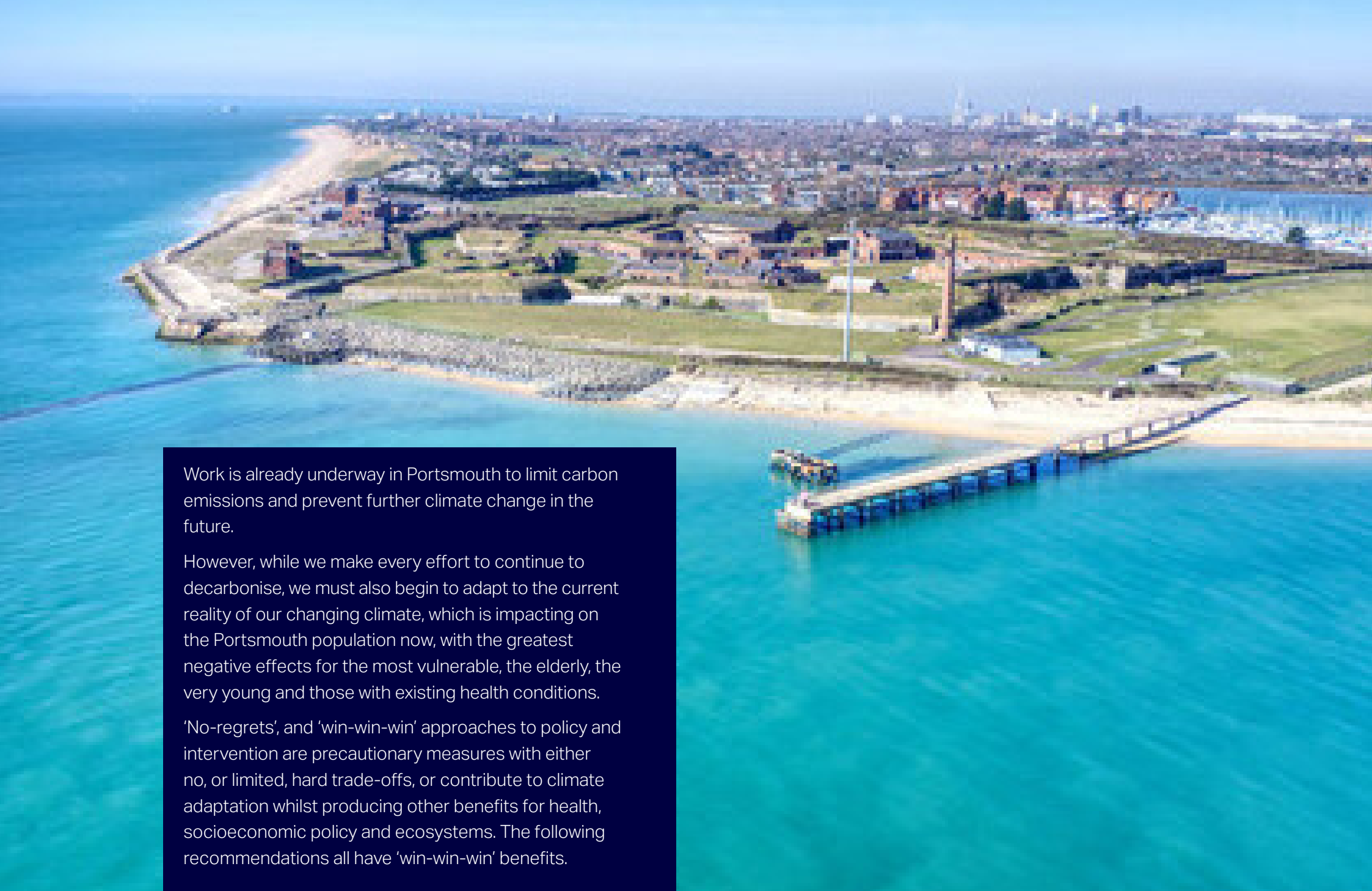
The 'Third Climate Change Risk Assessment' (CCRA3)⁷⁶ has given the risk to health from VBDs in the UK an urgency score of "more action needed", meaning that current adaptation is considered insufficient to reduce risks. Once a non-native vector or pathogen is established, it would be difficult for it to become eradicated. Enhanced surveillance and early detection of travel-related and locally acquired cases of mosquito-borne diseases are essential to implement timely and appropriate vector and disease control measures.

Some measures intended to mitigate the effects of climate change, such as roadside gully drains, and even household garden water storage (such as uncovered water-butts), can inadvertently provide more favourable habitats for both native and invasive mosquito species as some species breed in standing or shallow water.⁷⁷ Green infrastructure can provide habitat for urban ticks which transmit Lyme Disease. Carefully managed nature-based solutions are therefore important to keep vectors and people apart wherever possible, especially important in a densely populated city like Portsmouth.

Adaptation is also a crucial element in reducing the burden of vector-borne diseases. This includes routine vaccination where relevant, individual measures such as behavioural change and improving public awareness, so that people know how to avoid bites protect themselves from mosquitoes and other vectors.⁷⁸

It may also require changes to building design, such as screens on windows and doors and increased awareness among health services on the frontline and in diagnostics.⁷⁹

RECOMMENDATIONS: **WHAT MORE CAN WE DO?**



Work is already underway in Portsmouth to limit carbon emissions and prevent further climate change in the future.

However, while we make every effort to continue to decarbonise, we must also begin to adapt to the current reality of our changing climate, which is impacting on the Portsmouth population now, with the greatest negative effects for the most vulnerable, the elderly, the very young and those with existing health conditions.

'No-regrets', and 'win-win-win' approaches to policy and intervention are precautionary measures with either no, or limited, hard trade-offs, or contribute to climate adaptation whilst producing other benefits for health, socioeconomic policy and ecosystems. The following recommendations all have 'win-win-win' benefits.

EXTREME HEAT

A number of initiatives and plans are in place to tackle extreme heat in Portsmouth, particularly the most vulnerable. Mitigation measures already underway in the city include behavioural change messaging, use of national heat alert systems, sharing alerts with health and social care sites and energy efficiency measures for housing through work in Housing, Neighbourhood and Building Services via the Switched On and social housing improvement programmes.

In the future, this work could be expanded to provide improved awareness of protective behaviours and interventions, including improved response mechanisms and networks between public health, emergency planning, health and social care and the voluntary sector to provide safety netting in extreme heat for vulnerable individuals.

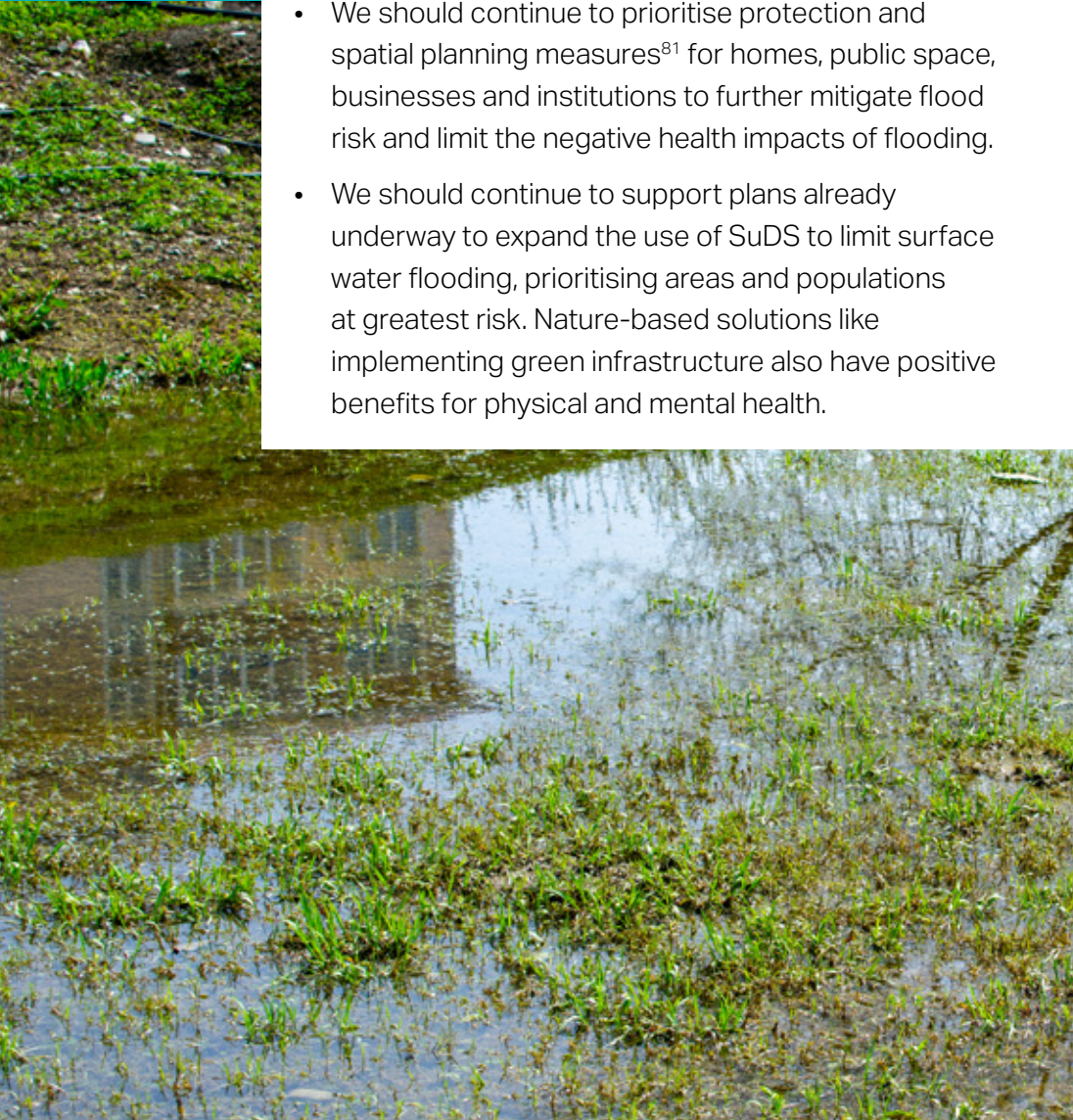
- Systematically maintaining and developing heat-resilient spaces in the city will ensure that all high-risk groups are given the support they need—older adults, children and those living in densely populated areas more susceptible to heat island effects, in accommodation that is poorly ventilated, insulated or overcrowded
- Heat mitigation measures also need to become standard in the planning and development process, for buildings and public space. New homes should adhere to building regulations, Decent Homes Standards, National Design Guide and National Model Design Codes to ensure thermal comfort.⁸⁰
- A programme of increased shading and increasing availability of greenspace is underway through the Greening Strategy. The model at Royal Albert Day Centre is part of broader work to assess heat risk in care homes, schools and play areas in the city, and could be expanded to include adaptation measures in those settings and in public spaces.

FLOODING

- We should continue to prioritise protection and spatial planning measures⁸¹ for homes, public space, businesses and institutions to further mitigate flood risk and limit the negative health impacts of flooding.
- We should continue to support plans already underway to expand the use of SuDS to limit surface water flooding, prioritising areas and populations at greatest risk. Nature-based solutions like implementing green infrastructure also have positive benefits for physical and mental health.



- In addition to supporting existing emergency plans in response to flooding, we should continue to work on identifying those at greatest risk and promote measures to ensure the continuity of the NHS services and health care facilities including residential care homes during flood events, for example using the NHS Green Plan and the Local Health Resilience Partnership to support this.
- Many small changes can have a big impact on flood water quantity and quality, and as a city we should recognise the co-benefits of flood risk management.



AIR POLLUTION

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- We can have a greater positive effect on both health and the environment if we more closely align the two agendas of air pollution and climate. Air pollutants and greenhouse gases often come from the same sources, such as diesel-fuelled vehicles. Emerging evidence (in press ⁸²) suggests that it is potentially more cost-effective for local authorities to integrate air quality and climate change policy. Integrating policy helps to manage any trade-off and justifies measures.
 - No single intervention to improve air quality is most effective on its own. A combined set of interventions tailored to the location achieves the maximum reductions in air pollution, many of which are underway in the city including active travel, electrification of transport, comprehensive air quality monitoring, clean energy through the Switched On programme and building efficiency.

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- However, more can be done in the city to improve air quality; in particular, doubling our efforts on:
 - Promoting a hierarchy approach as standard – prevent, mitigate, avoid air pollution
 - Routinely prioritising and promoting active travel over other forms of transport in policy, and adhere to NICE guidance on air pollution and physical activity: walking and cycling for active travel.⁸³
 - More effectively using urban planning and policy to reduce emissions and concentrations of air pollution, making a commitment to improving air quality in strategy documents that guide planning decisions. For example, expanding low emissions zones/low traffic neighbourhoods; promoting clean construction; increased use of green infrastructure to capture pollutants; reducing waste/landfill emissions.

VECTOR (INSECT) BORNE DISEASE

Currently, the risk to the local population from invasive mosquito borne disease is very low. However, the UKHSA have stated that under warming temperatures, we can expect the introduction and establishment of invasive mosquito species in the UK, with the area around London already suitable for *Ae. Albopictus* survival.⁸⁴ Therefore, it is important to continue regular mosquito surveillance to limit this risk to the Portsmouth population.

- Continued enhanced surveillance and early detection of travel-related and locally acquired cases of mosquito-borne diseases are essential to implement timely and appropriate vector and disease control measures.
- Some measures intended to mitigate the effects of climate change, such as roadside gully drains, and even household garden water storage (such as uncovered water-butts), can inadvertently provide more favourable habitats for both native and invasive mosquito species as some species breed in standing or shallow water.⁸⁵ Green infrastructure can provide habitat for urban ticks which transmit Lyme Disease. Carefully managed nature-based solutions are therefore important to keep vectors and people apart wherever possible, especially important in a densely populated city like Portsmouth.



- Adaptation will become increasingly important to reducing the burden of vector-borne diseases. This includes routine vaccination where relevant, individual measures such as behavioural change and improving public awareness, so that people know how to avoid bites protect themselves from mosquitoes and other vectors.⁸⁶

Adaptation also includes changes to building design, such as screens on windows and doors and increased awareness among health services on the frontline and in diagnostics.⁸⁷

REFERENCES

- 1 **Climate Change** – Our World in Data – <https://ourworldindata.org/climate-change>
- 2 **COP28 UAE Declaration On Climate And Health** – www.cop28.com/en/cop28-uae-declaration-on-climate-and-health
- 3 **Climate change: health effects in the UK** – GOV.UK – www.gov.uk/government/publications/climate-change-health-effects-in-the-uk
- 4 **Global Burden of Disease 2021: Findings from the GBD 2021 Study, Seattle, WA: IHME, 2024** – Institute for Health Metrics and Evaluation (IHME).
- 5 **GBD Compare** – Institute for Health Metrics and Evaluation – <https://vizhub.healthdata.org/gbd-compare>
- 6 **The Marmot Review 10 years on** – Michael Marmot, Jessica Allen, Tammy Boyce, Peter Goldblatt, Joana Morrison (2020) Health equity in England: London: Institute of Health Equity – www.instituteofhealthequity.org/resources-reports/marmot-review-10-years-on/the-marmot-review-10-years-on-full-report.pdf
- 7 **Epigenetics and Health** – Houses of Parliament, Parliamentary Office of Science & Technology (POST) – <https://researchbriefings.files.parliament.uk/documents/POST-PN-451/POST-PN-451.pdf>
- 8 **Synergistic Epidemic or Syndemic: An Emerging Pattern of Human Diseases** – Shelke, A, Shelke, S, Acharya, S and S Shukla (2023) Cureus. 2023 Nov; 15(11): e48286 – [https://pmc.ncbi.nlm.nih.gov/articles/PMC10696284/#:~:text=A%20syndemic%20interacts%20with%20a,%20Dcommunicable%20diseases%20\(PLWNCD\).](https://pmc.ncbi.nlm.nih.gov/articles/PMC10696284/#:~:text=A%20syndemic%20interacts%20with%20a,%20Dcommunicable%20diseases%20(PLWNCD).)
- 9 **Climate change: health effects in the UK** – UK Health Security Agency (UKHSA). 2023
- 10 **One Health** – World Health Organization (WHO) – www.who.int/news-room/fact-sheets/detail/one-health
- 11 **Nature-based Solutions for Climate Change in the UK: A Report by the British Ecological Society** – Stafford, R., Chamberlain, B., Clavey, L., Gillingham, P.K., McKain, S., Morecroft, M.D., Morrison-Bell, C. and Watts, O. (Eds.) (2021). London, UK – www.britishecologicalsociety.org/wp-content/uploads/2022/02/NbS-Report-Final-Updated-Feb-2022.pdf
- 12 **The Economics of Biophilia: Why designing with nature in mind makes financial sense. Second edition** – Catherine O. Ryan, William D. Browning, & Dakota B. Walker (2023). New York: Terrapin Bright Green, LLC – www.terrapinbg.com/report/eob-2
- 13 **2023: The warmest year on record globally** – Met Office – www.metoffice.gov.uk/about-us/news-and-media/media-centre/weather-and-climate-news/2024/2023-the-warmest-year-on-record-globally
- 14 **How is climate change impacting the world's ocean** – United Nations (UN) – www.un.org/en/climatechange/science/climate-issues/ocean-impacts
- 15 **Climate change: health effects in the UK** – GOV.UK – www.gov.uk/government/publications/climate-change-health-effects-in-the-uk
- 16 **A leading data scientist's journey from doomism to climate hope** – BBC Future – www.bbc.com/future/article/20240206-hannah-ritchie-sustainability-data-spreads-hope-not-doomism
- 17 **Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change** – IPCC, 2012: [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 582 pp.
- 18 **UK and Global extreme events – Heatwaves** – Met Office – www.metoffice.gov.uk/research/climate/understanding-climate/uk-and-global-extreme-events-heatwaves
- 19 **A milestone in UK climate history** – Met Office – www.metoffice.gov.uk/about-us/news-and-media/media-centre/weather-and-climate-news/2022/july-heat-review
- 20 **Local Climate Adaptation Tool** – <https://lcat.uk>
Climate Risk Indicators – <https://uk-cri.org>
- 21 Defined as day(s) on which a Level 3 Heat Health Alert is issued and/or day(s) when the mean Central England Temperature is greater than 20°C.
- 22 **Excess mortality during heat-periods: 1 June to 31 August 2022** – Office for National Statistics (ONS) and UKHSA, released 7 October 2022, ONS website, statistical article – www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/articles/excessmortalityduringheatperiods/englandandwales1juneto31august2022
- 23 **UK Climate Risk Independent Assessment (CCRA3)** – UK Climate Risk – www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA3-Chapter-5-FINAL.pdf
- 24 An urban health island is a metropolitan area that is significantly warmer than the rural areas surrounding it. Urban areas are more densely populated and densely constructed, generating heat. Map <https://uk.treeequityscore.org/map#12.04/50.8188/-1.05294>
- 25 **Local Climate Adaptation Tool** – <https://lcat.uk>
- 26 **Adverse Weather and Health Plan: supporting evidence (2023 to 2024)** – UKHSA (2023) – www.gov.uk/government/publications/adverse-weather-and-health-plan
- 27 **Health Effects of Climate Change (HECC) in the UK: 2023 report. Chapter 2. Temperature effects on mortality in a changing climate** – UKHSA – <https://assets.publishing.service.gov.uk/media/659ff712e96df5000df844bf/HECC-report-2023-chapter-2-temperature.pdf>
- 28 **Hot weather and health: guidance and advice** – UKHSA – www.gov.uk/government/collections/hot-weather-and-health-guidance-and-advice
- 29 **Adverse Weather and Health Plan** – UKHSA – www.gov.uk/government/publications/adverse-weather-and-health-plan; **Heatwave Plan** – Portsmouth City Council (PCC) and Southampton City Council – www.portsmouth.gov.uk/wp-content/uploads/2023/06/PCC-and-SCC-Joint-Heatwave-Plan-2023-V5-accessible.pdf
- 30 **Greening Portsmouth Strategy** – PCC – democracy.portsmouth.gov.uk/documents/s26330/Greening%20Portsmouth%20Strategy%20appendix.pdf; **Climate Change Strategy** – PCC – www.portsmouth.gov.uk/wp-content/uploads/2022/12/Climate-Change-Strategy-2022-Accessible.pdf
- 31 **Health Effects of Climate Change (HECC) in the UK: 2023 report. Chapter 2. Temperature effects on mortality in a changing climate** – UKHSA – <https://assets.publishing.service.gov.uk/media/659ff712e96df5000df844bf/HECC-report-2023-chapter-2-temperature.pdf>
- 32 **Securing Healthy Homes at the local level – A guide for local government in England on adopting the Healthy Homes Principles** – Town and Country Planning Association (TCPA) – www.tcpa.org.uk/wp-content/uploads/2024/06/Healthy-Homes-technical-guide-for-local-implementation.pdf
- 33 **Third UK Climate Change Risk Assessment (CCRA3) future flood risk: final report prepared for the Committee on Climate Change** – Sayers PB et al., UK 2020
- 34 **Adverse Weather and Health Plan: Supporting evidence** – UKHSA (2024) – https://assets.publishing.service.gov.uk/media/65fdb71af1d3a0001d32ae74/Adverse_Weather_and_Health_Plan_supporting_evidence_1_.pdf
- 35 **The English National Study of Flooding and Health - Summary of the evidence generated to date** – Public Health England et al (2020)

- 36 **Health Effects of Climate Change (HECC) in the UK: 2023 report – Chapter 3: Climate change, flooding, coastal change and public health** – UKHSA (2024) – <https://assets.publishing.service.gov.uk/media/657086ad746930000d488919/HECC-report-2023-chapter-3-flooding.pdf>
- 37 **Flood map for planning (Flood risk information for this location)** – GOV.UK – <https://flood-map-for-planning.service.gov.uk/flood-zone-results?polygon=%5b%5b462327.97604%5d,%5b462586.106748%5d,%5b469536.106822%5d,%5b469093.97991%5d,%5b462327.97604%5d%5d¢er=%5b465931.102213%5d&location=Portsmouth>
- 38 **Response to Climate Emergency Strategy appendix A** – PCC – [https://democracy.portsmouth.gov.uk/documents/s25687/Response to Climate Emergency Strategy appendix A.pdf](https://democracy.portsmouth.gov.uk/documents/s25687/Response%20to%20Climate%20Emergency%20Strategy%20appendix%20A.pdf)
- 39 **Coastal Partners** – Coastal Partners – <https://coastalpartners.org.uk>
- 40 **Sustainable Urban Drainage Systems for Roads** – SCOTS – www.scotsnet.org.uk/phone/sustainable-urban-drainage-systems-for-roads.html; **Highways Developer Design Guidance – Sustainable Drainage Systems** – Manchester City Council – www.manchester.gov.uk/downloads/download/7569/highways_developer_design_guidance_%E2%80%93_sustainable_drainage_systems; **SuDS in London – a guide** – Transport for London (TfL) – <https://content.tfl.gov.uk/sustainable-urban-drainage-november-2016.pdf>; **Lincolnshire Development Roads and Sustainable Drainage Design Approach** – Lincolnshire County Council – www.lincolnshire.gov.uk/downloads/file/2061/lincolnshire-development-roads-and-sustainable-drainage-design-approach; **Local SuDS Design Guidance** – Southampton City Council – ; **The Essex Design Guide** – The Essex Design Guide – www.essexdesignguide.co.uk
- 41 **Sustainable drainage systems review** – GOV.UK – www.gov.uk/government/publications/sustainable-drainage-systems-review
- 42 **Highways Developer Design Guidance – Sustainable Drainage Systems** – Manchester City Council – www.manchester.gov.uk/downloads/download/7569/highways_developer_design_guidance_%E2%80%93_sustainable_drainage_systems; **SuDS in London – a guide** – TfL – <https://content.tfl.gov.uk/sustainable-urban-drainage-november-2016.pdf>
- 43 **Strategic Flood Risk Assessment 2016 Update** – Partnership for South Hampshire (PFSH) – www.portsmouth.gov.uk/wp-content/uploads/2021/12/PUSH-Strategic-Flood-Risk-Assessment-2016-update-main-report-February-2016-accessible.pdf
- 44 **How to recover from flooding** – GOV.UK – www.gov.uk/government/publications/flooding-and-health-advice-for-frontline-responders/how-to-recover-from-flooding
- 45 **Flood Response Plan** – PCC – www.portsmouth.gov.uk/wp-content/uploads/2020/04/Flood-Response-Plan-Civil-contingencies-unit.pdf
- 46 **Health Effects of Climate Change (HECC) in the UK: 2023 report – Chapter 3: Climate change, flooding, coastal change and public health** – UKHSA (2024) – <https://assets.publishing.service.gov.uk/media/657086ad746930000d488919/HECC-report-2023-chapter-3-flooding.pdf>
- 47 **Health Matters: air pollution** – Public Health England (2018) – https://assets.publishing.service.gov.uk/media/6601897e65ca2fa78e7da777/CD7.3.G_Guidance_Health_Matters_Air_Pollution.pdf
- 48 **Improving outdoor air quality and health: review of interventions** – GOV.UK – www.gov.uk/government/publications/improving-outdoor-air-quality-and-health-review-of-interventions
- 49 **Health Matters: air pollution** – Public Health England (2018) – https://assets.publishing.service.gov.uk/media/6601897e65ca2fa78e7da777/CD7.3.G_Guidance_Health_Matters_Air_Pollution.pdf
- 50 **Associations of long-term average concentrations of nitrogen dioxide with mortality: a report by the Committee on the Medical Effects of Air Pollutants** – Public Health England for the Committee on the Medical Effects of Air Pollutants (COMEAP) (2018) – https://assets.publishing.service.gov.uk/media/5b76d41040f0b643410888e5/COMEAP_NO2_Report.pdf; **Estimating local mortality burdens associated with particulate air pollution** – GOV.UK – <https://www.gov.uk/government/publications/estimating-local-mortality-burdens-associated-with-particulate-air-pollution>
- 51 **Indoor Air Quality, POSTbrief 54** – UK Parliament POST – G Duffield and S Bunn, 2023 – <https://researchbriefings.files.parliament.uk/documents/POST-PB-0054/POST-PB-0054.pdf>
- 52 **Chief Medical Officer's Annual Report 2022: Air pollution** – Chief Medical Officer, Department of Health and Social Care (DHSC), 2022. Adapted from Public Health England. Health matters: Air pollution. London: Public Health England; 2018.
- 53 **What you need to know about climate change and air pollution** – World Bank Group – www.worldbank.org/en/news/feature/2022/09/01/what-you-need-to-know-about-climate-change-and-air-pollution
- 54 **Combined effects of air pollution and heat exposure in Europe: time for action** – European Environment Agency – www.eea.europa.eu/en/newsroom/editorial/combined-effects-of-air-pollution-and-heat-exposure
- 55 **Managing Exacerbations in Thunderstorm Asthma: Current Insights** – National Library of Medicine/PMC PubMed Central® – <https://pubmed.ncbi.nlm.nih.gov/articles/PMC8436255>
- 56 **Health Effects of Climate Change (HECC) in the UK: 2023 report – Chapter 4. Impacts of climate change and policy on air pollution and human health** – UKHSA – <https://assets.publishing.service.gov.uk/media/6570a68b7469300012488948/HECC-report-2023-chapter-4-outdoor-air-quality.pdf>
- 57 **The Impact of Pollution on Worker Productivity** – Graff Zivin J, Neidell M. American Economic Review. 2012;102(7):3652-73.
- 58 **Traffic-related air pollution and health co-benefits of alternative transport in Adelaide, South Australia** – Xia T, Nitschke M, Zhang Y, Shah P, Crabb S, Hansen A. Environ Int. 2015;74:281-90; **Public health benefits of strategies to reduce greenhouse-gas emissions: urban land transport** – Woodcock J, Edwards P, Tonne C, Armstrong BG, Ashiru O, Banister D, et al. The Lancet. 374(9705):1930-43.
- 59 **Public Health Outcomes Framework, Public Health Profiles** – Office for Health Improvement and Disparities (2024) – <https://fingertips.phe.org.uk> Date accessed: 10 May 2024
- 60 **WHO Global air quality guidelines: particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide** – WHO, 2021 www.who.int/publications/i/item/9789240034228
- 61 **Health effects of particulate matter: Policy implications for countries in eastern Europe, Caucasus and central Asia** – WHO, 2013 – www.euro.who.int/_data/assets/pdf_file/0006/189051/Health-effects-of-particulate-matter-final-Eng.pdf
- 62 **Reporting – Cleaner Air Portsmouth** – (PCC) – <https://cleanerairportsmouth.co.uk/reporting>
- 63 **What are we doing to lower air pollution – Cleaner Air Portsmouth** – PCC – <https://cleanerairportsmouth.co.uk/what-are-we-doing>
- 64 **Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006** – Defra.
- 65 **Every breath we take: the lifelong impact of air pollution. Report of a working party. February 2016** – Royal College of Physicians (RCP), and Royal College of Paediatrics and Child Health (RCPCH).
- 66 **Air quality vulnerability index, pilot data** – UKHSA.
- 67 **Census, 2021. Number of cars or vans – Census Maps** – ONS. Contains public sector information licensed under the Open Government Licence v3.0 – www.ons.gov.uk/census/maps/choropleth/housing/number-of-cars-or-vans/number-of-cars-3a/no-cars-or-vans-in-household?lad=E06000044.

- 68 **Chief Medical Officer's Annual Report 2022: Air pollution** – Chief Medical Officer, DHSC, 2022.
- 69 **Neighbourhood-level interventions to reduce outdoor air pollution: evidence synthesis** – E Hock et al. In press .
- 70 **Air pollution: outdoor air quality and health** – National Institute for Health and Care Excellence (NICE) – www.nice.org.uk/guidance/ng70/chapter/Recommendations#planning; **Physical activity: walking and cycling** – NICE – www.nice.org.uk/guidance/ph41
- 71 **What we say about... Air quality** – Association of Directors of Public Health (ADPH) www.adph.org.uk/resources/what-we-say-about-air-quality
- 72 **'Identification of the trade-off feasibility region between positive and negative traits of a predator-prey system between dengue virus and Aedes vector' Conference Paper, International Conference on Computational and Mathematical Modelling 2024** – Chathurangika, P & K De Silva (2024) – www.researchgate.net/publication/377968612_Identification_of_the_trade-off_feasibility_region_between_positive_and_negative_traits_of_a_predator-prey_system_between_dengue_virus_and_Aedes_vector
- 73 **Aedes albopictus - current known distribution: May 2024** – European Centre for Disease Prevention and Control (ECDC) – www.ecdc.europa.eu/en/publications-data/aedes-albopictus-current-known-distribution-may-2024; **Aedes aegypti - current known distribution: May 2024** – ECDC – www.ecdc.europa.eu/en/publications-data/aedes-aegypti-current-known-distribution-may-2024
- 74 **Port statistics** – Portsmouth International Port – <https://portsmouth-port.co.uk/about-us/port-statistics>
- 75 **UKHSA Advisory Board: core preparedness for environmental hazards** – UKHSA – www.gov.uk/government/publications/ukhsa-advisory-board-meeting-papers-march-2024/ukhsa-advisory-board-core-preparedness-for-environmental-hazards#:~:text=Under%20warming%20temperatures%2C%20we%20can,incl%20dengue%2C%20chikungunya%20and%20Zika
- 76 **UK Climate Change Risk Assessment 2022** – HM Government – <https://assets.publishing.service.gov.uk/media/61e54d8f8fa8f505985ef3c7/climate-change-risk-assessment-2022.pdf>
- 77 **Greening Up For Mosquitoes: A Comparison of Green Stormwater Infrastructure in a Semi-arid Region** – Brown HE, Keith L, Madera-Garcia V, Taylor A, Ramirez N, Ogata I. J Am Mosq Control Assoc. 2022 Jun 1;38(2):109-112. doi: 10.2987/21-7055. PMID: 35588179.
- 78 **Global Vector Control Response 2017–2030** – WHO and TDR (2017) – <https://iris.who.int/bitstream/handle/10665/259205/9789241512978-eng.pdf>
- 79 **Health Effects of Climate Change (HECC) in the UK: 2023 report – Chapter 8. Direct and indirect effects of climate change on vectors and vector-borne diseases in the UK** – UKHSA – <https://assets.publishing.service.gov.uk/media/65708af2809bc3001330819c/HECC-report-2023-chapter-8-vector-borne-diseases.pdf>
- 80 **Securing Healthy Homes at the local level – A guide for local government in England on adopting the Healthy Homes Principles** – TCPA – www.tcpa.org.uk/wp-content/uploads/2024/06/Healthy-Homes-technical-guide-for-local-implementation.pdf
- 81 **Health Impacts of Climate Change Report 2023 HECC report 2023. Chapter 3: Climate change, flooding, coastal change and public health** – UKHSA (2024) – <https://assets.publishing.service.gov.uk/media/657086ad746930000d488919/HECC-report-2023-chapter-3-flooding.pdf>
- 82 **'Neighbourhood-level interventions to reduce outdoor air pollution: evidence synthesis' in EPIC Integrating Action on Air Quality and Climate Change: A Guide for Local Authorities** – E Hock et al. (2023)
- 83 **Air pollution: outdoor air quality and health** – National Institute for Health and Care Excellence (NICE) – www.nice.org.uk/guidance/ng70/chapter/Recommendations#planning; **Physical activity: walking and cycling** – NICE – www.nice.org.uk/guidance/ph41
- 84 **UKHSA Advisory Board: core preparedness for environmental hazards** – GOV.UK – www.gov.uk/government/publications/ukhsa-advisory-board-meeting-papers-march-2024/ukhsa-advisory-board-core-preparedness-for-environmental-hazards#:~:text=Under%20warming%20temperatures%2C%20we%20can,incl%20dengue%2C%20chikungunya%20and%20Zika
- 85 **Greening Up For Mosquitoes: A Comparison of Green Stormwater Infrastructure in a Semi-arid Region** – Brown HE, Keith L, Madera-Garcia V, Taylor A, Ramirez N, Ogata I. J Am Mosq Control Assoc. 2022 Jun 1;38(2):109-112. doi: 10.2987/21-7055. PMID: 35588179.
- 86 **Global Vector Control Response 2017–2030** – WHO and TDR (2017) – <https://iris.who.int/bitstream/handle/10665/259205/9789241512978-eng.pdf>
- 87 **Health Effects of Climate Change (HECC) in the UK: 2023 report – Chapter 8. Direct and indirect effects of climate change on vectors and vector-borne diseases in the UK** – UKHSA – <https://assets.publishing.service.gov.uk/media/65708af2809bc3001330819c/HECC-report-2023-chapter-8-vector-borne-diseases.pdf>



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