Economic Impact Assessment of Climate Change on the Economy of the West Midlands Combined Authority Region

Executive Summary
August 2024

West Midlands Combined Authority | Greener Together

Contents

Report prepared by Paul Watkiss Associates in partnership with Sustainability West Midlands for the West Midlands Combined Authority.

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Introduction

This report presents the findings of the study 'An Economic Impact Assessment of Climate Change on the Economy of the West Midlands Combined Authority Region'. The study was undertaken by Paul Watkiss Associates (PWA) and Sustainability West Midlands (SWM) and was commissioned by the West Midlands Combined Authority (WMCA). The study undertakes three separate strands of analysis for the WMCA area, aimed at answering three distinct questions which seek to understand the local economic impact of climate change:

- **How will global climate change affect the local economy?** – the study has analysed the potential macroeconomic impact of climate change and what it could mean for local economic growth in the WMCA area.
- **What are the future economic costs of key local impacts of climate change?** – the study has analysed evidence on a selection of the most important future risks and opportunities and valued these in economic terms.
- **How much are extreme weather and climate impacts already costing the economy?** – the study provides three case studies of the existing economic costs of extreme weather in recent years to illustrate that extreme weather is already creating economic costs in the WMCA area.
- This work was commissioned to support and complement existing work on climate change adaptation, shown on page 9.

Headline findings

The top-down macroeconomic analysis and bottom-up analysis of individual risks indicate that the annual economic costs to the WMCA region could be potentially 1.5% - 3% of GVA by the 2050s, equivalent to £1.5 – £2.9bn/year.

GVA reduction in the WMCA area a year due to climate change

£350 - £638m

By 2030

£1.5bn - £2.9bn

By 2050

However, this analysis does not consider all possible risks, and an analysis of the uncertainty around these values indicates that there could be potentially higher costs, for example from higher warming scenarios, or if more uncertain extremes are included.

Some of these costs are already being felt today. Case studies on three recent extreme weather events estimates these cost the region a total of £21m. These are likely to be underestimates given significant data gaps.

Conclusions and recommendations

This study has found that the WMCA area is already experiencing economic impacts from climate extremes, and future climate change is projected to lead to significant additional costs to the region this century. The top-down macroeconomic analysis and bottom-up analysis of individual risks indicate that the annual economic costs to the WMCA region could be potentially 1.5% - 3% of GVA by the 2050s, equivalent to £1.5 – £2.9bn/year, though it is stressed that this analysis does not consider all possible risks. An analysis of the uncertainty around these values indicates that there could be potentially higher costs, for example from higher warming scenarios, or if more uncertain extremes are included.

The results reinforce the need for strong, ambitious mitigation and net zero targets as part of global efforts to reduce emissions. However, the lags in the climate system and current progress towards global emissions reduction means that there will be significant costs through to 2040 irrespective of this action, and these local impacts can only be reduced by adaptation. This presents a compelling economic case for WMCA and its partners to move from risk assessment to adaptation planning, investment and delivery. To do this the study identifies three recommendations:

1. Develop a regional adaptation plan for the WMCA area and an associated investment framework.
2. Use the Devolution Deal as a mechanism to govern the development and implementation of the plan.
3. Continue to develop the evidence base on vulnerabilities, risks and impacts to inform future adaptation planning.

Recommendation 1

Develop a regional adaptation plan and associated investment framework for the WMCA area.

The potential future costs highlighted by this study can be reduced significantly by adaptation and recent CCRA analysis indicates that adaptation can have high net benefits (Watkiss et al., 2022). Therefore, as a next step, the WMCA should develop a costed adaptation plan, supported by an investment framework to help mobilise finance from the public and private sectors.

The development of this plan could build on existing frameworks for early adaptation options that have been used in the UK Climate Change Risk Assessment and subnational partnerships.

In the interim, as part of its updated organisational adaptation plan, the WMCA should seek to mainstream adaptation into its existing policy areas and associated plans such as for housing and transport.

Recommendation 2

Use devolution as a mechanism to govern the development and implementation of the plan.

Many climate risks are interdependent and cannot be managed by a single organisation alone. Because of this, several regions have formed voluntary place-based partnerships. These use a regional leadership role to convene regional partners to develop a collective approach to adaptation (e.g. **Climate Ready Clyde in Glasgow City Region** or the **London Climate Ready Partnership**).

Further devolution could form the basis for such a regional adaptation plan and partnership. This could provide WMCA with the responsibility for leading regional place-based adaptation, identify potential resources, and help in identifying appropriate output and outcome targets that align with regional and national priorities.

Devolution also offers an opportunity to enhance delivery by mainstreaming adaptation into devolved policy areas and responsibilities. This would align adaptation into regional transport plans, economic development policy, etc. This integration would benefit from the introduction of climate risk screening for all major policy and investment decisions.

Recommendation 3

Continue to develop the evidence base on vulnerabilities, risks and impacts to inform future adaptation planning.

A key issue for WMCA is the potential impact of climate change on the region's largest economic sectors, including its priority growth sectors and specialisms, and thus its economic development objectives. However, the existing climate change literature does not have this level of disaggregation. To address this gap, primary research and evidence is needed for specific sectors.

It would be useful to develop an ongoing programme of research and evidence to address these gaps, and this evidence could then be fed into future adaptation plans, as part of an adaptive management approach. WMCA could address these gaps by working in partnership with universities, as well as by building capacity and engaging with relevant actors in the region.

The Adaptation Workstream of the WMCA's Environment Programme

The WMCA Environment Programme has four themes (natural environment, circular economy, climate adaptation and air quality), with one cross-cutting theme of behaviour change. Each theme has its own plan that provides the evidence to inform the WMCA's priorities for delivery.

The aim of the WMCA's climate adaptation programme is to ensure that the WMCA and the area understands its vulnerability to climate-related risks and both people and organisations are taking steps to become more resilient.

In 2022 the WMCA kickstarted their climate adaptation workstream by publishing a **Summary of Climate Change Impacts** in the WMCA Area, a high-level summary of the climate change scenarios, likely impacts and risks across its constituent areas. In 2024, the WMCA published its own internal Climate Adaptation Plan.

The Combined Authority is working across the WMCA area to develop adaptation awareness, build adaptive capacity and deliver adaptation actions through the following activities:

- Climate Risk & Vulnerability Assessment (CRVA) mapping tools – a spatial assessment that identifies where climate hazards and vulnerability factors are most concentrated in the region. Two tools have been produced; one for the social and built environment and one for transport networks in the West Midlands.
- Integrating adaptation in retrofit and decarbonisation programmes, focusing on overheating, flood risk and water efficiency.
- Convening Transport for West Midlands' (TfWM) Transport & Adaptation Working Group – convening colleagues from across TfWM to mainstream adaptation in their work on policy development, network resilience and behaviour change.
- Trialling community-led approaches to tackling climate change through the new **Community Environment Fund**.
- Collaboration with wider stakeholders to develop an adaptation investment pipeline of nature-based solutions, aligning with **Local Investment in Natural Capital** (LINC) work funded by the Department for Environment, Food and Rural Affairs (DEFRA).
- Maximizing the wider adaptation benefits of the upcoming **West Midlands Local Nature Recovery Strategy** (LNRS) to be developed by the WMCA.
- Promoting nature-based solutions as priority measures that offer a multitude of co-benefits including flood alleviation, urban cooling, biodiversity improvements and amenity value. These were included in the new guide on **Nature-based Sustainable Drainage Systems** (NBSuDS).
- Participating in Defra's pilot round of local authority climate adaptation reporting.

Impacts of global climate change on the local economy

Global climate change will have local effects on the WMCA economy. These effects will arise from impacts that occur directly within the WMCA area, but also impacts outside the area which propagate through the WMCA economy. These economy-wide effects were be assessed using two major pieces of macroeconomic analysis:

1. COACCH (Codesigning the Assessment of Climate Change Costs)
2. Rising et al, 2022.

As a first line of evidence, the study downscaled the results of a recent macro-economic modelling analysis undertaken in the Horizon 2020 project COACCH (Codesigning the Assessment of Climate Change Costs) to the WMCA economy. The analysis found that climate change could have a significant negative impact on regional Gross Domestic Product (GDP) under all future warming scenarios:

- By 2035, climate change is projected to result in an annual reduction in expected regional GDP (in the WMCA area) of approximately 0.75% annually for a central warming scenario (RCP4.5), as compared to the counterfactual without climate change.
- These impacts rise to 1.55% annually by 2050 (again for the central warming scenario, RCP4.5).
- By the 2070s, the impacts are projected to rise to between 1.4% and 2.6% annually for low and high warming scenarios respectively (RCP2.6-SSP2 and RCP6.0-SSP2).
- It is stressed that these are annual occurring costs, not just one-off shocks, and that the analysis only quantifies a sub-set of all possible impacts. These are driven by river floods (and their impact on industry, commerce, and people, and on labour and capital productivity), heat impacts on labour productivity, and changes in energy demand across Europe.

A second independent study (Rising et al, 2022) was reviewed to provide a comparative set of disaggregated results for the WMCA area. This study assessed the overall societal costs (and not just the costs to the economy as with the results above) from climate change and assessed a higher warming scenario (RCP7.0-SSP3). These study results project that climate change could have impacts equivalent to:

- around 0.8% of regional GDP in the 2011-2030 period,
- rising to around 3% by the 2041-2060 period, and to 7% by 2081-2100.
- It also assessed a low warming scenarios consistent with high global mitigation action and found this led to a significant reduction in impacts in the long-term, with estimated impacts equivalent to around 2% of regional GDP over the 2051-2060 and 2081-2100 periods.

The higher costs of this study, as compared to the COACCH values, are driven by the inclusion of societal costs and especially by catastrophic disruption, though the latter impacts are much more uncertain.

These results indicate that climate change could have important economic impacts on the WMCA area. Furthermore, it indicates that

significant impacts will occur over the next 20 years, irrespective of progress on mitigation towards the global Paris Agreement goals (to limit warming to well below 2°C above pre-industrial levels and pursuing efforts to limit to 1.5°C). The results show that much of the climate change over the next 20 years is already locked in and the impacts over this period can only be reduced with adaptation.

The costs of climate change equate to 25% - 50% of the additional GVA growth required in the WMCA area to match the UK average growth.

The results above were applied to the WMCA's baseline growth projections of Gross Value Added (GVA) to provide monetary values. This indicates that **by 2030, GVA in the WMCA area would be reduced by £350-£638m a year due to climate change, with these impacts rising to between £1.5bn and £2.9bn by 2050 (a 1.5% - 3% reduction of total projected GVA).**

The study also compared these costs to the 2030 GVA growth ambitions for WMCA, as set out in the Combined Authority's Plan for Growth economic strategy. Achieving the plan's targets will be more challenging under climate change, and this implies that adaptation measures will be required to help meet regional economic growth ambitions.

Economic costs of regional risks

The second strand of analysis studied the economic costs and opportunities for nine risks selected from the West Midlands Climate Change Risk Assessment and Adaptation Plan for the 2030s, 2050s and 2080s.

The risks have been selected due to their potential impact on economic performance in the WMCA. This includes risks to infrastructure, the built environment and business and industry. The estimates of current and future costs are generated from a mix of quantitative and qualitative assessments, drawn from academic and grey literature studies. Given the uncertainty in climate and impact models, a range of studies have been explored and used alongside expert judgement to generate indicative categories of magnitude (from low to very high, each with an associated £value/year), the results are shown on the next page.

Adaptation interventions to reduce economic costs

Key to impacts and benefits

Impact	Range
Very high	Over £25m per year
High	£5m to £25m per year
Medium	£0.5m to £5m per year
Low	Less than £0.5m per year

Benefit	Range
Very high	Over £25m per year
High	£5m to £25m per year
Medium	£0.5m to £5m per year
Low	Less than £0.5m per year

Economic risks of climate change to the WMCA area. Source: Authors. Note asterisks indicate the use of expert judgement. Note risk codes are taken from the West Midlands Climate Change Risk Assessment and Adaptation Plan.

Infrastructure

Risk	Time period			
	Current	2030s	2040s	2080s
I2: Risks to infrastructure networks and services from more frequent and extensive river, surface water and groundwater flooding	Medium impact (Transport)	High impact (Transport)	High impact (Transport)	Very High impact* (Transport)
I3: Risks to transport networks from greater incidence of slope and embankment failure	Medium impact	Medium impact	Medium impact*	Medium impact*
I6: Risks to energy from greater incidence of high and low temperature extremes, high winds and lightning	Low impact*	Low impact*	Medium impact*	Medium impact*
IR9 and BR3: Risks to water supplies from reduced water availability	Very high impact (Households and businesses)	Very high impact (Households and businesses)	Very high impact (Households and businesses)	Very high impact (Households and businesses)

Continued on next page

Health, communities and the built environment

Risk	Time period			
	Current	2030s	2040s	2080s
HRO12: Changes in energy demand from summer and winter temperature changes	Very high benefit (heating demand)	Very high benefit (heating demand)	Very high benefit (heating demand)	Very high benefit (heating demand)
	Uncertain (cooling)	High impact (cooling)	High impact (cooling)	Very high impact* (cooling)

Business and industry

Risk	Time period			
	Current	2030s	2040s	2080s
BR1: Risk of flooding of business and domestic sites from river, surface water and groundwater flooding	High impact	Very high impact	Very high impact	Very high impact
BR5: Disruption to business supply chains and distribution networks from greater incidence of extreme weather in the UK and abroad	Medium impact	High impact	High impact	High impact
BR6: Risks of reduced employee productivity as a result of climatic changes and higher temperatures	High impact	Very high impact	Very high impact	Very high impact

The analysis indicates that **the costs of climate change for these nine key risks are estimated to rise from the low hundreds of £millions/year currently** to approximately £1.5bn/year by the 2050s, and **£billions/year by the 2080s for WMCA**. The costs are dominated by flooding, impacts on water supply, the impacts of heat on labour productivity, and the increased demand for cooling. These costs are broadly similar to the macro-economic analysis above, providing confidence around the headline figures.

Flooding

One of the largest impacts identified in this detailed analysis is from flooding. The analysis draws on the published UKCCRA3 analysis for this impact (Sayers et al., 2021) but extends this to consider the increased value at risk over time. The CCRA3 results estimate that the expected annual damage from river and surface flooding to residential and business properties, including additional indirect costs, are currently £84m/year for Staffordshire, Warwickshire and the West Midlands. These costs are projected to rise to approximately £230m/year by the 2050s, and to approximately double this value by the 2080s. Whilst these estimates cover a larger geographical area, they are included here since flooding is a major climate risk for the WMCA area, and this is currently the best data available.

A subset of analysis was undertaken on damages to households in the WMCA area using Sayers and partners' data. **These results project total damages of £13m/year in the present day, rising to approximately £30m/year in the 2050s and £70m/year in the 2080s**. The highest damages are projected for Birmingham and Coventry.

Water availability

A further high risk identified is the effects of climate change on water availability (and the level of deployable output). The analysis took projections of water supply and demand with climate change from existing water resource management plans (Severn Trent Water, 2024) and then valued the potential impacts from climate change. **These costs are projected to increase (without adaptation) to as much as £1 billion/year by the end of the century for the WMCA area** as a result of estimated reductions in deployable output (the available amounts of water for use by households or businesses (e.g. for agriculture or manufacturing), and the balance between supply and demand.

Heat impacts

The analysis also identified potentially high impacts from heat. This involves the effects of high temperatures and heatwaves on working time, output, and labour productivity. Recent studies have identified that recent hot years have led to productivity impacts and the Office for National Statistics has estimated annual productivity losses from heatwaves at £31m per year, noting the results vary significantly from year to year. **The modelled estimates of the economic impacts of hot days in 2019 and 2020 in the WMCA area are estimated at £120m and £162m respectively**. These impacts are projected to rise significantly for WMCA with climate change, with potentially significant impacts (including on regional GVA). While not explicitly assessed within this study, there are also projected increases in heat-related fatalities, which will have high associated economic costs.

Heating and cooling

The analysis also identifies potentially very high annual economic benefits to households and businesses from reduced winter heating demand. The potential **reduction in domestic bills (benefits) under climate change are estimated at between £54 and £187m a year by the 2030s, rising to £82 – £311m a year by the 2050s** and to between £26 and £425m a year by the 2080s compared to a 2008 baseline. However, there are also projected increases in cooling demand (impacts) which will offset some of these benefits.

Infrastructure

The region also faces potential costs associated with risks to the transport network from landslides, risks to business supply chains, and risk to energy infrastructure from extremes of weather, though all of these are estimated to be lower in magnitude than the main impact categories above.

Whilst this work has focused on the overall economic costs, it is important to note that these impacts and **associated financial and economic costs will be distributed across different actors**. For example, infrastructure damage is borne by network operators and/or insurance companies, whereas changes in heating and cooling demand have a direct effect on households. This means it is important to understand the relative impact of risks on different actors to help inform future adaptation planning and prioritisation.

It also indicates that these **impacts will not be evenly distributed**. For example, those from poorer socio-economic backgrounds are likely to be disproportionately affected, and there could be larger impacts on small businesses as they have lower adaptive capacity.

Image credit: Network Rail

Existing economic costs of extreme weather

Whilst there are clear future economic costs from climate change, the WMCA area is already affected by the impacts of extreme weather. As well as having significant impacts on people and businesses, these events affect the economy, and can make it more challenging to meet the economic, social and policy goals of the [WMCA Inclusive Growth Framework](#).

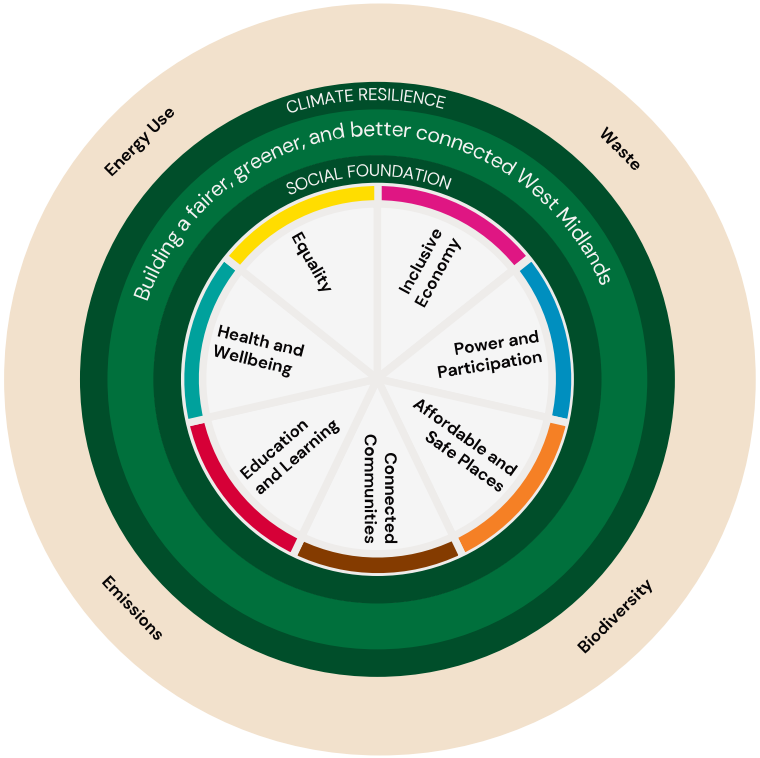

Figure 1: The WMCA Inclusive Growth Framework

This study has used the available evidence on the impacts of three historic weather events as case studies to assess the potential economic (societal) costs – exploring the impacts of Storm Doris in February 2017, the heatwave in July and August 2022, and the flash floods of the summer 2023.

The study found that these three events were collectively estimated to cost the WMCA area around £21m, with impacts affecting all areas of the Inclusive Growth framework. Detail on each of the case studies is included on page 18.

Event	Cost
February 2017 - Storm Doris	£7,045,030
July / August 2022 - Heatwaves	£11,805,340
August 2023 Flash Flooding	£2,791,130
Total	**£21,641,500**

Table 1: Costs of Storm Doris - 2017, Summer 2022 heatwaves and August 2023 Flash Flooding. 2023 prices. Source: Authors.

These costs are much lower than the 'current' period shown in the analysis of regional risks above, because they involve a more limited set of impacts, and are drawn from observed one-off events rather than as annualised costs. For example, in the events studied there will have been additional costs to the economy from effects on labour productivity, additional unreported damage from flooding, and disruptions to the road network and travel.

Case study summaries and costs

Case Study 1: February 2017 - Storm Doris

On 23 February 2017, Storm Doris hit the UK. A Met Office amber weather alert for wind was issued in the West Midlands, with winds of up to 60mph recorded in the Black Country. During the storm, people were advised not to travel by rail providers, local councils and health experts. Flooding and fallen trees due to the high winds caused the closure of at least eight B roads and part of the M5. Trains were suspended, delayed or cancelled due to the storm. There was also widespread disruption to power, with faults in the electricity network resulting in around 15 million lost customer hours. There was significant impact to businesses, with individual attractions and entire high streets having to close due to high winds and associated incidents in West Bromwich and Wolverhampton. In just one hour (10:00 – 11:00) on the 23 February, West Midlands Ambulance Service (WMAS) responded to 202 incidents, 43% more than the day before. The costs of this event were dominated by energy disruption and the economic costs of fatalities.

Image credit: BBC

Case Study 2: July / August 2022 heatwaves

In the summer of 2022, the UK experienced an unprecedented and extended period of extreme heat. This culminated in two official heatwave events, a level four heatwave (red warning) from 16 to 19 July and a level three (amber warning) from 11 to 14 August. Train services throughout the WMCA area were reduced, cancelled, or slowed due to the infrastructure's inability to cope with the high temperatures, with passengers being encouraged not to travel. There was also widespread disruption to power. Data provided by National Grid, the distribution network operator (DNO) for the West Midlands, shows there were 125 faults across their West Midlands area, affecting 46,225 customers. The fire service was inundated with callouts, including having to **monitor a battery recycling park** in Darlaston due to concerns over serious fire risk and [at least] four wildfires in the WMCA area in August The Office for National Statistics (ONS) estimated there were 100 excess deaths for two heat periods between June and August 2022, across the WMCA area.

The costs of the 2022 summer heatwaves were dominated by the economic costs of fatalities (£6.4m)[1] and rail disruption (£4.5m), with additional but lower costs associated with disruptions to energy supply, wildfires and costs to the fire service.

Image credit: West Midlands Fire Service

1. The economic (societal) costs of health impacts have a wide range due to the differences in valuation approaches used – a lower value is reported here - this is explained further in section 4 of the main report.

Case Study 3: Summer 2023 floods

July 2023 was the UK's sixth wettest July on record, with an average rainfall of 120.4mm across England. One particularly severe period of heavy rain and thunderstorms affected the WMCA area on 8 and 9 July, where **yellow weather warnings** for thunderstorms were issued by the Met Office across the entire region from Wolverhampton, across the Black Country. and cities of Birmingham and Coventry. Roads were flooded across the WMCA area, with Birmingham suffering particularly badly. Businesses were reported to suffer from flooding during this period.

The July 2023 flooding event resulted in 80 properties being flooded, with associated property damages. Whilst this was the largest cost of this event (£2.5m), there were also economic (societal) impacts from the projected impacts of flooding on mental health (£0.26m).

Image credit: West Midlands Fire Service

References

1. Watkiss, P (2022). **The Costs of Adaptation, and the Economic Costs and Benefits of Adaptation in the UK. Policy Paper**

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3. **Severn Trent (2024) Draft Water Resource management Plan 2024 Appendix A – How much Water we have**.

4. ONS (2024) **Impact of hot days on productivity in Great Britain methodology**

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