HEALTH IMPACTS OF CLIMATE CHANGE

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PUBLIC HEALTH DEVON COUNTY COUNCIL

2020

Contents

1 Introduction

The UK Climate Change Risk Assessment identified six priority risks and opportunities (1).

These are:

1. Flooding and coastal change risks to communities, businesses and infrastructure
2. Risks to health, well-being and productivity from high temperatures
3. Risks of shortages in the public water supply, and for agriculture, energy generation and industry, with impacts on freshwater ecology
4. Risks to natural capital, including terrestrial, coastal, marine and freshwater ecosystems, soils and biodiversity
5. Risks to domestic and international food production and trade
6. New and emerging pests and diseases, and invasive non-native species, affecting people, plants and animals

The following report considers the impact of climate and environmental change on health. The first chapter lays out the interdependent relationship between the environment and human health. The following chapters consider the health impacts within the six identified priorities. Section 3. Extreme Weather, address priorities 1 and 2. Impacts of environmental change on air quality and health are addressed separately in Section 4. Section 5. Water, addresses priority 3 and Section 6. Food, addresses priorities 4 and 5. Section 7. Disease, addresses priority point 6. Section 8. Mental Health, considers the environmental change impacts on mental health and wellbeing which is not covered in the UK Climate Change Risk Assessment.

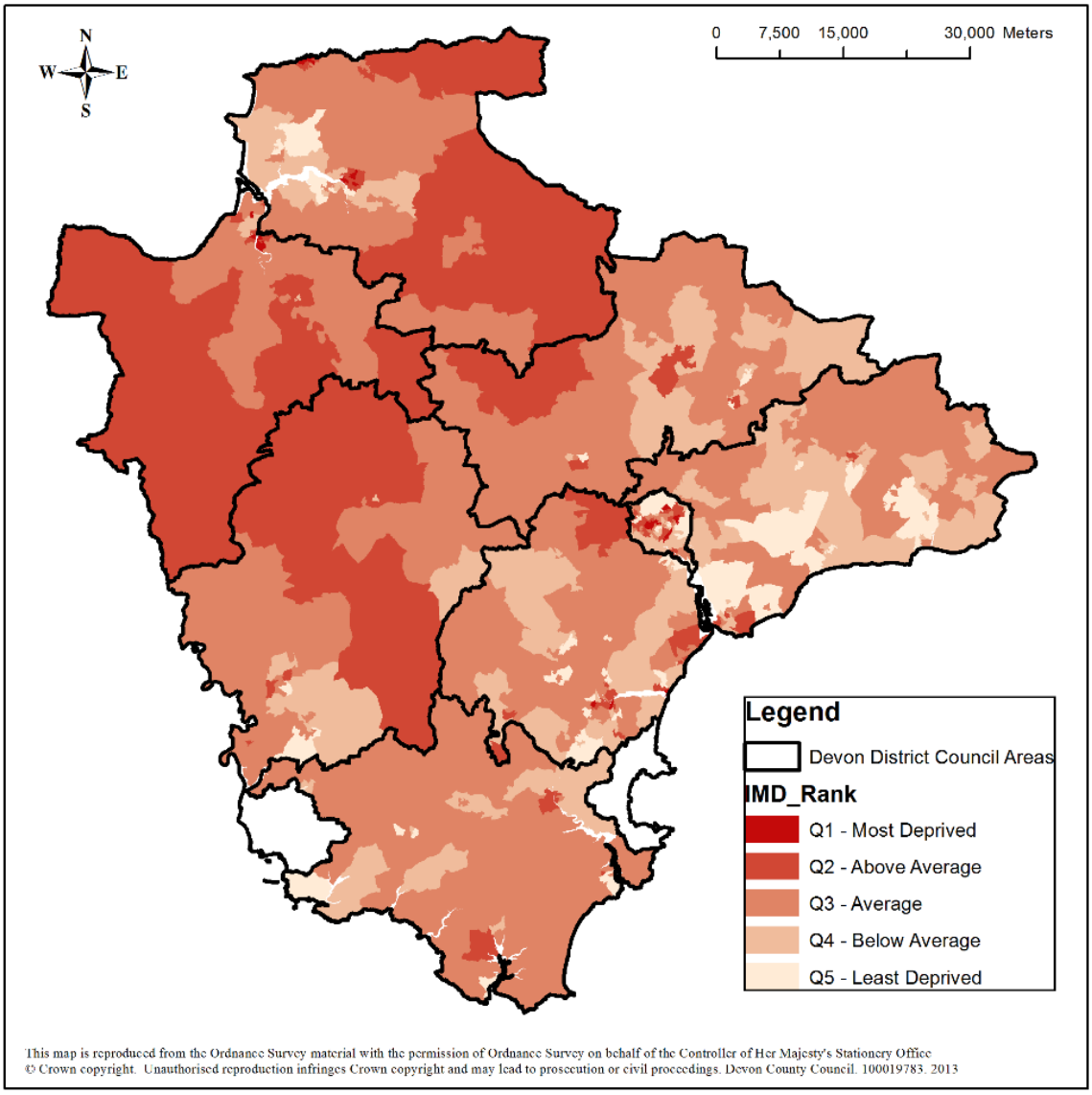
The impacts of climate change on health are not be universal. There is increasing evidence to suggest the most vulnerable in the population will be most affected: older people, infants, homeless people, those with severe chronic illnesses, and people with alcohol or drug dependencies. Increased fuel and food prices, reduced access to heating, cooling, health services, education and food security will all contribute to inequalities in population health in the face of climate change. There are also likely to be geographical inequalities, with urban and rural populations facing different challenges (2).

Overall levels of deprivation in Devon are lower compared to the England average, however around 5% of the Devon population live in the most deprived areas (top 20%) relative to England (Map 6.1). This equates to approximately 38,000 persons and includes areas within:

- Exeter
- Ilfracombe
- Barnstaple
- Bideford
- Dawlish
- Dartmouth
- Teignmouth
- Newton Abbot

- Tiverton

Figure 1.1. Map of Devon showing Lower Super Output Areas according to Index of Multiple Deprivation, 2015



Source: Indices of Deprivation 2015, Department for Communities and Local Government

Rural areas in Devon are generally more deprived than rural areas elsewhere in England whereas urban areas in Devon tend to be less deprived than urban areas in England. There are several rural towns which are more deprived that sit outside lesser deprived urban towns and these include:

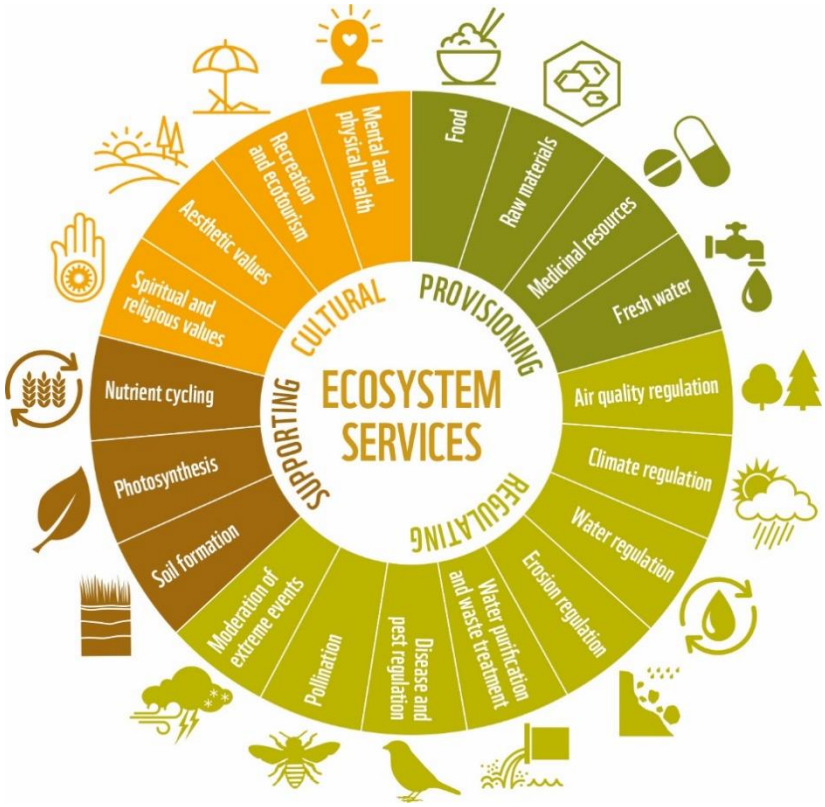
- Crediton
- Great Torrington
- Holsworthy
- Honiton
- Okehampton

- South Molton
- Tavistock

2 The history of planetary and human health

Human health is better today than at any time in history. Unparalleled advances in public health, health care, education, human rights legislation, and technological development have brought great benefits to humanity, albeit inequitably. Globally, life expectancy has increased from 47 years in 1950-1955, to 69 years in 2005-2010. Death rates in children under five years of age have decreased from 214 per thousand live births in 1950-1955, to 59 in 2005–2010 and the total number of people living in poverty has fallen by 0.7 billion over the past 30 years (3). The environment has been the foundation for humanity's progress. The Earth's ecosystems provide goods and services that are essential to human health and wellbeing. These include services such as maintaining a constant climate and the provision of clean air, and goods such as food and fuel (Figure 2.1). Health gains, however, have been achieved at the cost of eroding the Earth's natural systems. The unsustainable exploitation of the environment is likely to be at the expense of other populations, either now or in the future, or both.

Figure 2.1: Ecosystem Services (4)



Credit: Living Planet Report 2016, Figure 25; Published in October 2016 by WWF – World Wide Fund for Nature (formerly World Wildlife Fund), Gland, Switzerland ("WWF")
https://wwf.panda.org/knowledge_hub/all_publications/living_planet_report_timeline/lpr_2016/

Degradation of the environmental has been driven by highly inequitable, inefficient, and unsustainable patterns of resource consumption and technological development, along with population growth. Patterns of production and consumption are often inefficient. Gross inefficiencies exist in food production, water use and energy use, for example, about a third of global energy use is dissipated as waste heat. Technological development has underpinned humanity's exploitation of the environment; although many technological advances increase resource use efficiency, frequently this does not result in an overall reduction in the environmental footprint due to increasing disposable income being used for consumption of other goods.

The world population is projected to reach 9.7 billion in 2050 and 10.9 billion in 2100 (5). Population growth is unlikely to end this century without unprecedented reductions in fertility. Population growth increases consumption of material resources, places pressure on biodiversity and increases greenhouse gas emissions. The urban transition from rural to city living means that most of the world's population now live in towns and cities. By the middle of the 21st century, another two to three billion people will need to be housed in cities.

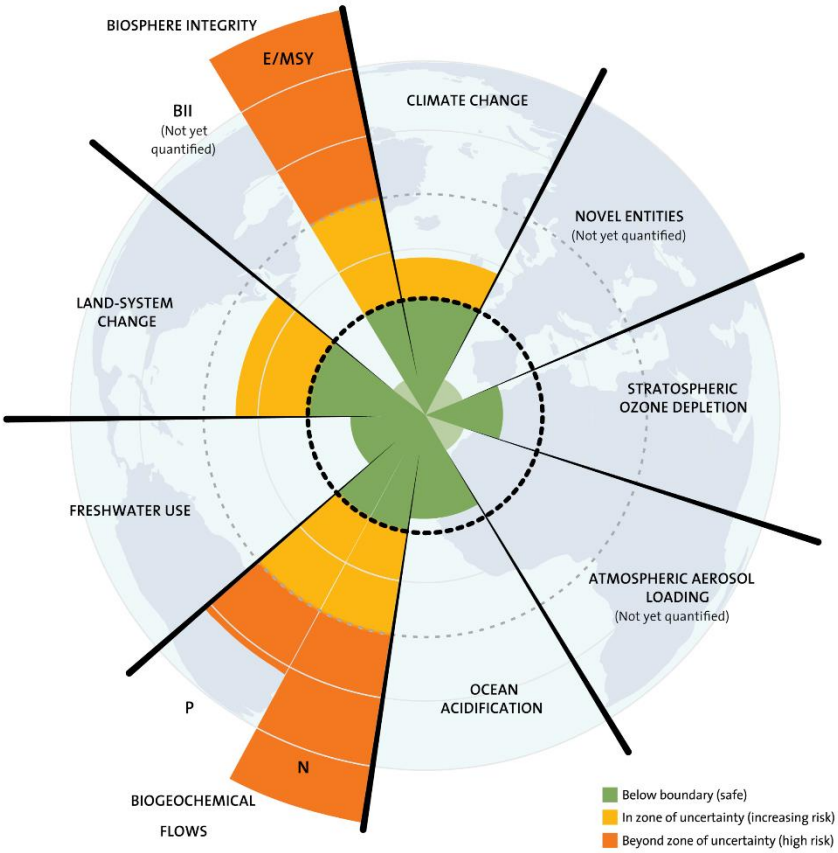
It is difficult to overstate the scale of human alteration to the natural world (3):

- The concentrations of major greenhouse gases are at their highest levels for at least the past 800,000 years.
- Annually roughly half of all accessible freshwater is appropriated for human use and more than 60% of the world's rivers have been damned affecting over 0.5 million km of river.
- About a third of the ice-free and desert-free land surface of the planet has been converted to cropland or pasture.
- Tillage agriculture is causing soil erosion that exceeds soil formation by 10 to 100 times and globally 55% of desertification is caused by human activity.
- More than 2.3 million km^2 of primary forest has been cut down since 2000.
- Species are being driven to extinction at a rate more than 100 times that observed in the fossil record and many remaining species are decreasing in number.

Recent human development has taken place within the relatively stable climatic conditions of the 'Holocene' epoch, a geological period that began about 12,000 years ago. The environmental conditions that fostered humanities extraordinary growth are beginning to shift as humanity has become a primary determinant of Earth's biophysical conditions. A new term has arisen for the present geological epoch, the 'Anthropocene'. This is the first time a new geological epoch may be marked by what a single species (*Homo sapiens*) has consciously done to the planet. The climate has changed more rapidly, oceans are acidifying, and entire biomes are disappearing, and these changes are occurring within an extremely condensed period of time. Rapid and irreversible changes in the Earth's environment may lead to a much less hospitable state and a deterioration of human development and health. Such is the magnitude of our impact on the planet that the Anthropocene might be characterised as the world's sixth mass extinction event (4).

The Planetary Boundaries concept, developed by the Stockholm Resilience Centre, describes the safe operating space for nine biological and physical processes and systems that are important to the maintenance of the Earth's functions on which human life relies (Figure 2.2). Of the nine identified planetary boundaries, four have been crossed as a result of human activity. They are: climate change, loss of biosphere integrity, land-system change and altered biogeochemical cycles. Climate change and biosphere integrity are considered 'core boundaries'. Significantly altering either of these will drive the Earth's system into a new state. Ocean acidification is estimated to be nearing the identified threshold and freshwater use is breaching the threshold in some regions (6). The ability of the planet's ecosystems to sustain future generations can no longer be taken for granted (7).

Figure 2.2: Planetary Boundaries (8)



Credit: J. Lokrantz/Azote based on Steffen et al. 2015

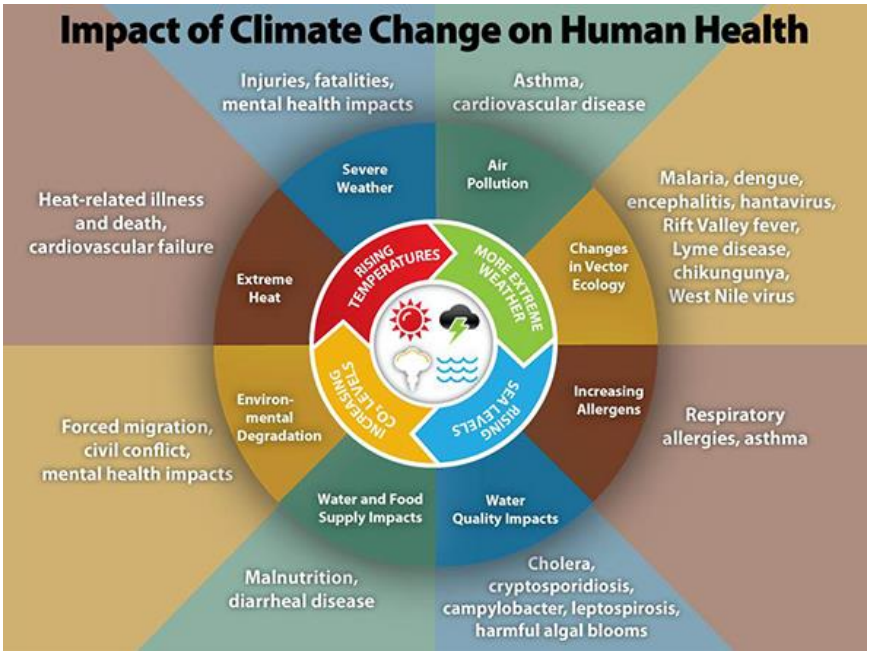
The natural environment underpins human health and wellbeing (Figure 2.3). The health impacts of global environmental change are far reaching and can be difficult to quantify. They may be direct, such as heat stress from climate change and indirect, such as social disruption (Figure 2.4). Since the mid-20th Century, the shrinking cryosphere in the Arctic and high-mountain areas has led to predominantly negative impacts on food security, water resources, water quality, livelihoods, health and well-being, infrastructure, transportation,

tourism and recreation, as well as culture of human societies (9). 23% of global deaths and 26% of deaths among children under five are due to modifiable environmental factors such as exposure to fine particulate air pollution and contaminated water (10). The World Health Organisation has called climate change "the greatest threat to global health of the 21st century".

Figure 2.3: The Wider Determinants of Health (11)

Credit: Barton, H. and Grant, M. (2006) A health map for the local human habitat. The Journal for the Royal Society for the Promotion of Health, 126 (6). pp. 252-253. ISSN 1466-4240 developed from the model by Dahlgren and Whitehead, 1991.Dahlgren G, Whitehead M (1991). "The main determinants of health" model, version accessible in: Dahlgren G, and Whitehead M. (2007) European strategies for tackling social inequities in health: Levelling up Part 2. Copenhagen: WHO Regional Office for Europe.

Figure 2.4: Impact of climate change on human health (12)



Credit: Centre for Disease Control and Prevention
Content source: National Center for Environmental Health
Available on the agency website for no charge -https://www.cdc.gov/climateandhealth/effects/default.htm
Reference to specific commercial products, manufacturers, companies, or trademarks does not constitute its endorsement or recommendation by the U.S. Government, Department of Health and Human Services, or Centers for Disease Control and Prevention

Planetary health describes the health of human civilisation and the state of the natural systems on which it depends. It is the achievement of the highest attainable standard of health, wellbeing, and equity worldwide through judicious attention to the human systems—political, economic, and social—that shape the future of humanity and the Earth's natural systems that define the safe environmental limits within which humanity can flourish (3). Increasing demands for resources and inequality add to the challenges of protecting and promoting human health in the Anthropocene epoch. Improved understanding of the connections between natural systems and health is needed, as well as a recognition of the benefits to health from the mitigation of damaging human activities and the conservation of natural systems. Achieving planetary health will require integrated policies to address the social, economic, and environmental determinants of health.

The adoption at the United Nations of the '17 Sustainable Development Goals' in 2015 reflects the recognition that the global status quo is untenable and represents a universal challenge. It calls for action by all countries to promote prosperity while protecting the planet (Figure 2.5) (13).

They provide an opportunity to tackle health, social and environmental challenges in an integrated way. In many cases policies to reduce environmental degradation have co-benefits for human health. Such co-benefits could offset part, and in some cases all, of the increased costs of mitigating action and may achieve health, environmental and economic benefits simultaneously (14).

Examples of health co-benefits include:

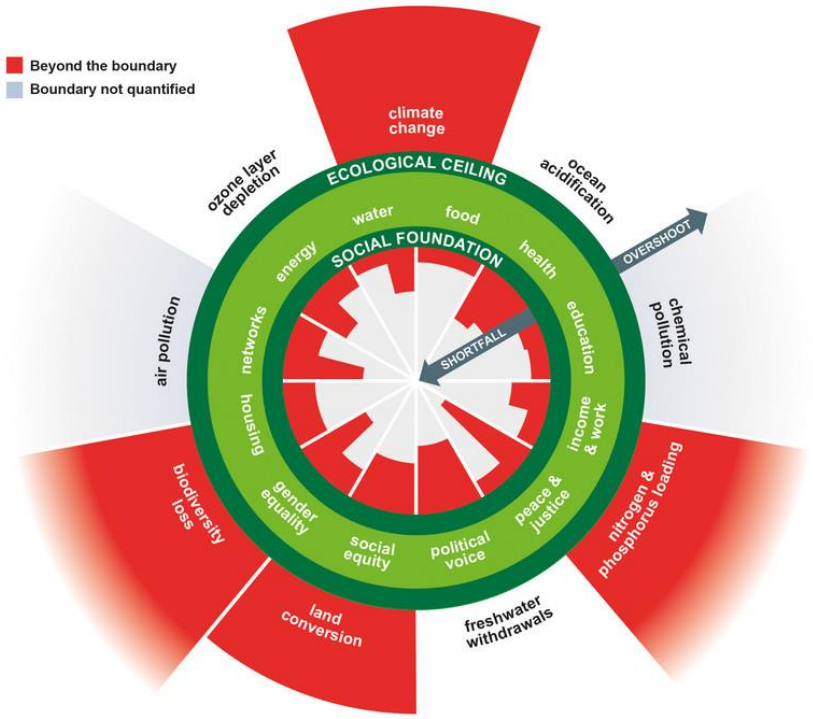
- reduced air pollution as a result of reduced fossil fuel combustion, which can help prevent respiratory disease
- reduced dietary saturated fat consumption as a result of moving towards more sustainable diets, which can help prevent cardiovascular disease
- increased physical activity as a result of reduced private car use, which can help prevent some cancers and obesity
- transport systems that prioritise active transport along with better urban land use, can help improve access for vulnerable groups, including people with disabilities, and lower wage earners, enhancing health equity (15).

Figure 2.5: Sustainable Development Goals (16)

Credit: Division for Sustainable Development Goals, United Nations
https://www.un.org/sustainabledevelopment/news/communications-material/

Humanity's 21st century challenge is to meet the needs of all within the means of the planet. The Doughnut of social and planetary boundaries is an approach to framing that challenge (Figure 2.6) (17). It adds to the framework of planetary boundaries, the demands of social justice, and sets a vision for an equitable and sustainable future. Social Return on Investment (SROI) is another useful approach that considers a much broader concept of value; it seeks to reduce inequality and environmental degradation, and improve wellbeing by incorporating social, environmental and economic costs and benefits (18).

Figure 2.6: The Doughnut of social and planetary boundaries (2017) (19)



3 Extreme weather events and communities

3.1 Background

Extreme weather events are becoming more common and intense worldwide as a consequence of human-induced climate change (20). These include; floods, storms, cyclones, wildfires, landslides, droughts and extreme temperatures. Such events effect people, property, society and the economy. Risks from extreme events are compounded by factors such as; demographic profiles, population density, technological and socioeconomic conditions, urbanisation in high risk zones and environmental degradation. Globally progress has been made towards the reduction of the number of lives lost in extreme events but the global cost of disasters is increasing (21).

Heat Waves

Recent years have seen some of the hottest summers recorded in England and Wales. In 1919, the mean summer temperature was 14.3 °C, in 2019 it was 16.1 °C (22). In July 2019 the UK experienced a record-breaking heatwave. Temperatures widely reached 35 to 36 °C and a temperature of 38.7 °C was recorded setting a new all-time temperature record. The exceptionally hot weather made conditions difficult, particularly for vulnerable individuals such as the frail and elderly. Services were also disrupted owing to train cancellations and main line closures due to concerns of rail buckling. Damage occurred to overhead electric wires as they sagged in the heat, and trackside vegetation caught fire in several locations (23).

Towns and cities are warmer than the surrounding areas due to human activity and are known as urban heat islands. The temperature difference is typically larger at night. Rising temperatures will exacerbate this effect. Good urban design is important in addressing this issue. “Green space” (such as parks and woodland) and “blue space” (water bodies such as rivers, canals and lakes) can reduce the urban “Heat Island Effect”. By adding 10% of green cover, maximum surface temperatures in high-density residential areas could be kept at or below the 1961-1990 baseline up to the 2080s (24).

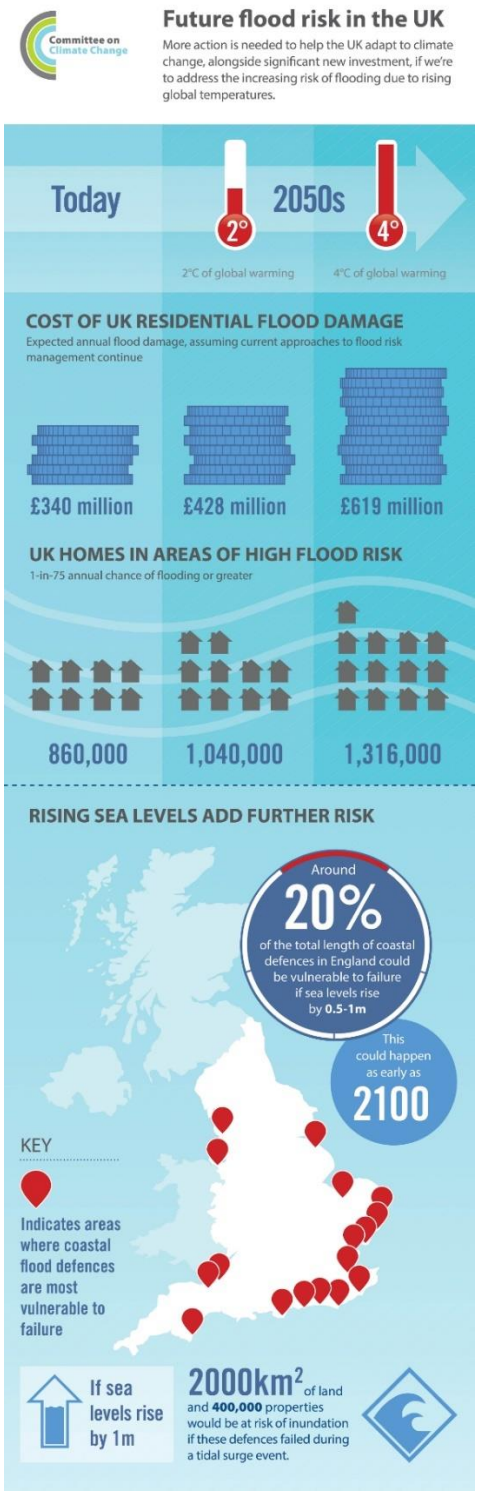
Flooding

In the UK six of the ten wettest years have occurred since 1998 and the top ten warmest years have all occurred since 2002 (25). The summer of 2018 was among the most warm, dry and sunny experienced for over 100 years. In the same year, Storm Callum was one of the most notable extreme rainfall events for the last 50 years causing significant flooding problems across parts of South Wales and South-West England.

Increases in heavy rain fall and extreme coastal water levels, increase the risk of river and coastal flooding. Mean sea level around the UK has risen by approximately 1.4 mm per year from the start of the 20th century. 20% of coastal defences could be vulnerable to failure by a rise of 0.5 -1 metre. This could happen as early of 2100.

The population at risk of exposure to flooding is expected to increase over time because of changes in population size and land-use. If global warming reaches 2˚C above pre-industrial levels by 2050, it is predicted that over a million UK homes would be in areas of high flood risk and the cost of flood damage could reach £428 million annually (26) (Figure 3.1).

Figure 3.1: Future Flood Risk in the UK (26)



Credit: Committee on Climate Change
https://www.theccc.org.uk/2016/01/15/infographic-future-flood-risk-in-the-uk/
https://www.theccc.org.uk/copyright-terms-conditions/

Communities

The United Kingdom's built environment includes 27 million homes with nearly 2 million commercial and industrial properties, hospitals, schools and other buildings. People living in developed countries typically spend 90% of their time indoors. Approximately 60% of this time is spent in the home. Environmental change will lead to warmer, wetter winters with reduced requirement for indoor heating and a reduction in cold weather-related deaths. Drier, hotter summers will cause uncomfortable indoor temperatures enhanced by the urban heat island effect, increased probability of flooding of buildings, and increased probability of building subsidence. These risks can impact both physical and mental health of the occupants and are likely to have a disproportionate effect on socially vulnerable groups. Enhanced building regulations can help new dwellings to become more resilient to climate change but it can be difficult and expensive to adapt existing building stock to cope with greater temperature and precipitation extremes (14).

3.2 Health impacts

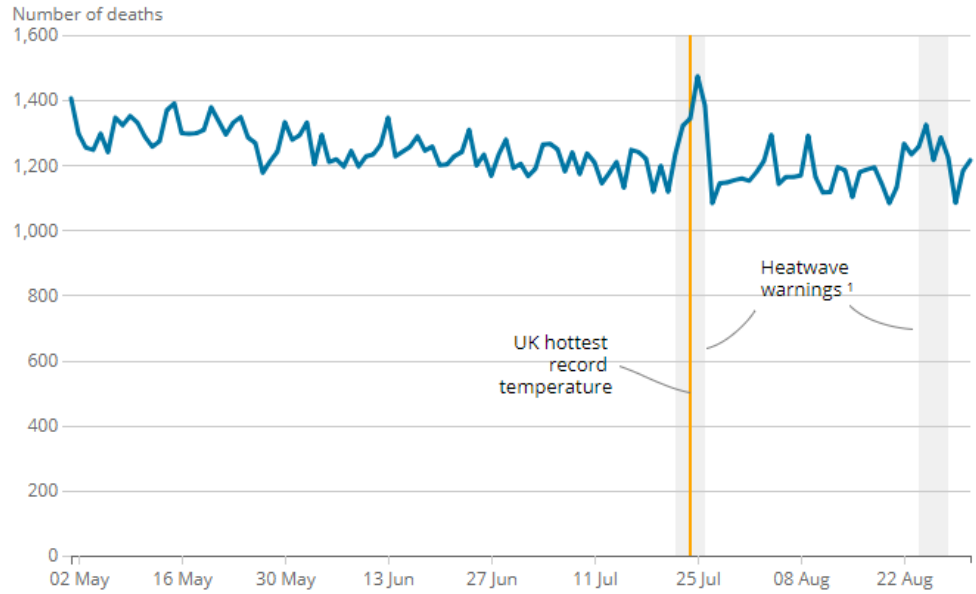
For every person killed by natural disasters it is estimated that another 1000 people are affected physically, mentally or through loss of property or livelihood (3). The severity of impact is a result of the event, the degree of exposure and how vulnerable individuals are to its effects.

Heatwaves

Heatwaves can happen suddenly, and quick rises in temperature affect vulnerable people very rapidly. Temperatures of more than 25°C are associated with excess deaths, with higher temperatures associated with greater numbers of deaths (27). The main causes of illness and death during a heatwave are respiratory and cardiovascular diseases (27). There are also specific heat-related illnesses including: heat cramps, heat rash, heat exhaustion and heatstroke.

Individuals at increased risk during heat waves include: the elderly, infants, people with serious long-term conditions, homeless people, people who misuse alcohol or drugs and people undertaking high levels of physically exertion (i.e. laborer's, athletes). Healthy people can also be affected in an extreme heatwave such as the one in France in 2003 which caused 15,000 heat related deaths (28). When temperatures reached 38.7 °C in the summer of 2019 in the UK a corresponding increase in the number of deaths was recorded (22) (Figure 3.2). Excess summer deaths show regional variations, which relate largely to differences in temperature levels across the country.

Figure 3.2: Deaths registered and recorded temperatures, England and Wales, May to August 2019 (22)



Credit: Office for National Statistics, Deaths registered weekly in England and Wales
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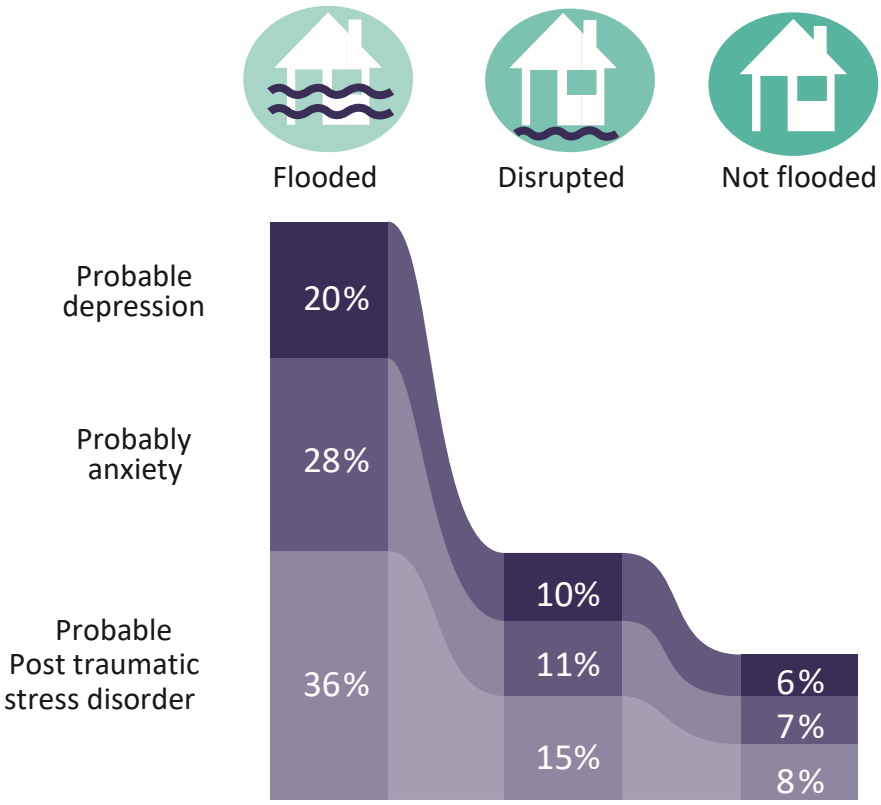
Flooding

Floods are one of the most common environmental emergencies and have significant health impacts. In the short term these are due to drowning, injuries, infections and exposure to chemical hazards. Disruption to services; including health services, safe water, sanitation and transportation ways, also impact health. Flooding can lead to contamination of the drinking water supply, increased risk of faecal-oral transmission of disease and increased risk of some vector borne diseases.

In the longer-term adverse mental health effects may arise due to the impact of damage to homes, loss of domestic utilities, having to move out of home, and delayed recovery. People who are flooded are 6 times more likely to have depression, anxiety or post-traumatic stress a year on, than those not affected by flooding (29). The risk of poor mental health outcomes is greater the deeper the floodwater, the longer the duration of flooding and if evacuation was required. Disruption is also caused to the local community through loss of access to health and social care and to work or education. People whose homes are not flooded but whose lives are disrupted by flooding also show affects to their mental health (Figure 3.3).

Figure 3.3: Likelihood of developing a mental health problem based on experience of flooding (30)



Communities

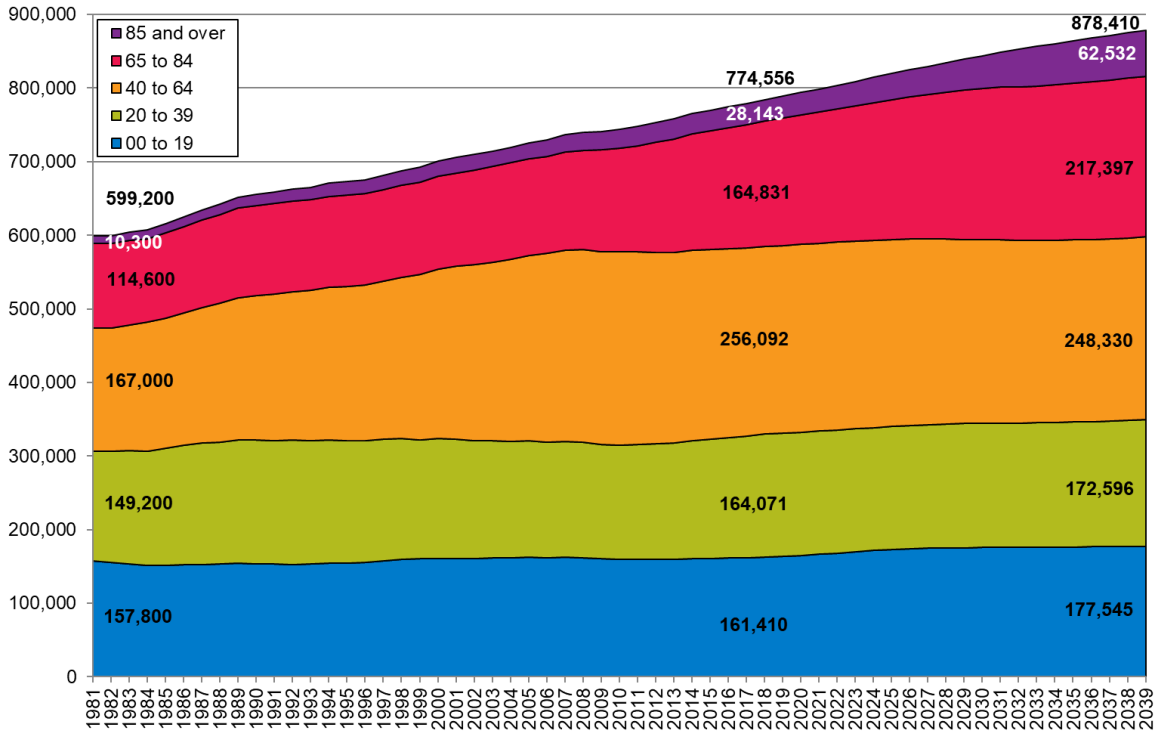
Climate change may exacerbate health risks and inequalities associated with building overheating, indoor air pollution, flooding damage, and water and biological contamination in the indoor environment. Overcrowding and poor ventilation are recognised risk factors for infectious disease transmission. High risk groups include the elderly (especially those living on their own), individuals with pre-existing illnesses and the socioeconomically deprived. Living in a top floor flat generally increases exposure to high temperatures whereas living in a ground or basement flat may increase health risks related to flooding. Radon levels are also higher in basements. Health care infrastructure (hospitals, general practices, care homes) will also be adversely affected by heatwaves and flooding. This includes pharmaceutical storage places. Climate change mitigation and adaptation policies in the built environment can reduce greenhouse gas emissions and also bring co-benefits for health by reducing heat and cold-related mortality, indoor air pollution and mould growth (14).

3.3 Local Impact

Heatwaves

Extreme weather is a risk for the health of the local population. In particular, rising temperatures and flooding. The South West is one of the most vulnerable areas in the UK to current and future effects of hot weather with more expected heat-related deaths per year estimated to reach 15.3 per 100,000 population by 2080 (14). In Devon the population is older than average compared to England. The population is also growing, particularly in the older age groups who are at greater risk from heatwaves (Figure 3.4). Homeless individuals are also more at risk from heatwaves and homelessness has been increasing in Devon (2).

Figure 3.4: Devon change in population profile from 1981-2039

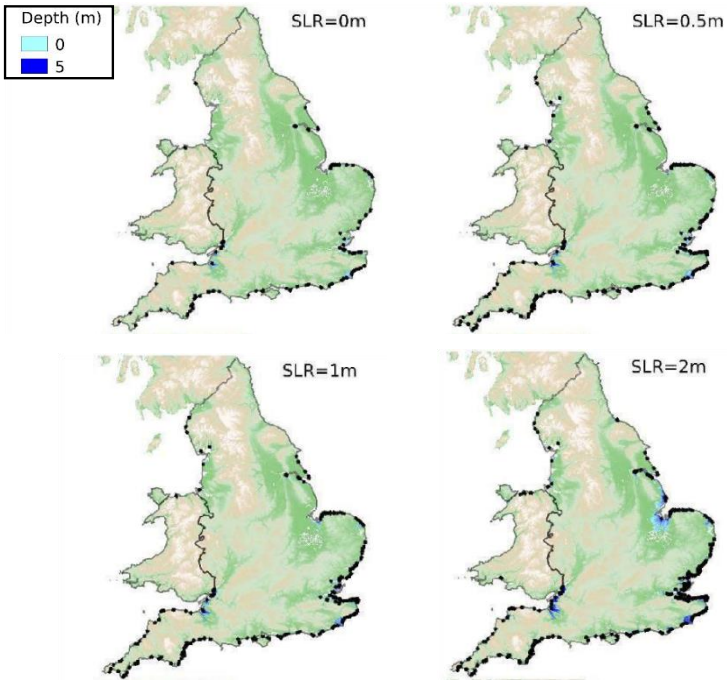


Source: Office of National Statistics

Flooding

Devon is the only county with two separate coastlines and is vulnerable to the effects of sea level rise and potential community displacement. Sea level rise projections for the 21st century are uncertain and generally range from around 25 cm to 1 m, with a few estimates consistent with 1.5–2.5 m. Small increases in mean sea level rise can lead to large decreases in the Standard of Protection (the frequency that a given defence is likely to be overwhelmed, expressed as a return period in years). The inundation extent is estimated to increase with sea level rise if vulnerable defences are lost (Figure 3.5). Figure 3.6 shows the corresponding number of properties (residential or non-residential) at risk in England under 1m sea level rise (31).

Figure 3.5: Increasing inundation with sea level rise in England (31)

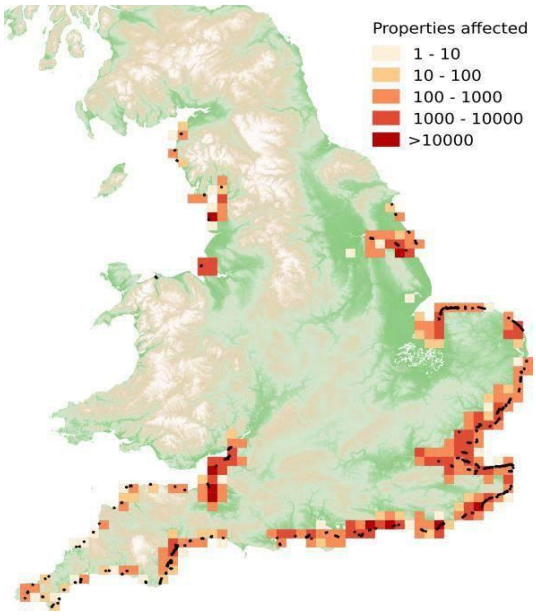


Temporary inundation extent (blue) and defences at risk (black), under a 1:200-year return period tidal surge if vulnerable defences were lost, for different values of local sea level rise (SLR).

Credit: Government Office for Science

Contains public sector information licensed under the Open Government Licence v1.0

Figure 3.6: Properties in England with moderate or greater probability of flooding with 1m sea level rise (31)



Credit: Government Office for Science

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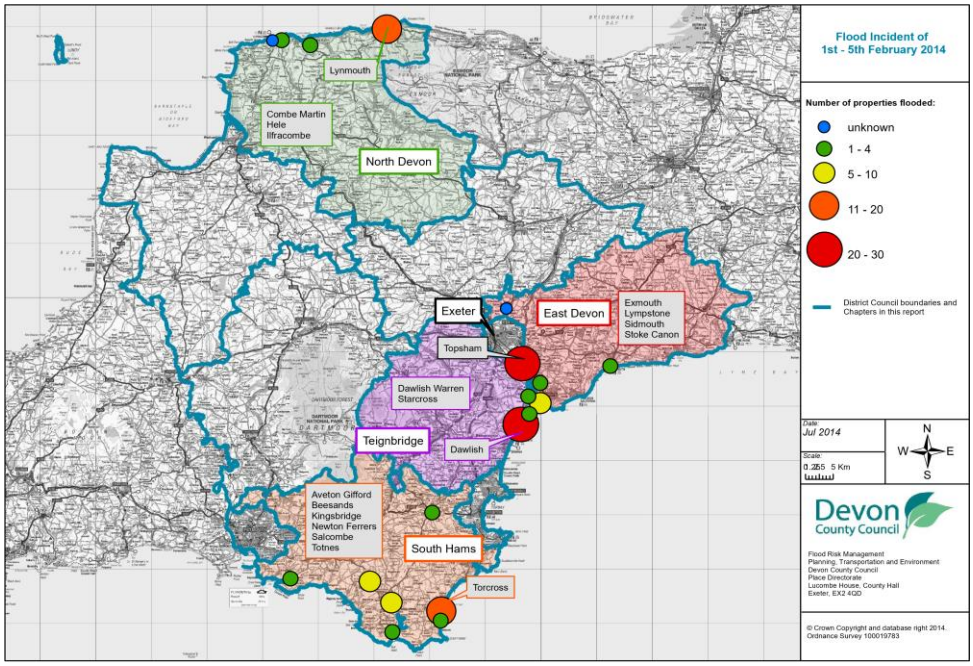
Climate change may lead to a doubling or quadrupling of river flooding in the UK by the 2080s. The projected areas prone to river flooding with most people at significant risk under climate change (medium or high emissions, 2050s) and factoring in population growth changes are the South East & London and the East Midlands. The South West, Yorkshire and the Humber are considered next in the ranking (14).

Box 3.1: Case Study – Dawlish 2014

Devon has experienced 58 significant flood events since 2012. Between December 2013 and February 2014 Devon was affected by a long duration flood event (Figure 3.7). This was the result of heavy rainfall causing significant surface water and river flooding, and intense storms with high tide levels. These events resulted in 3 people losing their lives and the flooding of 256 residential and commercial properties (32).

The rail network across the southwest region was subject to significant delays and service cancellations because of the severe weather. During the stormy weather in February a section of the railway track was washed away at Dawlish cutting off the South West Peninsula. Structural damage was caused to the sea wall and several properties on the seafront. 28 properties suffered forms of internal flooding which lead to the evacuation of 20 local residents. Network Rail's repair works were further delayed by several landslides. The railway line between Exeter and Penzance was closed until April 2014. The repair of the sea wall and railway at Dawlish cost £35 million. There was also extensive regional disruption with the economic impact, including the tourist and fishing industries, estimated to be between £60m to £1.2bn (113).

Figure 3.7: The extent of flooding across Devon over 1st-5th February 2014 (32)



Credit: Devon County Council Flood Risk Management Team

Communities

As part of the Devon Climate Emergency Response resilience work stream, a review of the community risk register is being undertaken. This will draw on the expertise of the Local Resilience Forum to assess the current risks in the Community Risk Register that specifically ascertain to climate impact over the next 10-20 years (33). The Devon Climate Emergency Response Group are also working to support communities to identify action they can take to mitigate and adapt to climate change, such as the development of community toolkits.

The Devon Community Resilience Forum supports communities to develop a community emergency plan; a document that guides community response in an emergency and helps communities to prepare. They provide a nine-step plan to support communities to prepare, respond and recover from emergencies such as flooding. The community emergency plans are also uploaded to a secure website where they can be viewed by the emergency services. If there is an emergency, they will be able to view the plan to understand how the community may already be responding, where there is high risk, and what resources the community has (34).

Box 3.2: Community Emergency Plan – Nine-step guide (34)

1. Getting together and organising the work
2. Knowing the unknowns
3. Identifying skills and resources
4. Legal Health Check
5. Organising key facilities
6. Keeping in touch
7. Activating your emergency plan
8. Taking control
9. Testing your plan

Devon Community Resilience Forum

3.4 Adaptation and Resilience

Flooding and heatwaves

Devon County Councils' Flood Risk Management team work with partners on natural flood management projects as one method to alleviate the risk of flooding. This approach includes measures such as; woodland creation, restoring wetland and grassland habitats, and reconnecting flood plains. This approach offers co-benefits for planetary health and human health such as carbon storage in peat rich soils, increasing biodiversity and providing access to green space for the population for recreation which supports both physical and mental health.

PHE and the NHS provide guidance to the public on resilience against heatwaves and flooding (Box 3.3, Box 3.4).

Box 3.3: Top tips for staying safe during floods (30)

1. Think about flooding before it happens. Sign up for free flood warnings and create a personal flood plan.
2. Try to avoid contact with flood water. Do not drive through flood water and do not let children play in flood water.
3. Feeling distressed after a flood is normal. Support from family and friends is important during the recovery process.
4. Do not use petrol or diesel generators indoors to dry out your home. The exhaust gases contain carbon monoxide, which can kill.
5. When cleaning up after a flood, wear rubber gloves, boots and eye protection, and wash hands afterwards.

Public Health England and the Environment Agency

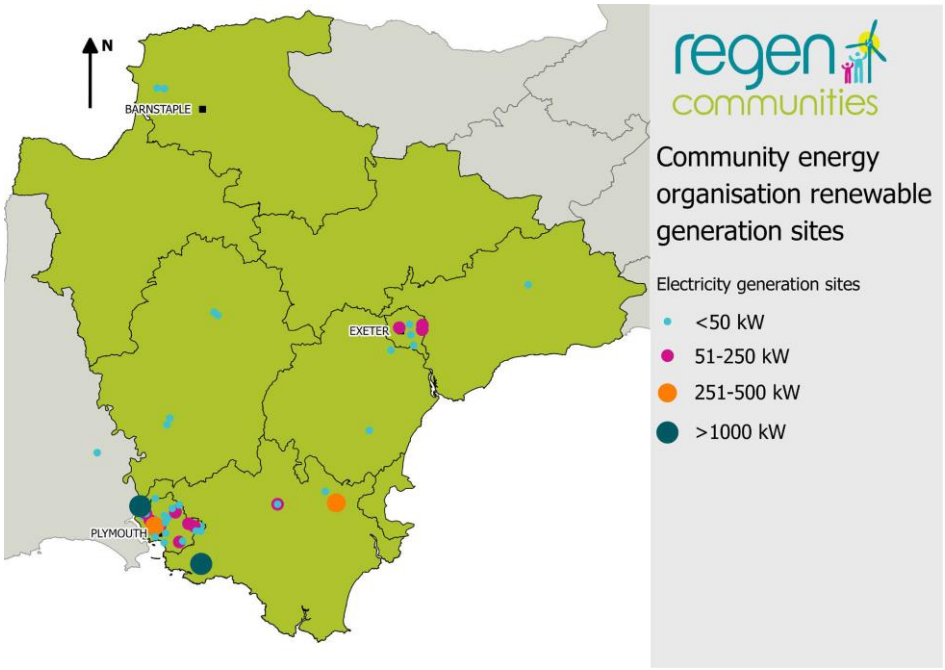
Box 3.4: NHS tips for coping in hot weather (35)

- Keep windows that are exposed to the sun closed during the day, and open windows at night when the temperature has dropped.
- Avoid the heat: stay out of the sun between 11am and 3pm.
- Wear light, loose-fitting cotton clothes.
- Keep rooms cool by using shades or reflective material outside the windows. If this is not possible, use light-coloured curtains and keep them closed (metallic blinds and dark curtains can make the room hotter).
- If possible, move into a cooler room, especially for sleeping.
- Have cool baths or showers, and splash yourself with cool water.
- Drink plenty of fluids and avoid excess alcohol. Water, lower-fat milks and tea and coffee are good options.
- If you have to go out in the heat, walk in the shade, apply sunscreen and wear a hat and light scarf.
- Check up on friends, relatives and neighbours who may be less able to look after themselves.

Communities

Whilst environmental changes are leading to negative impacts on communities, they have also led to communities coming together in new and innovative ways. For example, the Devon Community Energy Network represents community-led renewable energy and energy efficiency projects (Figure 3.8). There are 22 community energy organisations active in the Devon County Council area and 46 renewable electricity projects have been installed. These have supported; 1,117 households with energy efficiency services or installations, provided 52% of the referrals into the Cosy Devon fuel poverty scheme in the six months to December 2017, installed 6.2MW of renewable electricity capacity, which will generate approximately 6000MWh annually which equates to 2,109 tonnes of CO_2 emissions saved (36). This community project helps to tackle climate change, increase energy security, address fuel poverty and keeps money in the Devon economy. Projects like this strengthen and engage communities and help to build resilience.

Figure 3.8: Map of community owned renewable electricity projects in Devon (36)



Credit: Devon County Council and Regen Transforming Energy
Devon Community Energy Impact Report 2018
https://www.regen.co.uk/publications/devon-community-energy-impact-report-2018/

3.5 Opportunities

There are opportunities to provide spatial development strategies that consider the climate emergency together with healthy and resilient communities. The Greater Exeter Strategic Plan will facilitate healthy lives through a variety of measures including greenspaces, sustainable transport, and encourage active communities (37). Developing and supporting more energy efficient homes has environmental benefits, tackles fuel poverty and reduces winter deaths (38).

Health and climate change are integral to initiatives seeking to improve planning, housing and the built environment. NHS England's Healthy New Towns Programme provides opportunities to develop further learning from projects in Exeter and Cranbrook. The vision for Cranbrook is to create a healthy, vibrant, attractive, and sustainable town (39). The development of Exeter Science Park and the existence of world leading academic institutions in Devon provides opportunity to support initiatives through research and technological developments that support climate and health.

There are opportunities in the community for health providers and other services in further improving their sustainability. A Net Zero NHS will contribute significantly to reducing local emissions (40). This would reduce the health impact of air pollution and could lead to savings for the NHS through reduced ill health providing economic benefits (41). Tackling

climate change has several co-benefits for health, the environment, and the economy that may be particularly beneficial at times of economic uncertainty (14).

The Devon Climate Emergency Project promotes community action, providing opportunities to develop healthier communities through social contact, interaction and support. Co-production of knowledge and other methods can bring communities and local organisations with specific expertise together, creating greater cohesion and engagement. Resources are available on the Devon Climate Emergency Project website (42).

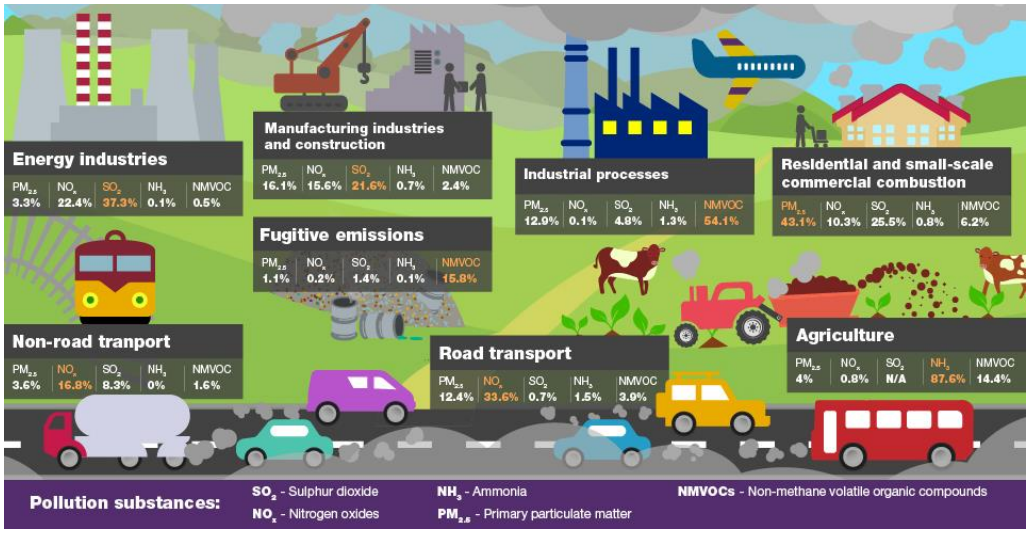
4 Air

4.1 Background

Air pollution is a result of the way we currently generate power, heat our homes, produce food, manufacture consumer goods and power transport. It leads to both poor air quality and environmental change. Exposure to this complex mix of particles and gases shortens lifespans and damages quality of life. It also harms the natural environment, affecting our climate, waterways, biodiversity and crop yields (43).

Outdoor air pollution originates from natural and man-made sources. While natural sources contribute substantially to local air pollution in arid regions more prone to forest fires and dust storms, the contribution from human activities far exceeds natural sources (44) (Figure 4.1). Pollutants may not only prove a problem in the immediate vicinity but can be transported over long distances.

Figure 4.1: Sources of air pollution (45)



Credit: Public Health England

Air pollutants are also present indoors. They are generated from a wide range of sources and behaviours including; domestic appliances which burn carbon containing fuels (coal, gas, wood), personal care products, building materials and household products (cleaning, DIY), tobacco smoke, and radon - a naturally occurring radioactive gas that comes from the ground.

The emission of gases and particles into the atmosphere produces a warming effect and is the primary cause of climate change. Greenhouse gases, such as carbon dioxide (CO2) and methane (CH4), act directly, trapping radiation in the atmosphere. By 2013, the concentration of CO2 in the atmosphere reached 40% above the levels present before the

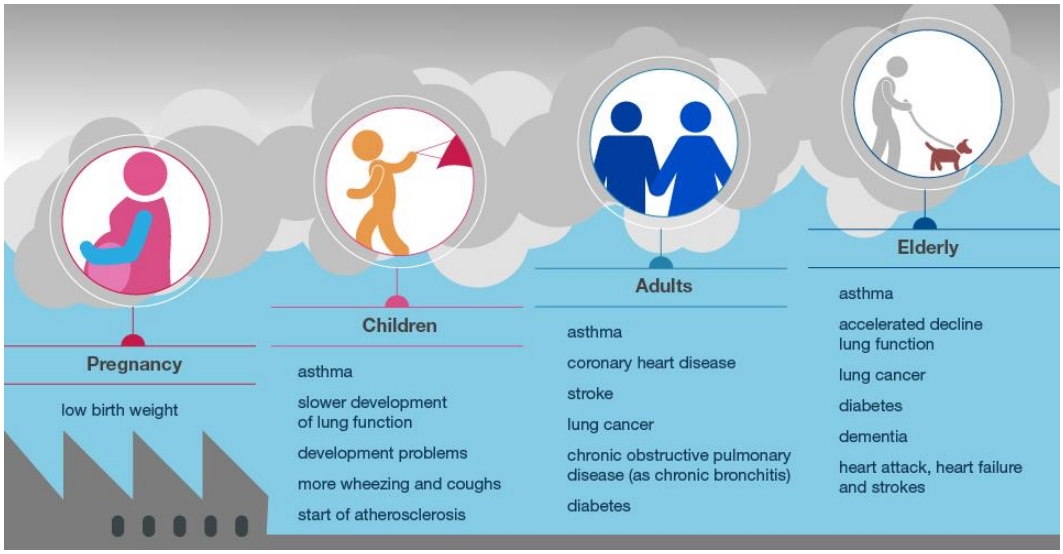
Industrial Revolution. The Intergovernmental Panel on Climate Change (IPCC) concluded that, unless very stringent emission standards are achieved, by the end of the 21st century global surface temperatures will be more than 1.5°C above their 19th-century levels (46).

Climate change, in turn, affects the air we breathe. Fine particles (PM10, PM2.5) increase in concentration during hot, still air conditions. High temperatures increase the levels of ozone (O_3) in the lower atmosphere, which leads to respiratory disease as well as reducing crop productivity, forest growth and the ability of vegetation to take up carbon dioxide. Conversely, ozone in the highest levels of the atmosphere forms the ozone layer, which reduces the amount of ultraviolet radiation reaching the surface, protecting against skin cancer. In the 1970's, thinning of the ozone layer prompted measures to tackle the release of chlorofluorocarbons (CFCs) that were primarily responsible. It has been proposed that the expected 50-60 year timescale for the ozone layer to recover may be delayed due to climate change (47).

4.2 Health impacts

Air pollution is the leading environmental cause of early death, leading to 4.2 million deaths globally per year (44). In the UK it is estimated that exposure leads to between 28,000 and 36,000 deaths annually (45). Long-term exposure reduces life expectancy, mainly due to cardiovascular and respiratory diseases, and lung cancer. Short-term exposure, over hours or days, to elevated levels of air pollution can also impact health, including exacerbating existing respiratory disease such as asthma, and increasing respiratory and cardiovascular hospital admissions and mortality. Exposure to air pollution has health effects at every stage of life (Figure 4.2).

Figure 4.2: Air pollution affects people throughout their lifetime (45)



Credit: Public Health England

There are legal requirements and aspirational targets for levels of air pollutants (https://uk-air.defra.gov.uk/air-pollution/uk-eu-limits). Particulate matter (PM) and nitrogen dioxide (NO_2) are both major components of urban air pollution. There is no clear evidence of a safe level of exposure below which there is no risk to health. Further reduction of PM or NO_2 concentrations below the air quality standards is likely to bring additional health benefits. It is estimated that a 1 µg/m^3 reduction in fine particulate air pollution in England could prevent around 50,900 cases of coronary heart disease, 16,500 strokes, 9,300 cases of asthma and 4,200 lung cancers over an 18 year period (48).

The total cost to the NHS and social care of air pollution for PM2.5 and NO_2 combined between 2017 and 2025, is estimated at £1.60 billion (48). Air pollution also impacts the economy through people taking time off from work. The Department for Environment, Food and Rural Affairs (DEFRA) estimated that in 2012, poor air quality cost the economy £2.7 billion through its impact on productivity (49).

Air pollution is a significant contributor to health inequalities. Some people are more affected because they live in polluted areas, are exposed to higher levels of air pollution in their day-to-day lives or are more susceptible to health problems caused by air pollution. Groups more affected by air pollution include; older people, children, individuals with existing cardiovascular or respiratory disease, pregnant women, communities in areas of higher pollution - such as close to busy roads, and low-income communities.

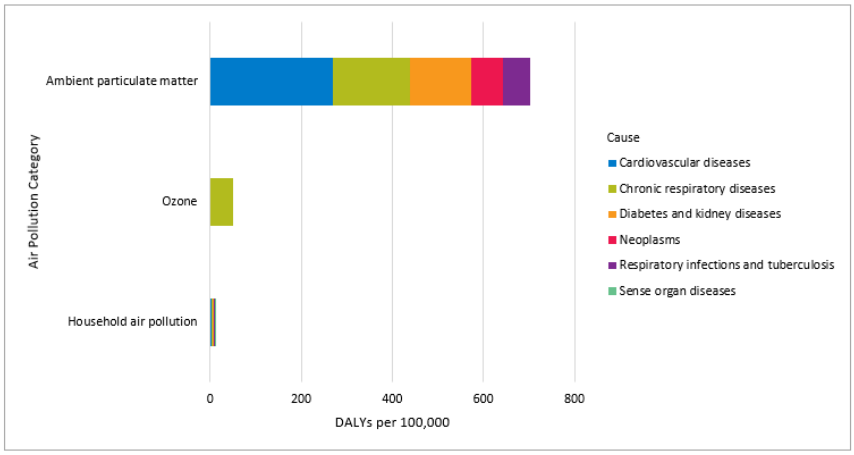
Climate change may also result in the earlier seasonal appearance of symptoms from hay fever and related respiratory diseases. The effects of climate change on plant distribution can expose the population to aeroallergens (pollen) from more plants, with different flowering seasons, and for a longer duration (27). Thunderstorms are associated with high levels of aeroallergens and a rise in asthma exacerbations, known as thunderstorm asthma. Thunderstorms are likely to increase as the global temperature rises.

4.3 Local impact

Air pollution is a risk for the health of the local population. In Devon and Torbay there are 14 sites where the national air quality objectives are not likely to be achieved and are designated as Air Quality Management Area's (AQMA). All are due to excessive levels of nitrogen dioxide (NO2). The Crediton AQMA is also designated for excessive levels of particulate matter.

When comparing air pollution categories, it is ambient particulate matter which causes the greatest amount of illness and death in Devon (Figures 4.3, 4.4). The percentage of deaths attributable to ambient particulate matter across Devon ranges from 3.4 - 4.4% (Figure 4.5). This is below the figure for England of 5.1%.

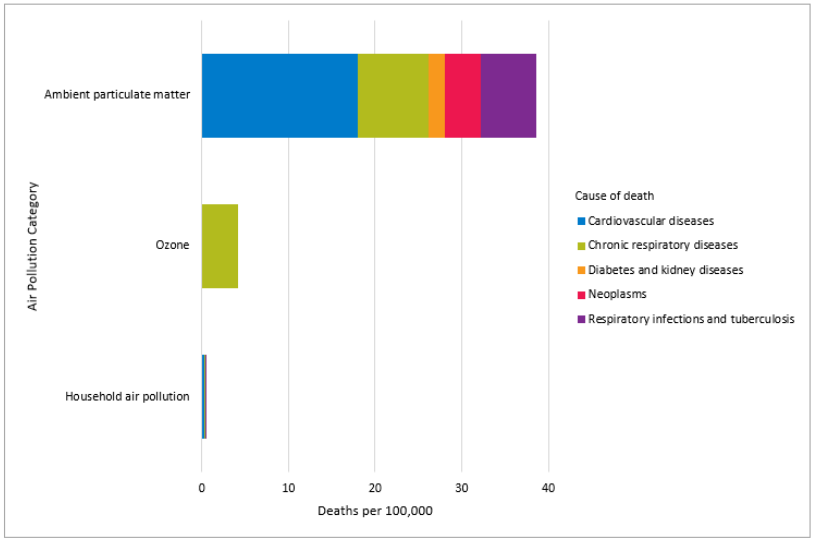
Figure 4.3: Air pollution by all diseases for Devon (DALYs*)



*Disability Adjusted Life Years –number of years lost due to ill-health, disability or early death

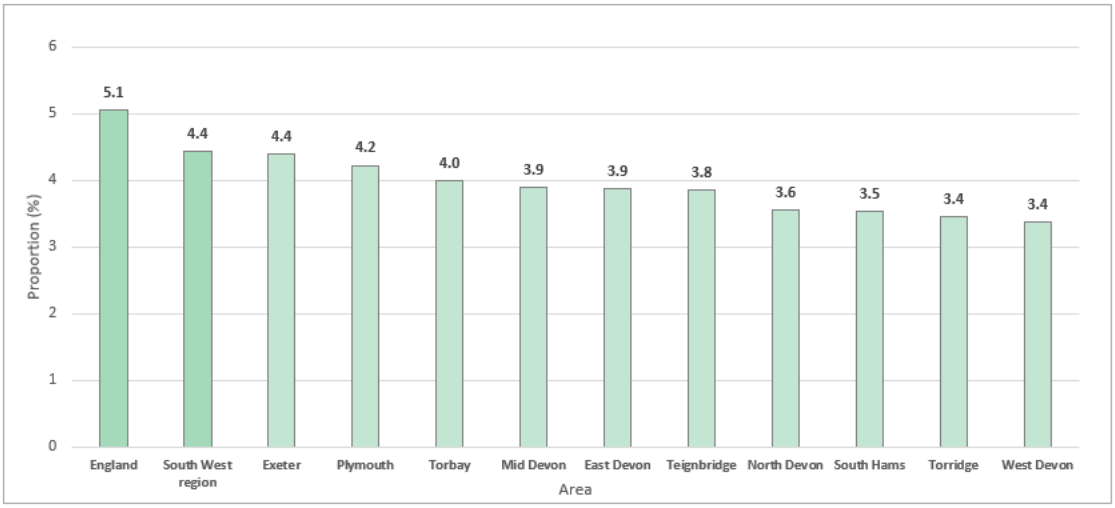
Credit: Devon County Council Public Health Team
GBD visualisation tool for Devon

Figure 4.4: Air pollution by all diseases for Devon (Deaths)



Credit: Devon County Council Public Health Team
GBD visualisation tool for Devon

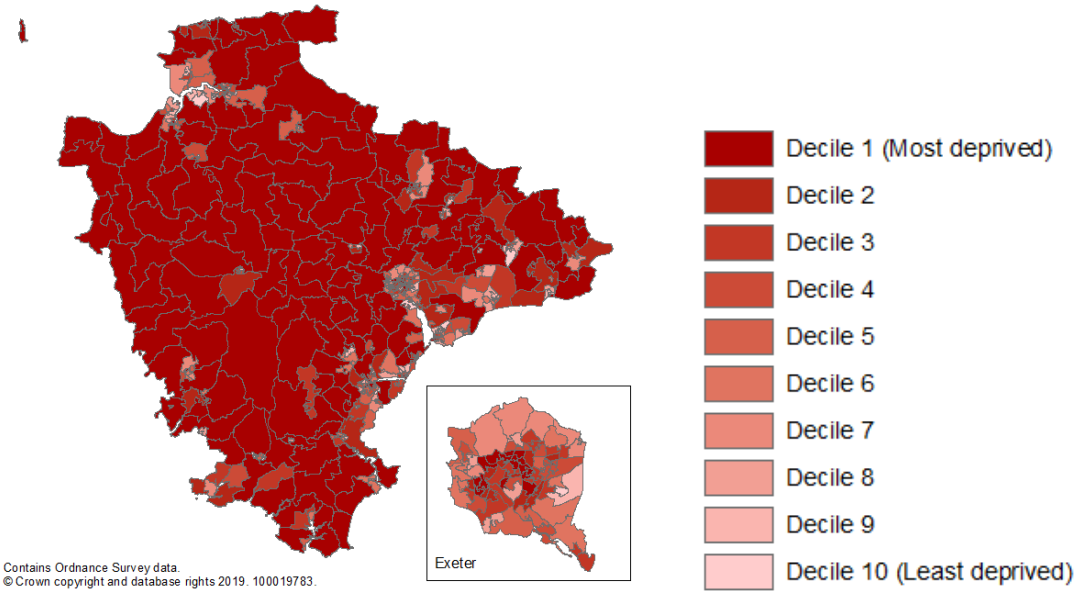
Figure 4.4: Fraction of mortality attributable to particulate air pollution (2017)



Credit: Devon County Council Public Health Team

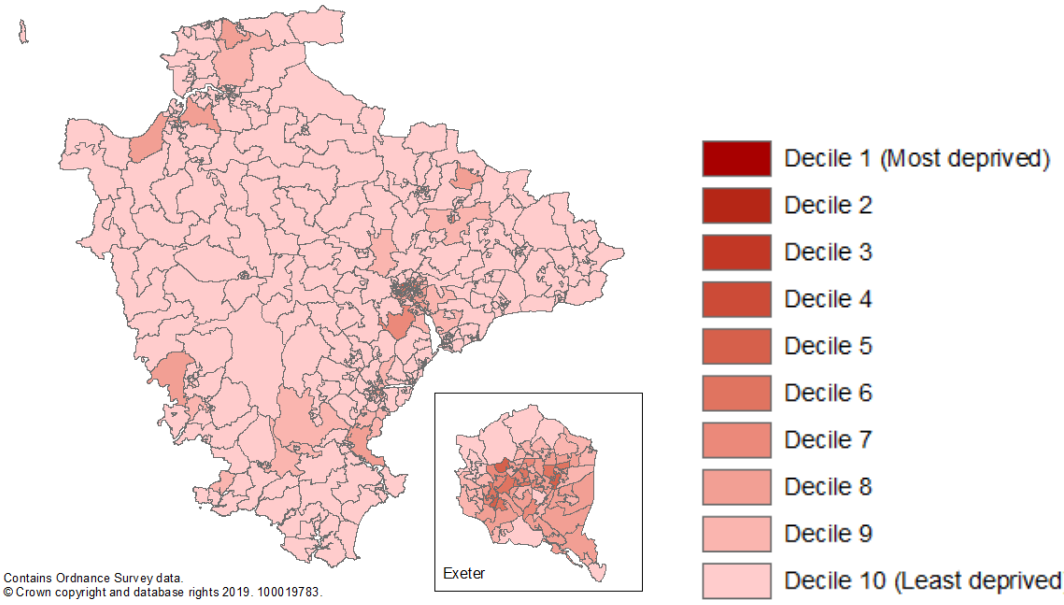
The Governments Indices of Deprivation considers the 'indoor' living environment which measures the quality of housing and the 'outdoor' living environment which considers air quality and road traffic accidents. The majority of Devon is in the most deprived deciles for the indoor living environment domain (Figure 4.5.6). In contrast the majority of Devon is in the least deprived deciles for the outdoor living environment (Figure 4.7).

Figure 4.5: Indices of deprivation for indoor living environment



Credit: Devon County Council Public Health Team

Figure 4.6: Indices of deprivation for outdoor living environment



Credit: Devon County Council Public Health Team

4.4 Adaptation and Resilience

At the beginning of 2019 the Department for Environment, Food & Rural Affairs' published its Clean Air Strategy which sets out the comprehensive actions required across all parts of government and society to improve air quality (43). It focuses on reducing emissions from transport, homes, farming and industry, and supporting clean growth and innovation.

The IPCC has advised that to limit global warming to 1.5°C, emissions of carbon dioxide must reduce globally by about 45% from 2010 levels by 2030, reaching 'net zero' around 2050 (50). 'Net zero' means that any remaining emissions would need to be balanced by removing CO2 from the air. The Devon Climate Emergency Response Group has established a Net-Zero Task Force to produce an evidence-led Devon Carbon Plan with the aim of reducing carbon emissions by 50% by 2030 and to net-zero by 2050.

PHE's evidence review into effective approaches to tackle air pollution identified four key interventions (51) :

- Promoting a step change in the uptake of low emission vehicles - by setting more ambitious targets for electric car charging points, as well as encouraging low emission fuels and electric cars
- Boosting investment in clean public transport, as well as foot and cycle paths
- Redesigning cities so people aren't so close to highly polluting roads
- Discouraging highly polluting vehicles from entering populated areas - for example, with low emission or clean air zones

Interventions such as Ultra Low Emission Zone's (ULEZ) can reduce air pollution. In April 2019 the Mayor of London launched the world's first ULEZ. The Central London ULEZ

operates in the existing central London Congestion Charge Zone. Vehicles must meet strict emission standards to drive in the ULEZ area. It operates 24 hours a day, every day of the year. Preliminary results indicate that after six months CO2 emissions from road transport in the central zone have reduced by 4 per cent (9,800 tonnes) and NOx emissions have reduced by 31 per cent (200 tonnes) (52).

To avoid exposure to high levels of air pollution, it is important to be aware of air quality. The Daily Air Quality Index (DAQI) provides recommended actions and health advice for both the general population and for at-risk individuals (Table 4.1). Updates are available from DEFRA's Pollution forecast (https://uk-air.defra.gov.uk/forecasting/) and on social media.

Table 4.1: Recommended actions and health advice (53)

Air Pollution Banding	Value	Accompanying health messages for at-risk individuals*	Accompanying health messages for the general population
Low	1-3	**Enjoy** your usual outdoor activities.	**Enjoy** your usual outdoor activities.
Moderate	4-6	Adults and children with lung problems, and adults with heart problems, **who experience symptoms**, should **consider reducing** strenuous physical activity, particularly outdoors.	**Enjoy** your usual outdoor activities.
High	7-9	Adults and children with lung problems, and adults with heart problems, should **reduce** strenuous physical exertion, particularly outdoors, and particularly if they experience symptoms. People with asthma may find they need to use their reliever inhaler more often. Older people should also **reduce** physical exertion.	Anyone experiencing discomfort such as sore eyes, cough or sore throat should **consider reducing** activity, particularly outdoors.
Very High	10	Adults and children with lung problems, adults with heart problems, and older people, should **avoid** strenuous physical activity. People with asthma may find they need to use their reliever inhaler more often.	**Reduce** physical exertion, particularly outdoors, especially if you experience symptoms such as cough or sore throat.

Department for Environment Food and Rural Affairs

4.5 Opportunities

Action to reduce our emissions has co-benefits for health. Nationally the Road Investment Strategy (54), Transport Decarbonisation Plan (55), Road to Zero strategy (56), and the British Road Safety Statement (57) all support and contribute to the reduction of transport emissions to improve air quality and health.

Providing good quality infrastructure and public transport and encouraging people to walk and cycle rather than drive, can help people become more physically active, reducing their risk of major diseases including heart disease, diabetes and cancer (Box 4.1). Projects such as the Government's Transforming Cities Fund aims to drive up productivity and spread prosperity through investment in public and sustainable transport in some of the largest English city regions (58). It focuses on intra-city connectivity, making it quicker and easier for people to get around, making improvements that can rebalance the transport system to facilitate more active travel. There are also opportunities to continue developments for active travel, building on those implemented during the Covid-19 pandemic and future sustainable transport funding.

Box 4.1: Creating opportunities and promoting active travel (45)

- Reallocation of road space to support walking and cycling
- Restricting motor vehicle access
- Introducing road-user charging and traffic-calming schemes
- Creating safe routes to schools
- Improving or adding green spaces and tree cover improves air quality, as well as making spaces feel more welcoming
- Small-scale improvements, such as good street lighting or improved road crossings

Public Health England

5 Water

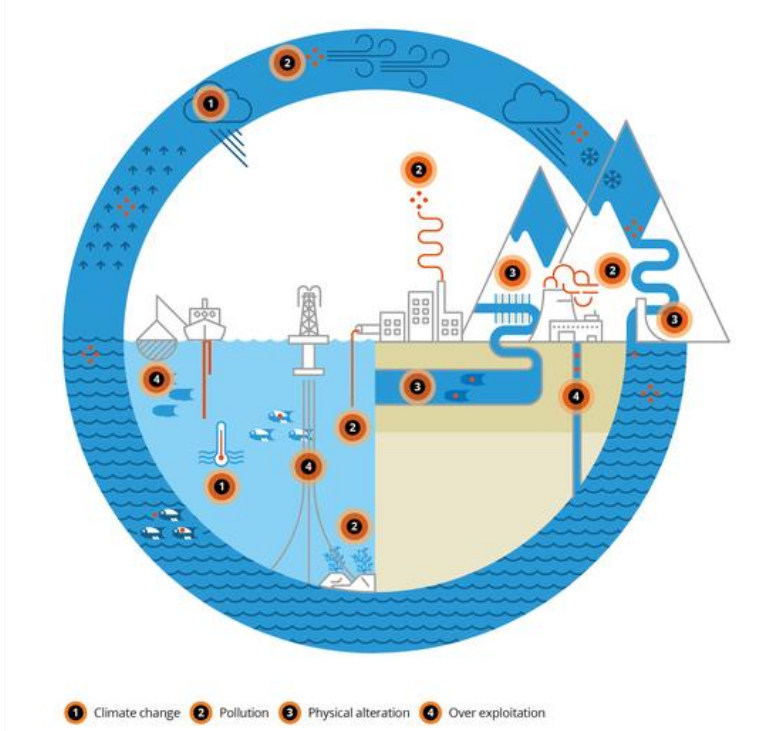
5.1 Background

Water is present in every aspect of our lives. Nearly all (about 97%) of the Earth's water is contained in the oceans. A very small amount is locked away as ice sheets and glaciers. This leaves a tiny amount which travels around in the water cycle, which underpins all terrestrial ecosystem services (59). Over-exploitation, climate change, physical alterations to water habitats and pollution undermine the quality and availability of water (Figure 5.1:) (60).

Freshwater comprises surface water (e.g. rivers and lakes) and groundwater (i.e. aquifers, springs). Groundwater is becoming increasingly polluted and in many regions of the world it is being extracted faster than it can be replenished. The rate of depletion more than doubled between 1960 and 2000 (61).

Food production uses large amounts of freshwater. Demand for water is projected to increase by 55% worldwide between 2000 and 2050. By 2050, 3.9 billion people (more than 40% of the world's population) are projected to be living under severe water stress (61).

Figure 5.1: Water cycle – Main issues affecting water quality and quantity (60)

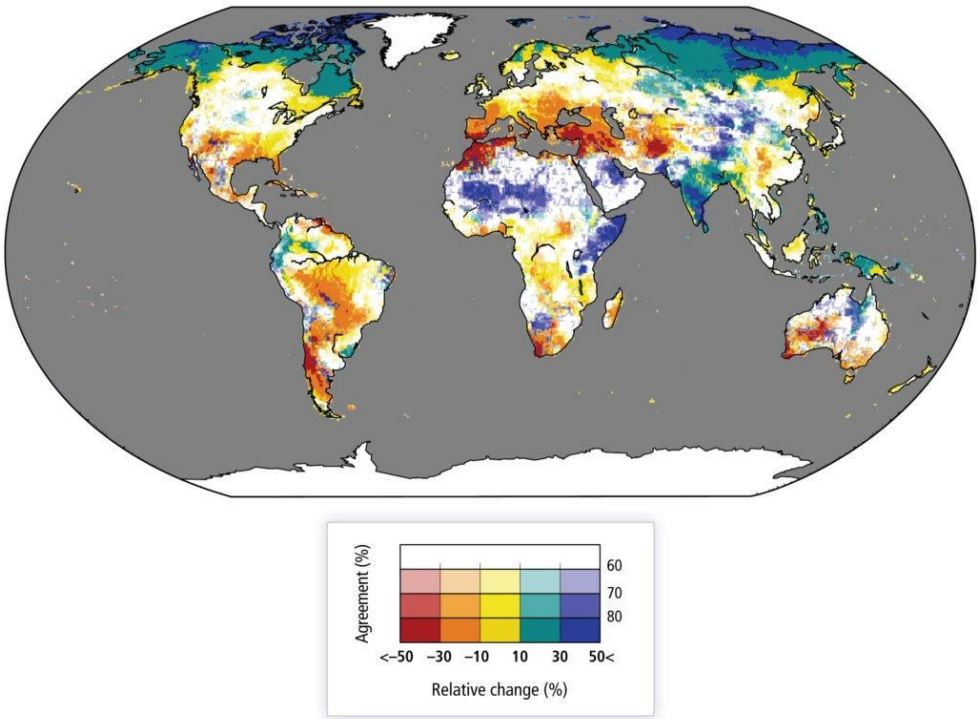


Credit: European Environment Agency
https://www.eea.europa.eu/signals/signals-2018-content-list/infographic/water-cycle-2014-main-issues/view
https://creativecommons.org/licenses/by/2.5/dk/deed.en_GB
https://www.eea.europa.eu/legal/copyright

Climate change is projected to affect water availability through; increases in temperature, rising sea-levels, changes in rainfall, speeding glacial melt and drought. Rising temperatures lead to reduced natural storage of water through reduced snow and ice volumes and an increased evaporation rate from lakes, reservoirs, and aquifers. Higher temperatures also increase water demand and competition for the resource. In high latitudes water resources are expected to increase (Figure 5.2:), but overall the negative impacts of climate change on freshwater systems outweigh the benefits. Reduced surface water and groundwater resources are expected with major effects on water availability after 2050 (62).

Climate change is also projected to reduce raw water quality, posing risks to drinking water quality even with conventional treatment. The sources of risk are increased temperature, increases in sediment, nutrient and pollutant loadings due to heavy rainfall, reduced dilution of pollutants during droughts, and disruption of treatment facilities during floods (63).

Figure 5.2: Average percentage change in average annual runoff for an increase in global temperature of 2°C (colour saturation shows the percentage of model runs agreeing on the change) (62)



Credit: AR5 Climate Change 2014: Impacts, Adaptation, and Vulnerability
Chapter 3. Freshwater resources, Figure 3.4
Intergovernmental Panel on Climate Change

Pollution of surface water by agricultural fertiliser run off impacts water quality and is a key driver of ecosystem change. Excess nitrogen and phosphorus entering the environment leads to excessive plant growth in water bodies (eutrophication). Algal blooms in water

bodies release toxins and block sunlight from entering the water, depleting the oxygen level and harming other aquatic life. Warmer water also encourages algal blooms and increases risks from toxins and natural organic matter in water to human health.

Water services will see reduced reliability and increases in operating costs. Drinking water management and infrastructure will be affected by reduced availability and contamination for which additional or new treatments may be required. Sanitation systems are also at risk. Increased storm runoff increases the amount of pathogens, pollutants, and sediment in the wastewater. Dry weather leads to higher concentrations of pollutants and can cause water mains and sewers to crack and leak. Conventional high-volume flushing systems can also be susceptible to failure after extended droughts. Sea level rises increase the salinity of groundwater resources and wastewater. Sewage systems and treatment plants need to adapt to these changes (63).

5.2 Health impacts

Water security

Water insecurity has far-reaching impacts on health with negative effects on drinking water supplies and sanitation services. Inadequate supplies can also compromise hygiene behaviours, such as hand washing, and increase the risk of diarrhoeal and other diseases. Diseases due to poor drinking-water access, poor sanitation, and poor hygiene practices cause 4.0% of all deaths and 5.7% of all disability or ill health in the world (64). Water scarcity also has indirect health effects due to its implications for, energy production, economic growth and food production. The importation of food is associated with a hidden transfer of freshwater (the water used to produce the food), the so-called virtual water trade. Water insecurity means that water-rich regions are likely to reduce the amount of virtual water they export leaving import-dependent regions without enough water to sustain their populations (65).

Algal Blooms

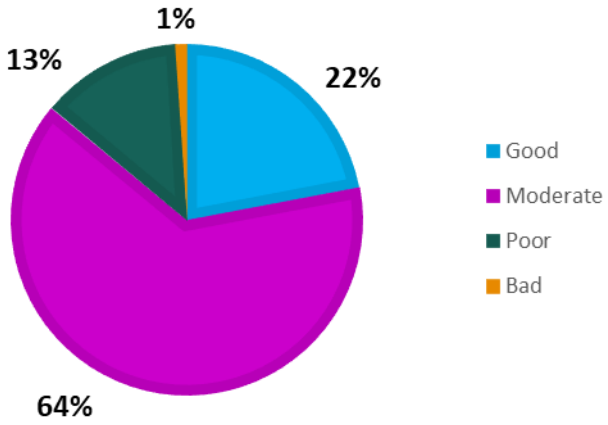
Harmful algal blooms can be hazardous to human health. People may be exposed to these through contact with the skin (e.g. when swimming), through inhalation (e.g. when motor boating or water skiing), or by swallowing contaminated water. The algal toxins can cause skin rashes, nausea, vomiting, stomach pains, fever and headaches. Occasionally they can cause more serious illness such as liver and brain damage. Children are at greater risk than adults of developing problems because of their comparative lower body weight (66).

5.3 Local impact

The environmental change impacts on water quality are a risk for the health of the local population. Devon's surface waters include rivers, reservoirs, estuaries and coastal waters. The quality of 78% of the surface freshwater has been assessed as less than good (Figure 5.3). Common reasons for less than good status include impacted aquatic wildlife; physical modification; high levels of copper and zinc, associated with natural geology and historic

mining activity, and high levels of phosphate, associated with agricultural fertilisers. 20% of the estuaries and 66% of the coastal waters in Devon and Torbay are at good status with the remainder at moderate status (67).

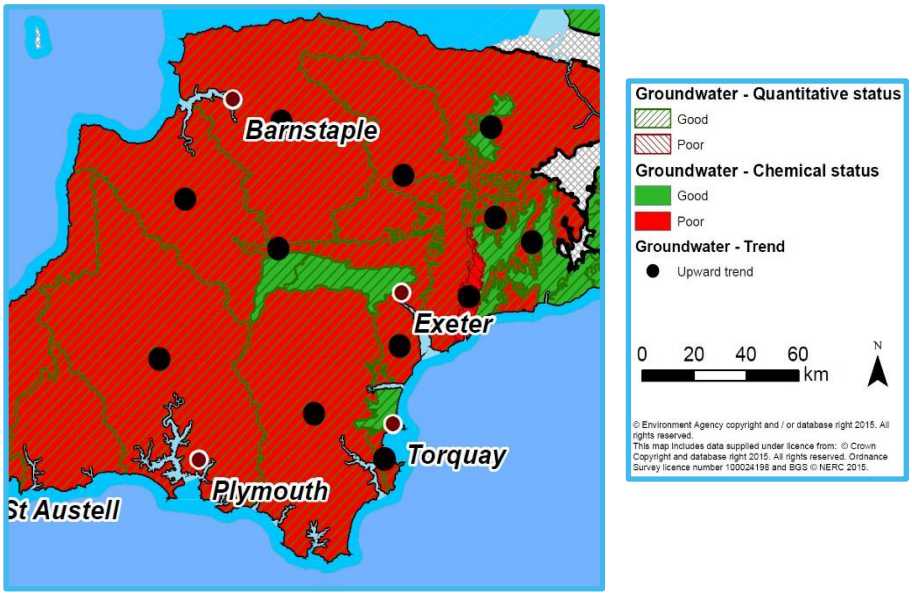
Figure 5.3: Freshwater surface water overall quality in North Devon, Devon South, Devon East and Tamar management catchments 2016 (67)



Credit: State of the Environment Report, Devon Local Nature Partnership

In Devon the quantitative status of groundwater is mostly good, but the quality is mostly poor. The main causes are high nitrate concentrations, pesticides and other chemicals (Figure 5.4**:**). Large areas have been designated as nitrate vulnerable zones (NVZs) (Figure 5.5). NVZs are areas designated as being at risk from agricultural nitrate pollution. They include about 55% of land in England. Farmers with land in NVZs must follow mandatory rules to tackle nitrate loss from agriculture.

Figure 5.4: Chemical status and quantitative status for groundwater (67)



Credit: State of the Environment Report, Devon Local Nature Partnership

Figure 5.5: Nitrate Vulnerable Zones (67)

Credit: State of the Environment Report, Devon Local Nature Partnership

South West Water's public water supply comes from approximately 90% surface water sources and 10% groundwater sources. Water consumption in the South West reduced by 15% from 1996 due to a reduction in leakage and an increase in the number of homes using water meters (67). Typical water consumption for a one person household in England and Wales was 149 litres/person/day in 2018 (68). In the South West this was 157

litres/person/day for 2018 - 2019 (69). Total consumption is forecast to increase as the population increases.

5.4 Adaptation and Resilience

Water security

Efficient use of water and management of fertiliser use are key to maintaining this vital resource. Water harvesting and water conservation are strategies for reducing water loss while increasing crop yields. Although methods such as drip or trickle irrigation are more expensive to install than conventional irrigation, they can be up to 33% more efficient in water use. These methods can also carry fertilisers directly to the roots of crops, reducing the run off into the environment. Typically, only 30-50% of applied nitrogen fertiliser and 45% of phosphorous are taken up by crops (65). Reducing the amount of pollutants entering the water system reduces costs and energy required for treatment. Efficient use of water in the home through reduced consumption, rainwater harvesting and the use of grey water (wastewater generated by household processes such as washing dishes) also have cost saving benefits.

South West Waters flagship environmental programme "Upstream Thinking" is aimed at improving water quality in river catchments and reducing water treatment costs. The programme has two main elements: advice and grants for farmers and the restoration of peatland in partnership with landowners. Restored peatlands hold a third more water, release a third less carbon and release water more slowly supporting summer water levels in rivers. The result is improved water quality as well as better homes for wildlife, reduced risk of flooding and reduced costs for consumers (70). Their programme "Clean Sweep" has also seen the closure of 250 crude sewage outfalls.

Algal Blooms

Not all algae blooms are toxic, but it is not possible to tell from appearance and so it's best to assume they are harmful and take precautions (Box 5.1)(66). The toxins which may be produced by algae are also poisonous to animals and can cause severe illness and death. Farmers and pet owners should ensure that their animals do not have access to affected water.

Box 5.1: Minimising the health risks of algal blooms (66)

- Do not swim in the water
- Do not swallow the water
- Avoid contact with the algae
- Do not eat fish caught from the water
- Observe and abide by any warning notices positioned around the water
- Anyone who has come into contact with affected water should shower with fresh water immediately
- Anyone who has come into contact with affected water and has become ill should obtain medical attention

Public Health Wales

5.5 Opportunities

Action to improve the management of fresh water and to reduce contamination provides opportunities for heath. Directly, cleaner, safer water for consumers is seen as a result of actions such as restoring peatlands and closing sewage outlets. Indirectly, the improved maintenance of natural spaces provides opportunities for individuals to engage and connect with nature supporting both physical and mental health.

6 Food

6.1 Background

The environmental challenges to maintaining the world's food supply are intensifying at a time when demands are expected to rise faster than at any time in human history (65). Environmental change can affect food security (availability, accessibility, utilisation and system stability) and the nutritional content of food. Climate change, land use changes, pollution, ocean acidification, freshwater depletion and loss of biodiversity all have an impact. Failure to reduce food waste and spoilage, amplify these and a rise in global food prices is expected.

Climate change

Global temperature increases pose a large risk to food security globally and regionally (62). The Met Office and World Food Programme have developed an interactive map which explores how different scenarios of global greenhouse gas emissions and adaptation to climate change could change the geography of food insecurity; https://www.metoffice.gov.uk/food-insecurity-index/. Changing temperatures, rainfall patterns and rising carbon dioxide (CO2) levels affect crop yields. In more temperate climates like our own there may be a positive effect on crop yields. However, the impact globally is predicted to be negative. Climate change also increases the concentrations of ground-level ozone (a plant toxin) and increases plant diseases. Crop yields are predicted to decrease by 1% per decade for the remainder of the century as a result of climate change alone, with or without adaptation, while demand for crops is projected to increase by 14% per decade up to 2050 (62).

Land use change

Across the globe around a quarter of natural habitats have been converted to other land uses (65). At present, 90% of food is grown in soil, a non-renewable resource in human timescales. Land clearance and intensive farming are accelerating natural soil degradation, exacerbated by urbanisation and unsustainable use by industry. It is estimated that soil degradation has led to 12 million hectares per year of agriculture land becoming unsuitable for cultivation (71). Soil degradation leads to threats to food security as well as flooding (decreased freshwater retention) and microbial biodiversity loss.

Changes in land use and soil erosion also contribute to climate change. Land clearing through burning of forests increases air pollution, while the degradation of soil, which acts as a carbon sink, contributes to increased greenhouse gases in the atmosphere. Climate change, in turn, is expected to affect the extent of soil erosion.

Pollution

Major sources of chemical contamination and waste include; nitrogen and phosphorous from agricultural fertiliser run off; heavy metals, solvents, polymers and dioxins from industries such as textile production and electronic manufacturing; and drug or

pharmaceutical pollution through excretion and improper disposal. Many man-made pollutants can enter the food chain. Methylmercury accumulates in aquatic food chains and is known to have adverse effects on foetal brain development. Climate change can also increase the mobilisation of persistent pollutants and increase airborne transport.

Ocean acidification

Increased levels of carbon dioxide in the atmosphere and consequently increased absorption of carbon dioxide by the oceans, has caused the acidity of the oceans to rise (3). Since the beginning of the industrial revolution, 250 years ago, the pH of the ocean has on average decreased by 0.1pH, equivalent to an increase in ocean acidity of about 26% (46). Ocean acidity is predicted to increase by up to 170% by 2100 (72).

The key predicted effects of acidification are; the reduced abundance of many marine animals; a reduction in the ability of shelled animals such as mussels to form and maintain shells; and rapid global loss of coral reefs, on which many fish species depend for part of their lifecycles. Disturbances from affected species will also affect other parts of the food web.

Fresh Water Depletion

Fresh water is required for food production. Water tables in the world's three biggest grain producing nations are falling due to unsustainable withdrawal for agriculture. Climate change is predicted to cause further limitations. This could mean that 20–60 Mha of cropland has to be reverted from irrigation back to rainfed watering by the end of the century, potentially causing a loss of 600–2900×10^{12} kcal of food production (73). Animal products are also dependant on fresh water. Demand is growing as populations grow and diets change in emerging economies. To double the global production to meet this demand would need an estimated 2000–3000 km^3 of additional water (65).

Biodiversity loss

Biodiversity, the diversity among living organisms, is a key environmental determinant of human health. Ecosystems, such as our food production systems, depend on a host of organisms: primary producers (plants), herbivores, carnivores, decomposers, pollinators, pathogens and natural enemies of pests. At a planetary scale biodiversity also has a role in limiting the impacts from other changes in the Earths systems, such as regulating the climate and removing harmful pollutants. Biodiversity is being lost at a rate unprecedented in human history (3). Drivers of this loss include land-use change, habitat loss, overexploitation (e.g. overfishing), pollution, invasive species and climate change.

6.2 Health impacts

Undernutrition contributes to the deaths of about 3 million children each year (74). Poor nutrition also leads to stunting, wasting, and impaired cognitive and physical development. It is estimated that soil degradation leads to the loss of 20 million tonnes of grain per year (71). The direct impacts of climate change on crops are expected to result in yield losses of about 8% of the present-day total. In addition to reducing the quantity of food

environmental changes may affect the nutritional content as well. In many parts of the world soil has lost its nutrients. Rising concentrations of carbon dioxide in the atmosphere can also lead to reduced zinc, iron, and protein in some crops. It is estimated that these reductions could put an additional 150 million people at risk for zinc deficiency, which can impair growth and impair the immune system (75).

Sea food provides a key source of protein and micronutrients such as iron, zinc, and omega-3 fatty acids (76). Around 90% of assessed stocks are already overfished or fished at maximum yield (77) and environmental change is projected to lead to large-scale distribution shifts and local extinctions (9). Potential health benefits from consuming omega-3 fatty acids (mainly from oily fish), on ischaemic heart disease risk, are constrained by reductions in fish stocks. The UK is unable to meet healthy diet guidelines for the population from its domestic landings, which fell to 19% of the recommended intake in 2012.

Pollination by insects is an important form of reproduction for at least 87 types of leading global food crops, comprising more than 35% of the annual global food production. The loss of pollinators could reduce the amount of fruits, vegetables, nuts and seeds in the diet and leave hundreds of millions of people at risk of vitamin A and folate deficiencies. A 50% loss is estimated to increase deaths by around 0.7 million annually (78).

6.3 Local impact

England has the greatest decline of pollinators anywhere in Europe. Nationally the cost of replacing pollination services provided by bees alone is thought to be over £1.8 billion a year (79). Food waste is also an important local issue.

In Devon, agriculture and food production accounts for 13% of the county's economy, compared to 7.6% nationally. Changes towards more sustainable dietary patterns with less meat, may present a challenge to Devon farming. Sustainable intensification – defined as increasing yields, without adverse environmental impact, and without the cultivation of more land – may be one way forward (80).

Pollinators

Devon Wildlife Trust have been working to create spaces for insects beyond their nature reserves and across the wider landscapes. This has led to the creation of 94 new wildflower-rich grasslands covering more than 300 hectares in North Devon. In South Devon's Avon Valley, it has meant 27 new insect-friendly grasslands encompassing 38 hectares. In Exeter they have worked with schools and communities to create urban meadows on city streets, parks, allotments, school gardens and roundabouts. Devon County Council has produced a pollinators action plan and has signed up to the Devon Local Nature Partnership's Devon Pollinators Pledge to "Get Devon Buzzing" (79). 500 farmers, parishes, schools, local authorities, community groups and organisations have signed up to the pledge (Box 6.1).

Box 6.1: Get Devon Buzzing (81)

- Plant bee-friendly flowers to provide nectar and pollen.
- Create and protect meadows and other areas rich in wild flowers.
- Leave areas to grow wild and build a 'bug hotel' in your garden.
- Think carefully about whether to use pesticides. Only use them if absolutely necessary.

Devon Local Nature Partnership

Food waste

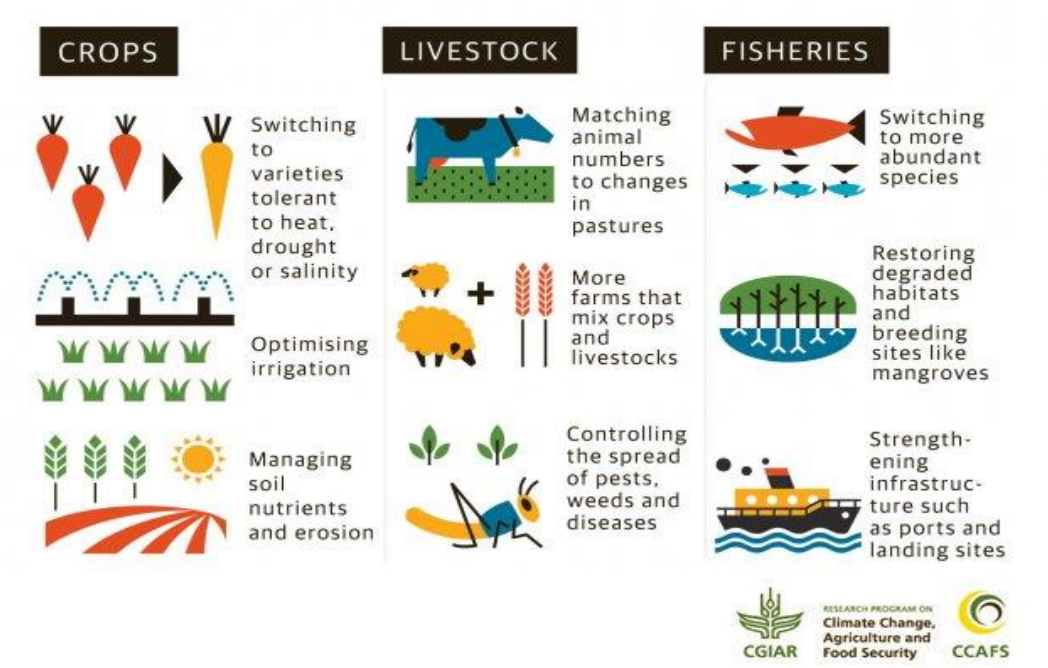
Approximately one third of all food produced for human consumption is lost or wasted each year. Food production has major environmental impacts and food wastage compounds these. It ranks as the third top emitter of carbon dioxide (CO2) after the USA and China, it wastes 250km^3 of fresh water, and it cost US$750 billion per year (82). Reducing food waste means less land is needed for agriculture, saving energy, water, helping to protect biodiversity and improving food security. Food wastage also raises social questions on issues surrounding food poverty.

Devon County Council studies of household bins across the County show that kitchen organics are the largest contributor to the average content. The Council is involved in several schemes tackling food waste in Devon. The Devon Waste Education Programme works with primary and secondary schools through visits and workshops to address all aspects of waste in the school environment. Redistribution of food waste in the community, from households or businesses, is encouraged through the Community Fridges scheme. These are food storage areas where anyone can put food in, and anyone can take food out. Community Fridges are typically located in social spaces, enabling people to connect to their communities. There are also schemes addressing food waste from supermarkets, such as Devon and Cornwall Food Action and Exeter Food Action. Most of Devon's district councils collect food waste recycling with the exception of Exeter City Council which is planning to introduce food waste collection in 2021 (83).

6.4 Adaptation and Resilience

Multiple adaptions to crops, livestock and fisheries are needed to maintain food security. Farmers might need to switch to new varieties or crops that are more tolerant to heat, drought or salinity. Livestock keepers will need to think about the rise of new diseases affecting their cattle and crops. Fishers might need to restore degraded breeding sites to maintain fish populations (Figure 6.1).

Figure 6.1: Climate change, food and farming, adaption is key (84)



Credit: Vermeulen SJ. 2014. Climate change, food security and small-scale producers. CCAFS Info Brief. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark. Available online at: www.ccafs.cgiar.org
https://ccafs.cgiar.org/blog/climate-change-and-farming-what-you-need-know-about-ipcc-report#.XnJKqfZ2t8R
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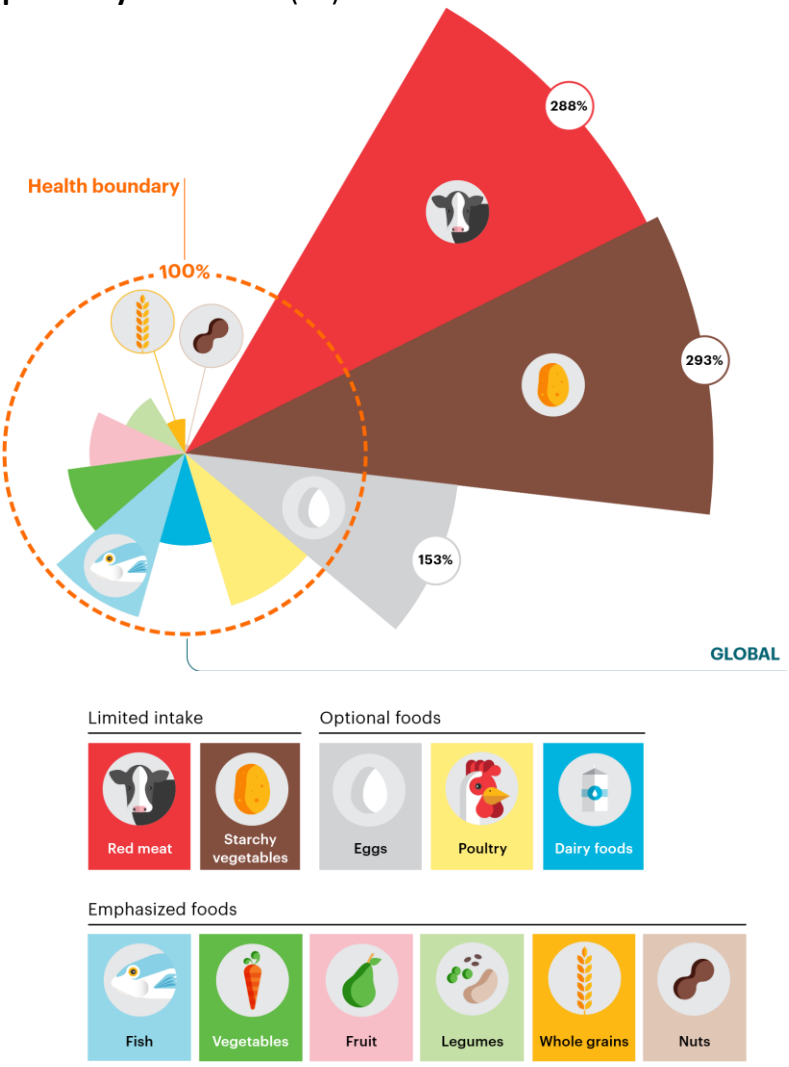
Changing dietary patterns would make diets more sustainable, reduce the impact of agriculture on the environment and have co-benefits for health. Animal products generally require more land, water and energy to produce, and create more waste than crops. The livestock sector accounts for 15% of global emissions which is equivalent to exhaust emissions from all the vehicles in the world. In industrialised countries, the average person eats twice as much meat as is deemed healthy and global consumption is set to rise by over 75% by 2050. Overconsumption is contributing to the rise of obesity and non-communicable diseases like cancer, type-2 diabetes and heart disease (85). Diets that support good health are low in red meat and high in fruits and vegetables. Foods that should be eaten abundantly for good health generate the lowest environmental impact while those to be consumed sparingly for health should also be limited for environmental reasons (Figure 6.2) (Box 6.2).

Figure 6.2: The "diet gap" between current dietary patterns and intakes of food in the planetary health diet (86)



Credit: The EAT Foundation
This graphic was prepared by EAT and is included in an adapted summary of the Commission Food in The Anthropocene: the EAT-*Lancet* Commission on Healthy Diets From Sustainable Food Systems.
The entire Commission can be found online at eatforum.org/eat-lancet-commission
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Box 6.2: Characteristics of low environmental impact diets consistent with good health (87)

- Diversity - a wide variety of foods eaten.
- Balance achieved between energy intake and energy needs.
- Based around: minimally processed tubers and whole grains; legumes; fruits and vegetables
- Meat, if eaten, in moderate quantities
- Dairy products or alternatives (e.g. fortified milk substitutes and other foods rich in calcium and micronutrients) eaten in moderation.
- Unsalted seeds and nuts.
- Small quantities of fish and aquatic products sourced from certified fisheries.
- Very limited consumption of foods high in fat, sugar or salt and low in micronutrients e.g. crisps, confectionery, sugary drinks.
- Oils and fats with a beneficial Omega 3:6 ratio such as rapeseed and olive oil.
- Tap water in preference to other beverages - particularly soft drinks.

Food Climate Research Network

Box 6.3: Tips to reduce food waste at home (88)

- **Start small** – Take smaller portions at home or share large dishes at restaurants
- **Leave nothing behind** – Keep your leftovers for another meal or use them in a different dish
- **Buy only what you need** – Be smart with your shopping. Make a list of what you need and stick to it. Don't buy more than you can use
- **Don't be prejudiced** - Buy "ugly" or irregularly shaped fruits and vegetables that are just as good but look a little different
- **Check your fridge** – Store food between 1 and 5 degrees Celsius for maximum freshness and shelf-life
- **First in, first out** – Try using produce that you had bought previously and, when you stack up your fridge and cupboards, move older products to the front and place newer ones in the back
- **Understand dates** - "Use by" indicates a date by which the food is safe to be eaten, while "best before" means the food's quality is best prior to that date, but it is still safe for consumption after it. Another date mark that you can find on food packages is the "Sell by" date, which is helpful for stock rotation by manufacturers and retailers
- **Compost** – Some food waste might be unavoidable, so why not set up a compost bin
- **Donate the surplus** – Sharing is caring

Food and Agriculture Organization of the United Nations

6.5 Opportunities

Changing to planetary health diets and reducing overconsumption of calories has a greater impact on food related emission reduction than reducing food waste or changes to farming practices (89). Tackling the food aspects of climate and environmental change provides opportunities to improve health and the global issues of obesity and malnutrition (90).

The Change4Life programme supports younger children and their families to eat better and take regular exercise (91). The campaign focuses on food swaps to healthier options and can both encourage and be supported by more sustainable environmental and economic choices. One Small Step in Devon also supports lifestyle changes, such as diet and drinking (92).

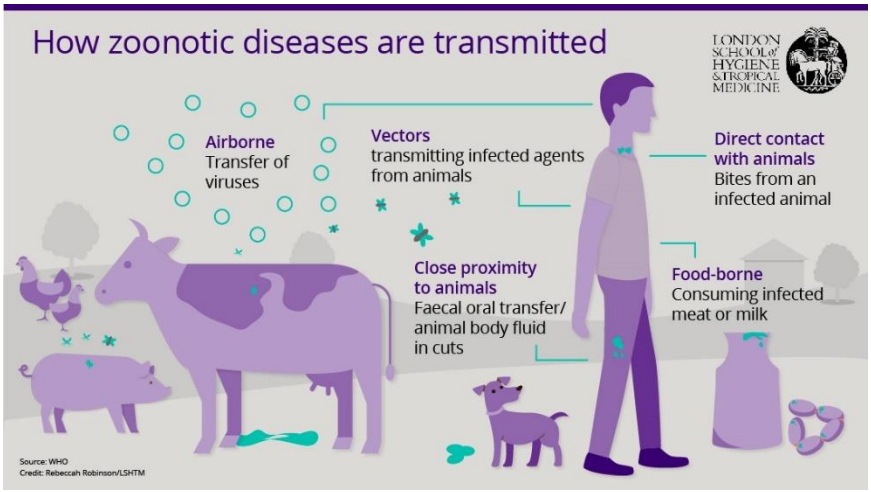
Opportunities should be sought in developing an agricultural policy on leaving the EU that seeks to support local environments and provide sustainable and affordable food to promote a healthier society. This is particularly important in rural economies (93), such as Devon.

7 Disease

7.1 Background

Ecological changes have led to increased rates of disease including emerging (new or rapidly increasing) and re-emerging diseases such as Ebola, novel viral infections (such as Severe Adult Respiratory Syndrome (SARS), Middle Eastern Respiratory Syndrome (MERS), COVID-19) and malaria (65). Zoonotic diseases are spread between animals and people and can be caused by viruses, bacteria, parasites, and fungi. These diseases can be transmitted through direct contact with animals, contact with contaminated food or water, and via vectors (Figure 7.1:). Between 1940 and 2005 half of the global emerging infectious disease events of zoonotic origin are estimated to have been a result of environmental change. Climate change and changes in; land use, agricultural practices, food production practices and biodiversity are expected to substantially increase the frequency of emerging infectious diseases (65).

Figure 7.1: How Zoonotic diseases are transmitted (94)



Credit: The London School of Hygiene & Tropical Medicine
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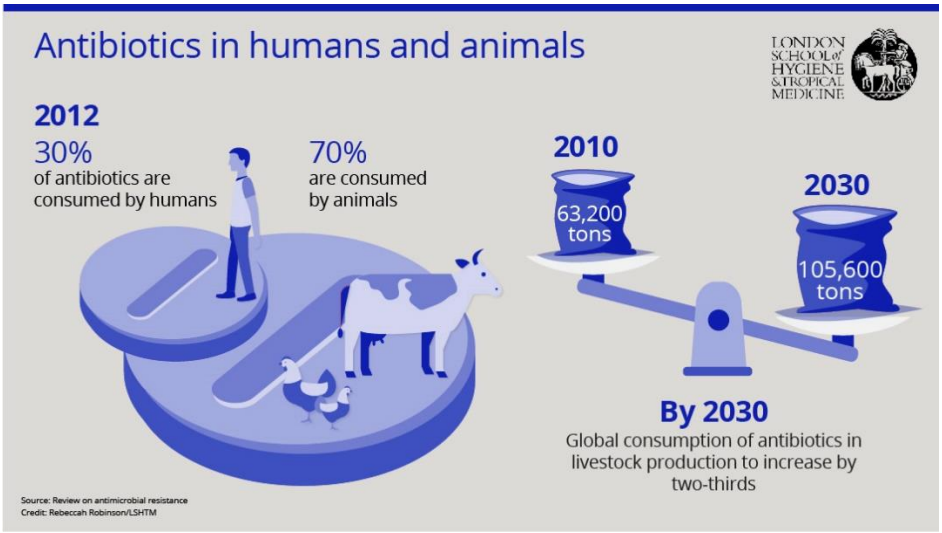
Vector-borne diseases, such as malaria, dengue fever and Lyme disease, are transmitted by animals such as ticks and mosquitos. It is likely that the range, activity and vector potential of many ticks and mosquitoes will increase across the UK, with milder winters, warmer summers and wetter springs (14). Climate change is causing the invasion of disease vectors to new areas and the introduction of exotic species and pathogens into the UK is a possibility (14). Extreme weather events such as drought can affect water table levels, and plant and animal life, and can consequently affect mosquito populations. Urban mosquitoes can exploit aquatic habitats created in response to drought, such as water storage containers.

Changes to natural habitats, such as the loss of forest to industrial operations and farming, creates pathways for the spread of disease from wild animals into domesticated animals and humans. Deforestation benefits mosquitoes by creating new breeding sites and microclimates (increased temperature and humidity) that are favourable to their survival and reproduction. The loss of biodiversity, including predator populations, can increase the population of vectors or hosts.

Environmental change also impacts water- and food-borne diseases by influencing growth, survival, persistence, transmission and virulence. Climate change with rising temperatures, humidity, and variability of rainfall is likely to amplify the spread of water-borne pathogens, particularly increasing the incidence of diarrhoeal disease. Intact forests filter pathogens from surface water and reduce flooding. These effects are lost with deforestation. Drinking water and recreational water may be contaminated by sewage during heavy rain fall and flooding. Bacterial pathogens are more likely to grow on crops in warmer conditions and become attached to leafy crops under conditions of both flooding and drought. Food borne diseases such as Salmonella grow more readily in warmer weather which also favours pests and fungal mycotoxins that affect food safety (14).

Genetic changes in disease vectors or pathogens can be caused by human activity. Mosquito resistance to pesticide and the emergence of antibiotic resistant bacteria are driven by the use of pesticides and the overuse of antibiotics. In many countries most antibiotics are used in the animal sector and these are mainly used to encourage growth rather than for treatment (Figure 7.2). Without effective antimicrobials, medical procedures such as Caesarean sections, hip replacements, and chemotherapy treatment, become very high risk. It is projected that deaths from drug resistant infections could rise to 10 million a year by 2050, more than the projected 8.2 million deaths a year from cancer (94).

Figure 7.2: 7 Antibiotics in humans and animals (94)



Credit: The London School of Hygiene & Tropical Medicine
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7.2 Health impacts

Malaria is caused by a parasite which is transmitted by mosquitoes. There are 350–500 million malaria infections worldwide and approximately 1 million deaths each year (95). 200 million additional people are estimated to be at risk of malaria due to climate change, with higher temperatures and shifts in rainfall patterns supporting conditions for transmission (63). Locally transmitted malaria has recently re-emerged in Greece and there are concerns that climate change could lead to the resurgence of malaria in Europe. In the UK only a few months in the year provide temperature conditions appropriate for the transmission of malaria by indigenous mosquitoes. Although such transmission occurred in the past, it is a minor threat currently as living conditions have improved considerably. As the climate becomes warmer, conditions for transmission become more favourable, and last for longer.

An increase in the number of mosquito species and the abundance of mosquitoes in the UK has implications for transmission of other diseases such as the West Nile virus. The establishment in the UK of exotic mosquitoes such as Aedes albopictus and ticks such as Hyalomma marginatum will also become more likely. In other parts of Europe these species transmit chikungunya virus and Crimean-Congo Haemorrhagic Fever virus, respectively (14).

Dengue is the most rapidly spreading mosquito-borne viral disease, with a 30-fold increase in global incidence over the past 50 years. Each year there are about 390 million infections worldwide. Over the last two decades climate conditions have become more suitable for the vectors of dengue in central north western Europe. The first transmission of dengue in Europe since the 1920s was reported in 2012 in Madeira, Portugal (63).

Climate-sensitive water and food borne infections of concern include organisms that are transmitted by the faecal oral route as well as bacteria and protozoa that occur naturally in aquatic systems. Exposure to contaminated water or food occurs by ingestion, incidental ingestion during swimming; and by direct contact with eyes, ears, or open wounds. The bacteria which cause cholera may be transmitted by drinking water or by exposure to seawater and seafood. Temperature, rainfall, changes in salinity due to freshwater runoff, the addition of organic carbon or other nutrients, and changes in pH all affect the risk of infection and exposure routes.

Salmonella and Campylobacter are among the most common food- and water-borne bacterial pathogens worldwide, causing gastroenteritis symptoms of diarrhoea and vomiting. In both cases higher rates of disease are seen at warmer temperatures. In 2016 there were 8,558 cases of Salmonella reported in England and Wales, 854 in the South West, and 52,381 cases of Campylobacter reported in England and Wales and 6,573 in the South West (96)(97). Viral diseases can be similarly affected. Hand, foot, and mouth disease, a common infection in under 5-year olds caused by coxsackievirus and enterovirus, shows a rapid rise in incidence when temperatures exceed 32°C.

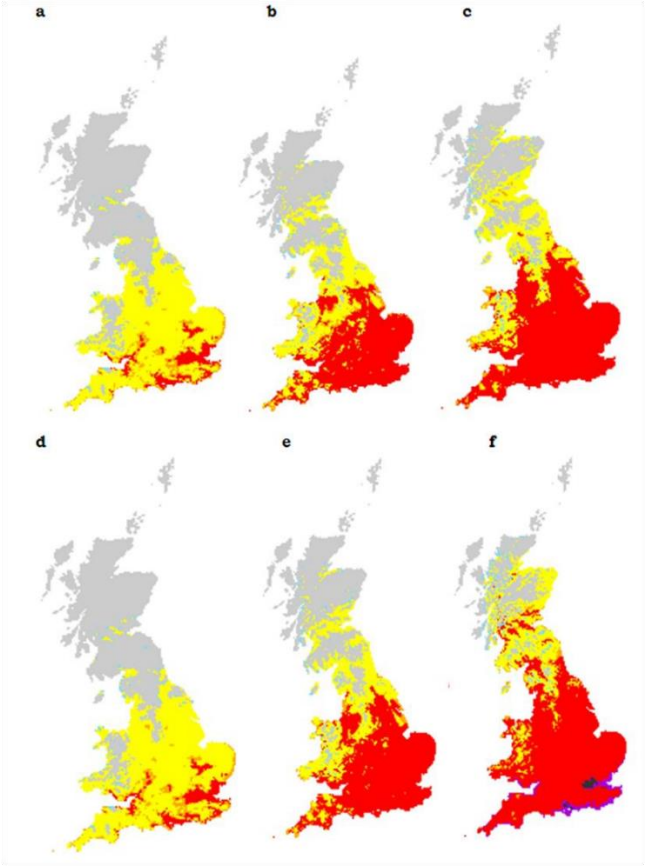
Aspergillus is a mould which is found on commodities, such as maize, milk, and dried fruit. Water stress, rising atmospheric carbon dioxide, and raised temperatures can increase its production of a toxin called aflatoxin. Exposure to this toxin increases the risk of liver

cancer, particularly in conjunction with hepatitis B, and can increase the risk of childhood stunting (65).

7.3 Local impact

The impact of environmental change on disease is a risk for the health of the local population. Under both medium-low and medium high climate-change scenarios, the risk of transmission of malaria is predicted to increase in the South of England, spreading northwards towards Scotland (Figure 7.3) (14).

Figure 7.3: Projected future risk maps for vivax malarial transmission under medium-low (a, b and c) and medium-high (d, e and f) climate change scenarios. (14)
Maps show risk for the period 2020s (a and d), 2050s (b and e) and 2080s (c and f)



Credit: Public Health England
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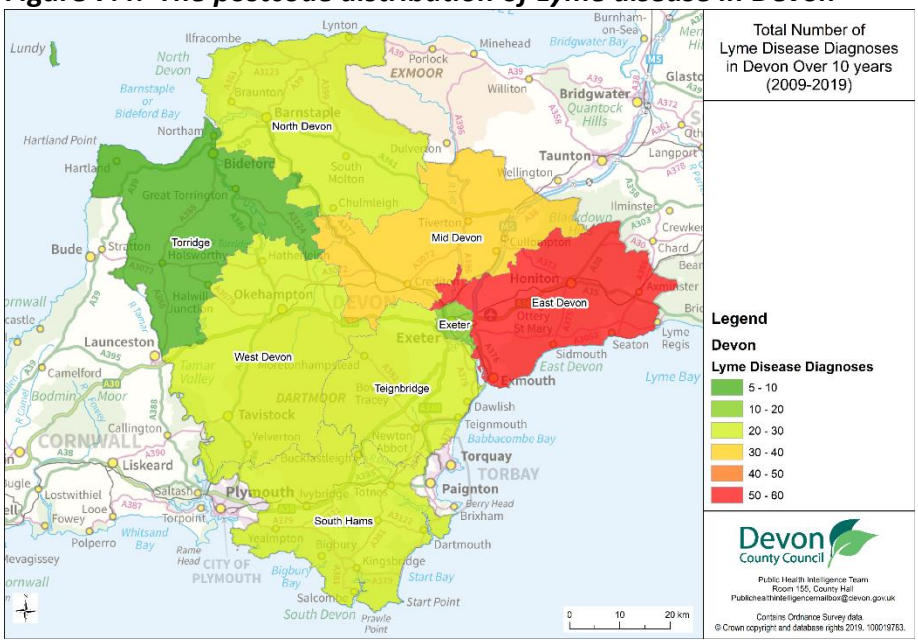
There are approximately twenty species of tick that are endemic in the United Kingdom. Ticks are known to transmit a range of pathogens to humans via the bite of infected ticks. The most common of which is the bacterial infection that causes Lyme disease. Lyme

disease is the most common vector-borne human infection in England and Wales with the highest numbers of cases seen in the southern counties (Figure 7.4**:**).

There are estimated to be around 2000-3000 new cases every year. Laboratory-confirmed reports of Lyme disease have risen steadily from 0.38 per 100,000 population for the period 1997-2000, to 2.70 cases per 100,000 population in 2017. Changes in the distribution of ticks is thought to have contributed to this rise (98).

Figure 7.4: ***The postcode distribution of Lyme disease in Devon***



Credit: Devon County Council Public Health Team

7.4 Adaptation and Resilience

One of the key aspects in tackling antimicrobial resistance is reducing infections and therefore the need for antibiotic use. Risk of infection can be reduced by hand washing, preparing food hygienically, practicing safe sex and keeping vaccinations up to date (Figure 7.5:). Estimated global rates of handwashing after using the toilet are 19%. Effective handwashing education in the community reduces the number of people who get sick with; diarrhoea by 23-40%, respiratory illnesses, like colds, by 16-21%, and reduces absenteeism due to gastrointestinal illness in schoolchildren by 29-57% (Figure 7.6:). About 1.8 million children under the age of 5 die each year from diarrhoeal diseases and pneumonia. Handwashing with soap could protect about 1 out of every 3 young children who get sick with diarrhoea and almost 1 out of 5 young children with respiratory infections like pneumonia (99).

Public Health England has published information to promote “Tick Awareness” (Box 7.2) and the County Council runs a public campaign each year.

Figure 7.5: Preventing antibiotic resistance (100)

Credit: United Nations News Centre
https://news.un.org/en/story/2017/11/635832-antibiotic-resistance-crisis-we-cannot-ignore-un-warns-calling-responsible-use
https://shop.un.org/rights-permissions

Figure 7.6: Effective handwashing (101)

Credit: Clean hands protect against infection
https://www.who.int/gpsc/clean_hands_protection/en/
World Health Organization; 2020. Licence: CC BY-NC-SA 3.0 IGO.

Box 7.2: Key tick awareness messages (98)

- '**Be tick aware**' and remember that you could be exposed to ticks whenever you spend time outdoors, including when in your garden or the local park
- Ticks mainly attach to animals, but sometimes they may bite you or your family
- You can prevent tick bites by walking on clearly defined paths, using insect repellent and performing **regular tick checks**
- Some tick bites can result in infection, so it is important to remove ticks safely and as quickly as possible
- The safest way to remove a tick is by using a pair of **fine-tipped** tweezer or a tick removal tool
- Contact your GP or dial NHS 111 **promptly** if you begin to feel unwell with flu-like symptoms or develop a spreading circular red rash. Remember to tell them you were bitten by a tick or have recently spent time outdoors

Public Health England

7.5 Opportunities

The emergence of the novel coronavirus SARS-CoV-2 at the end of 2019 in Wuhan, China, has evolved into a major threat to health and healthcare across the world. Pandemic mitigations including the coronavirus-induced lockdown period and its impact on other species, or anthropause, have shown what alternatives could look like. The rapid response to the pandemic has demonstrated that policies and the general population can adapt and except change at pace. There is an opportunity to build on recent learning and for this be translated into tackling the global threat of climate change.

The pandemic highlights the need for a comprehensive and integrated approach to human health. Enhancing environmental health through better air quality, water and sanitation, waste management, along with efforts to safeguard biodiversity, will reduce the vulnerability of communities to pandemics and thus improve overall societal well-being and resilience (102). The pandemic has also highlighted the complex link between social determinants, disease, and the environment. Local Government has the opportunity to establish and support "Health in All Policies" (HiAP) that are inclusive and adaptive to climate change (103).

8 Mental health

8.1 Background

Environmental change is likely to affect mental health in many ways. Heat waves have been linked to increased rates of admissions for mental illness and increased rates of aggression have also been observed. Extreme heat exposure can lead to psychological exhaustion. Increasing ambient temperatures, extreme weather events and rising sea levels can impact mental health through economic strain and traumatic events, among others. Future climate refugees will also have needs arising from the mental health impacts of migration and forced relocation.

Extreme weather events such as floods, droughts, cyclones and heat waves can increase the stress on those who already suffer with mental ill health and may create enough stress for some who are not ill to become so. Secondary stressors such as; problems with compensation, physical health related stressors, recovery of and rebuilding of homes, loss of resources, stress relating to education and schooling and continued lack of infrastructure, can have profound effects on mental health and psychosocial resilience that may continue over extended periods of time (14).

Following natural disasters risk factors for depression in adults include; being female; not being married; holding religious beliefs; having poor education; experiencing injury, or bereavement during the disaster; or losing employment or property. Manifestations of disaster-related psychiatric trauma include severe anxiety reactions (such as post-traumatic stress) and longer-term impacts such as generalized anxiety, depression, aggression, and complex psychopathology. For slow-developing events such as prolonged droughts, impacts include chronic psychological distress and increased incidence of suicide (63).

Extreme weather events, sea level rises and conflict over resources can lead to environmental change related displacement. Important bonds exist between individuals and their sociophysical environment. Disruption of these bonds can cause grief, loss, and anxiety. Displacement causes mental health effects through the trauma of leaving familiar surroundings and possessions, the breaking of social ties, the increased risk of violence, the difficulty of resettlement, and the absence of mental health services. An important protective factor is to keep families, and even entire communities united. For instance, this might involve the engagement of local communities to plan and implement the managed retreat of threatened coastal communities (65).

Environmental challenges play a role in ‘sense of place’ and identity. The term *solastalgia* is used to describes the mental or existential distress caused by environmental change (104). Following a decade long drought in New South Wales, Australia, an increase in anxiety, depression, and possibly suicidality was seen in rural populations. Concerns about financial and work-related issues were compounded by loss of hope for the future and by a sense of powerlessness or lack of control (65).

Combating environmental change has co-benefits for mental health. Work to retain and develop the natural environment, such as urban natural spaces; reduces flooding by absorbing water and decreasing run off from heavy storms; captures CO2 and other pollutants, improving air quality, by increasing the number of plants; and lowers ambient temperatures reducing the 'Heat Island Effect'. Such projects also improve the publics access to, and the quality of, natural spaces which supports mental health.

8.2 Health impacts

Access to green space such as woodlands and parks or blue space such as rivers or lakes is linked to better mental health and wellbeing across all socioeconomic strata and genders (Figure 8:). Higher levels of neighbourhood greenery are linked to lower levels of depression, anxiety and stress. Moving to greener urban areas is associated with sustained improvements in mental health, while moving to less green areas is associated with a decline in mental health.

Figure 8: Green Space and Blue Space (105)

Credit: Public Health England

Engaging in physical activity in natural environments is associated with additional benefits to mental wellbeing that are not seen with similar levels of indoor physical activity. Older people who engage in walking as a physical activity are less likely to develop dementia (106). In schoolchildren, greater surrounding greenness at home and school is associated with improved mental health and improved cognitive development. Annual time spent at the beach is associated with a reduction in behavioural difficulties and a positive impact of

green and blue space exposure has been seen on Attention Deficit Hyperactivity Disorder (ADHD) and related symptoms (107).

Access to good quality natural space is also associated with a range of positive health outcomes including better self-rated health; lower body mass index scores, overweight and obesity levels and increased longevity in older people. Acute hospital patients feel better and are discharged sooner when they can see greenery outside their window or enjoy a hospital garden. Other benefits include encouraging physical activity, improved social networks and sustainable communities. Income-related inequality in health is also less pronounced where people have access to green space (106).

8.3 Local impact

Environmental change poses a risk for the mental health and well-being of the local population. Land use in Devon is predominantly rural with 93% of the total land area classified as green space and 0.8% of the total land area being occupied by buildings. As the population of Devon grows, it is predicted that the amount of green space will decrease. 71% of Devon's population visit the natural environment frequently (at least once a week), compared to 58% in England. Large areas of Devon benefit from public access to the natural environment, within a reasonable distance from where they live. This includes the South West Coast Path and an extensive public rights of way network which provides access to the countryside and opportunities to undertake a range of recreational activities. Some areas are deficient in accessible green space compared to the Natural England standards. Areas of Mid Devon, North Devon and Torridge experience the greatest levels of deficiency (67).

Table 8.1 shows self-reported wellbeing measures in the Devon STP.

Table 8.1 Self-reported wellbeing measures in the Devon STP (2016/17)

Indicator	Devon	South West	England
Low satisfaction score	3.4%	4.1%	4.5%
Low worthwhile score	-	3.7%	3.6%
Low happiness score	7.2%	8.6%	8.5%
High anxiety score	17.7%	18.7%	19.6%

Source: Public Health Outcomes Framework, 2018

Box 8.1: Naturally Healthy (108)

'Naturally Healthy' is a priority theme of the Devon Local Nature Partnership. Their work brings together partners from the health, wellbeing, community and environment sectors to enable everyone to benefit from an increased connection with Devon's natural environment.

Naturally Healthy means reconnecting with the natural world to benefit your physical and mental health. This could be a nature ramble, wild swimming, bird watching, gardening or environmental volunteering such as a beach clean or surveying an ancient monument. A more relaxed approach could be as simple as an afternoon painting a beautiful landscape. The key is finding an activity that suits the individual. Many Naturally Healthy interventions offer a chance to learn new skills, meet new people and increase activity levels in a safe and supportive way. Regardless of age or fitness there is something for everyone and no experience needed for most activities.

The initiative is:

- Working with the health and well-being sector to support commissioning of Naturally Healthy interventions and their inclusion in strategies and delivery plans, as part of the prevention agenda.
- Engaging with providers to develop activities which encourage long term behaviour change and target priority audiences.
- Promoting and signposting opportunities to the public for high quality local access to the environment.

www.naturaldevon.org.uk

8.4 Adaptation and Resilience

Supporting wellbeing and good mental health as well as providing access to services is important in managing the impact of environmental change on mental health. A Public Health England survey revealed more than eight in ten people (83%) had experienced early signs of poor mental health including feeling anxious, stressed, having low mood or trouble sleeping in the last 12 months. Nearly six in ten people (57%) who experienced concerns about their mental health turned to unhealthy behaviours – smoking, drinking alcohol, unhealthy eating or taking recreational drugs. Just over half of people (53%) who experienced concerns about their mental health avoided social situations or contact from friends and family.

In October 2019 Public Health England, in partnership with the NHS, launched 'Every Mind Matters' to help people take simple steps to look after their mental health, improve their mental wellbeing and support others. The new platform is available to the public and will enable people to create a personalised action plan recommending a set of self-care actions to deal with stress, boost mood, improve sleep and feel in control. It shows people how to

build simple evidence-based changes into their daily lives – such as reframing unhelpful thoughts, breathing exercises and increasing physical activity (109).

Early Help 4 Mental Health (EH4MH) is a prevention and early intervention programme in Devon, working with schools and children and young people to promote positive emotional health and wellbeing. The aim is to promote and support resilience in children and young people, helping to tackle mental health issues early before they become more serious. Schools have been accessing training and clinical supervision from EH4MH practitioners to help with embedding a whole school approach to positive mental health. The programme also offers face-to-face and online counselling support through Young Devon and Kooth.com for those children who are experiencing emerging mental health issues (2).

8.5 Opportunities

Environmental change has led to the development of numerous community projects - tackling its causes and developing community resilience, such as the development of community flood groups. Such community projects can support mental health and wellbeing; bringing people together, reducing isolation and loneliness, and strengthening social support. In the most deprived communities, almost half of people report a severe lack of support making those who are at greater risk less resilient to the health effects of social and economic disadvantage (110). Supporting confident and connected communities improves mental and physical health, builds resilience for wellbeing and reduces health inequalities (111).

There are opportunities for learning to develop our understanding of our relationship and impact on the environment and future environment. The Naturally Healthy Devon Schools project extended the work of the Natural Connections Demonstration Project with an additional focus on the health benefits of learning in the natural environment (LINE). The aim of the project was to encourage school aged children to regularly interact with Devon's natural environment in order to improve their health and wellbeing, by engaging in LINE as an integral part of the curriculum (112).

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