This World Health Organization (WHO) health and climate change urban profile presents a snapshot of key climate hazards, climate-sensitive health risks, and the potential health benefits of climate change adaptation and mitigation. The profile does not provide comprehensive information on all climate hazards, vulnerability factors or health risks but rather provides examples of some immediate risks based on available evidence and reported priorities and initiatives. Outlined in this profile are opportunities to promote policies and projects that protect the climate and environment while having large immediate health benefits at a local level.
Climate hazards and health risks (1, 2)

Evidence to support

Flooding / extreme precipitation
- Projections for the Clyde river basin estimate that precipitation from October to March will increase by up to 42% by 2050 if greenhouse gas (GHG) emissions remain high (1).
- The River Clyde poses a significant flooding risk to 32% of the total city area, as current sea levels are expected to rise by approximately 50 cm by 2080 (1).
- Currently in the Glasgow City Council area, 45,000 homes, businesses and services are considered at risk of flooding (mainly surface water flooding). This is predicted to increase to 57,000 by 2080 due to the impact of climate change (a 26% increase)(8).
- Poor health and the high prevalence of mental health disorders makes the population particularly vulnerable to these impacts. Of all Scottish councils, Glasgow City has the highest number of people with mental health disorders (9).

Heat stress
- Scotland’s 10 warmest years on record have all occurred since 1997 (10).
- Glasgow’s housing infrastructure is unprepared for ever-increasing temperature rise. Many parts of the city will be affected by the urban heat island effect (11).
- Heatwaves can result in premature death and illnesses, particularly affecting older and younger people. Heat exacerbates existing illnesses, such as COPD and ischemic heart disease, both of which are among the top five illnesses causing premature death in Glasgow (12).
- In Scotland, cases of COPD as a cause of death and disability have increased by 20% within a decade (12).

Health and social inequality
- Climate change is a threat multiplier to existing vulnerabilities. Socioeconomic and health inequalities significantly impact the city’s adaptive capacity (2).
- Twenty-nine per cent of Glaswegians live in the most deprived Scottish decile, the highest percentage among the Scottish cities (13).
- The gap in life expectancy at birth between the least and most deprived deciles has widened to a 15-year gap for males and a 12-year gap for females (11). Higher rates of mental disorders are also associated with the most deprived areas (14).
- Between 2014-2018, premature mortality in Glasgow was 17% higher and mortality for all ages was 12% higher than in Liverpool and Manchester, cities with similar socioeconomic profiles and histories of deindustrialization (15, 12).

Air pollution
- In 2016, in Glasgow City, people 65+ experienced a 57% higher rate of chronic obstructive pulmonary disease (COPD) disability-adjusted life years than the Scottish average (6)(7).
- Glasgow’s average concentration of PM2.5 was 13.3 μg/m³ in 2010. By 2019, this had declined to 9.9 μg/m³ (18), but was still slightly above the WHO air quality guideline value of 5 μg/m³ (17).
- In 2017, there were an estimated 354 deaths attributable to air pollution in adults aged 25 years and older in Glasgow City, twice the number of any other Scottish city (18).

BreathLife City - X
Glasgow is not part of the BreathLife global campaign to mobilize cities to protect health and the planet from the effects of air pollution (19).

Health and development indicators

56 years
Between 2018-2020, healthy life expectancy (HLE) in Glasgow was 56 years for males and 57.4 years for females (1).

Top 5
Out of all local authorities in the UK, Glasgow City is ranked in the top 5 for the number of people exposed to frequent flooding (4).

25%
Twenty-five per cent of households in Glasgow were in fuel poverty during 2016–2018, 11% of these in extreme fuel poverty (5).

57%
In 2016, in Glasgow City, people 65+ experienced a 57% higher rate of chronic obstructive pulmonary disease (COPD) disability-adjusted life years than the Scottish average (6,7).

5.9 μg/m³
Glasgow’s average concentration of PM2.5 was 8.3 μg/m³ in 2010, by 2019, this had declined to 5.9 μg/m³ (18) but was still slightly above the WHO air quality guideline value of 5 μg/m³ (17).

354 deaths
In 2017, there were an estimated 354 deaths attributable to air pollution in adults aged 25 years and older in Glasgow City, twice the number of any other Scottish city (18).

1 Air pollution increases the risk of cardiovascular diseases, respiratory conditions, including chronic obstructive pulmonary disease, and some cancers. It poses a particular risk to vulnerable groups like older people, children, and those with chronic respiratory conditions or pre-existing medical conditions (7).

2 Many of the drivers of climate change, such as inefficient and polluting forms of energy and transport systems, also contribute to air pollution.

3 The BreathLife Network and global campaign is a collaboration between WHO, the Climate and Clean Air Coalition, the United Nations Environment Programme, and the World Bank.
Comparing CO2 emissions in 2019 against a 2006 baseline reveals a 41% reduction, indicating that the city was ahead of its 2020 target of a 30% emissions reduction. This is 15 years earlier than Scotland’s net zero target – to achieve a 41% reduction in emissions striking a balance between climate, environment, health, equality, inclusion and well-being. Glasgow aims to build healthy, accessible and safe places by establishing the Liveable Neighbourhoods Plan which includes a ‘20 Minute Neighbourhood’ approach. The plan also seeks to deliver blue-green infrastructure for multiple benefits it provides, including flood risk, urban cooling and biodiversity. Across the city, interventions are being delivered to retrofit rain gardens and combine public spaces with temporary stormwater storage.

Benefits to health

Clean and sustainable transport
- In 2018, Glasgow introduced a Low Emission Zone for local bus services. Monitoring records show air quality has been steadily improving across the city, although some pockets of the city centre continue to fail to meet the NO2 annual mean objective required to protect human health. Improvement is expected when the Low Emission Zone will be expanded to all vehicles entering the city centre in 2023 (21).
- Glasgow has developed an active travel strategy. The strategy aims to achieve a significant modal shift across the city to walking, wheeling and cycling. The strategy supports other city policy objectives related to climate, environment, health, equality, inclusion and well-being.
- Glasgow aims to build healthy, accessible and safe places by establishing the Liveable Neighbourhoods Plan which includes a ‘20 Minute Neighbourhood’ approach. The plan also seeks to deliver blue-green infrastructure for the multiple benefits it provides, including flood risk, urban cooling and biodiversity (22).
- The cycle hire scheme is expanding to 1000 bikes and 100 stations. It has a 40% female user base, double the national average for female participation in cycling (23).

Flooding
- Glasgow’s Local Flood Risk Management Plan includes surface water management plans, flood studies, emergency plans, flood forecasting, maintenance, awareness raising and vulnerability mapping. The Scottish Environment Protection Agency’s Floodline system works to warn communities of river and coastal flood risks (24).
- The Metropolitan Glasgow Strategic Drainage Partnership aims to transform how the city region thinks about and manages rainfall, to end uncontrolled flooding and improve (environmental) water quality (25).
- Flood risk management interventions target areas where rainfall adversely impacts communities, with a focus on sustainable, blue-green, interventions for surface water drainage to deliver multiple benefits as part of a ‘sponge city’ concept. Across the city, interventions are being delivered to retrofit rain gardens and combine public spaces with temporary stormwater storage (26).

Nature-based solutions
- “Connecting Nature” is a five-year project from the European Commission’s Horizon 2020 (€ 12 million) to lead nature-based solutions projects (27). This project complements the city’s Open Space Strategy, which is based on the principles of liveability, health and wellbeing, and resilience, and aims to use open space to deliver multiple co-benefits including climate change adaptation and mitigation (28). “Clyde Climate Forest” will see 18 million trees planted in both urban and rural parts of the Glasgow City region over the next decade, which will reduce damaging atmospheric emissions (29).

Clean and sustainable transport
- Increasing the provision of active travel routes is expected to promote more walking, wheeling and cycling, improving health and wellbeing, and resilience, and aims to use open space to deliver multiple co-benefits including climate change adaptation and mitigation (28). Studies in Greater London have shown that adaptive responses to increase resilience to heat can reduce annual heat-related mortality by between 32 to 69% across the adaptation scenarios tested, compared to a ‘no adaptation’ scenario (32).
- The development of nature-based solutions and tree planting can contribute to improving air quality, reducing the urban heat island effect and minimizing the risk of flooding. Reducing these environmental risks can avoid premature deaths, injuries and illnesses. Other co-benefits include promoting physical activity, lowering the risk of cardiovascular diseases, and improving mental health by significantly reducing stress levels (33-35).

Climate and health commitments

<table>
<thead>
<tr>
<th>Climate change assessments and plans</th>
<th>Completed?</th>
<th>Health included?</th>
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</thead>
<tbody>
<tr>
<td>Climate risk and vulnerability assessment</td>
<td>✓</td>
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<tr>
<td>Adaptation plan</td>
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<td>Mitigation plan</td>
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<th>Climate change and health targets and initiatives</th>
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<tr>
<td>Global Covenant of Mayors</td>
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<td>Resilient Cities Network</td>
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<td>One Planet City Challenge</td>
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<td>Thriving Cities Initiative</td>
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Glasgow has started identifying the distribution of vulnerable groups likely to be affected by climate change and recognises that vulnerability is dynamic and changes over time (1). The Just Transition Commission developed recommendations that the Scottish Government is taking into account when developing its Just Transition Plan, which includes plans for the fair distribution of cost, community-led climate action, and participatory budgeting (36).

### Sustainable and Resilient Food Systems

The Glasgow City Food Plan aims to achieve a fair, resilient and sustainable food system over time (1). Participatory budgeting developing its Just Transition Plan, which The Just Transition Commission developed (1). Vulnerability is dynamic and changes over time (13). Glasgow has started identifying the creation and continued maintenance of high quality infrastructure and access to safe public spaces and green areas can foster strong social connections, a global assessment of the burden of disease from environmental risks. 2016. World Health Organization. Geneva. (http://apps.who.int/iris/bitstream/10665/79075/1/9789240034090_eng.pdf) accessed 12 May 2021)

### Transition to active travel

Glasgow is committed to accelerating the transition to a more inclusive, healthy and sustainable city. This includes promoting walking, wheeled cycling and for all. The creation and continued maintenance of high quality infrastructure and access to safe public spaces and green areas can foster strong social connections, a global assessment of the burden of disease from environmental risks. 2016. World Health Organization. Geneva. (http://apps.who.int/iris/bitstream/10665/79075/1/9789240034090_eng.pdf) accessed 12 May 2021

### Accelerate action

Glasgow has a lot of strategies that aim to reduce the risk to the population from climate threats and promote health equity. However, faster implementation is needed to ensure targets are met and negative climate impacts are avoided. This can be achieved by strengthening local authority leadership, aligning policies, and ensuring sufficient budget and resources are available.

### Prioritize engagement

Meaningful early engagement with communities should be prioritized to ensure health-promoting adaptation and migration projects reach the vulnerable people and those who do not have sufficient budget and resources are available. Community engagement also ensures alignment with local priorities and an opportunity to maximize the multiple benefits of climate action.

### Calls for action

11. MIoklevic M, Emmanuel R, John T. A spatial exploration of deprivation and health equity within the city. Cycling in Glasgow is on the rise, however, 60% of people in the city do not have access to a bike, 30% don’t currently ride a bike but would like to, and 78% would like to see more money spent on cycling (23). For more information see the Glasgow Transport Strategy and the Active Travel Strategy.
12. Majekodunmi M, Emmanuel R, Jafry T. A spatial exploration of deprivation and health equity within the city. Cycling in Glasgow is on the rise, however, 60% of people in the city do not have access to a bike, 30% don’t currently ride a bike but would like to, and 78% would like to see more money spent on cycling (23). For more information see the Glasgow Transport Strategy and the Active Travel Strategy.
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Acknowledgements

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LEGEND

Key climate hazards

- Flooding
- Sea-level rise
- Extreme and/or increased precipitation
- Heatwaves and/or increased temperatures
- Drought
- Urban heat island effect
- Air quality degradation

Key health risks

- Heat-related illness and death
- Injury and death from extreme weather events
- Malnutrition and foodborne disease
- Mental and psychosocial health
- Non-communicable diseases
- Respiratory illness
- Vector-borne and infectious diseases
- Water security and waterborne diseases
- Zoonoses
- Effect on health systems, including health care facilities

*The key climate hazards listed in this legend may not be a comprehensive list of hazards associated with climate change. Other extreme events including tropical storms or wildfires, if identified as a key hazard, will be presented on page 2.*